Module 5

Interventions to increase physical activity in children between five and twelve years of age
Module 5

Interventions to increase physical activity in children

Prepared on behalf of the Prevention Research Centres:
NSW Centre for Overweight and Obesity
NSW Centre for Physical Activity & Health
NSW Centre for Public Health Nutrition

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This is one of a set of modules in the series Building solutions for preventing childhood obesity.

Other modules are:

- Overview module
- Module 1: Interventions to promote consumption of water and reduce consumption of sugary drinks
- Module 2: Interventions to increase consumption of fruit and vegetables
- Module 3: Interventions to reduce consumption of energy-dense, nutrient-poor foods
- Module 4: Interventions to promote eating breakfast
- Module 6: Interventions to increase physical activity in adolescents
- Module 7: Interventions to reduce sedentary behaviours

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1 **Background and methods**

1.1 **Overview**

This research report is one of a series presenting a synthesis of the recent evidence on the effectiveness of interventions to prevent weight gain and promote healthy weight among children and adolescents. This series of reports is designed to update the proposed approaches for children and families presented by the Centre for Public Health Nutrition report, ‘Best options for promoting healthy weight’.

The “Building solutions for preventing child obesity” report has been presented as a series of modules to reflect clusters in the evidence base, allow clear comparisons between similar interventions, and highlight promising approaches as well as gaps in the evidence. The methods used in preparing the report are also described in the ‘Overview Module’. The specific methods used in preparing this module on physical activity interventions in children aged 5 to 12-years are outlined below.

1.2 **Search strategy**

Studies and interventions promoting physical activity among children and adolescents (at least five years of age) published between January 2003 and April 2007 in peer-reviewed journals were identified by searching the Medline, Pubmed and Cinahl databases and by consulting systematic reviews.

The databases were searched using the following search strategy to identify additional intervention evidence for this module:

(Physical activity OR exercise OR inactivity) AND (child OR children OR adolescent OR adolescent behaviour OR adolescent psychology) AND (intervention OR intervention studies OR research design).

1.3 **Exclusion and inclusion criteria**

The following exclusion and inclusion criteria were applied to research papers identified through the search strategy.

**Exclusion criteria:**
- Sample size <16 participants.
- Focused on the treatment or management of overweight/obesity.
- Studies based in a hospital setting.
- Studies which included groups with special needs (e.g., physically disabled) or specific health conditions (e.g., diabetes).
- Studies that did not include a measure of PA participation.
- Studies that reported only physical fitness outcomes.
- Studies that reported only perceived exertion outcomes.

**Inclusion criteria:**
- Studies with population-level focus.
- Studies with individual-based approaches.
- Studies with randomised controlled trial (RCT) or quasi-experimental designs.
- Post-only designs or studies with no controls were considered on a case-by-case basis.
2 Problem analysis and rationale for intervention

Engaging in regular physical activity confers numerous physical, social and psychological health benefits for children and adolescents. Being physically active plays a role in achieving and maintaining a healthy weight and maximising bone strength. Physical activity also improves blood pressure, cholesterol and insulin levels, all of which are risk factors for developing cardiovascular disease and type 2 diabetes in adults. In addition, evidence suggests that children and adolescents who are regularly active experience better psychological wellbeing and that physical activity provides opportunities for children to connect socially with peers and develop important social skills.

The NSW Department of Health identifies increasing physical activity levels in children as a priority area in chronic disease prevention. Current recommendations are that children and adolescents between five and 18 years of age should participate in at least 60 minutes of moderate-to-vigorous activity daily, and engage in no more than two hours of sedentary activity, such as television watching or playing computer games.

In Australia in 2004-05, 64% of children aged five to 14 years participated in an organised sport outside of school hours, an increase of 2% in the participation rate from 2003. The most recent data on physical activity patterns of children and adolescents in NSW was collected as part of the NSW Physical Activity and Nutrition Survey (SPANS), which investigated self-reported physical activity among children and adolescents in Years Six, Eight and Ten. The findings indicated that 75% of boys and girls aged 11 to 16 years met the current physical activity recommendations for children and adolescents. The prevalence of moderate-to-vigorous activity increased by 15% to 25% from 1985 to 2004. SPANS also reported that girls were less active than boys, older students were less active than younger students, children in cities were less active than children in rural areas, girls from lower socioeconomic backgrounds were less active, and children from Asian or Middle Eastern backgrounds were less active. Approximately 3% of Year 6 students walked to school every day, around 33% traveled by car, and 20% used public transport.

Fundamental movement skills provide the foundation for lifelong participation in structured and unstructured activity as well as adopting a generally active lifestyle. Development of fundamental movement skills is not an automatic process that occurs as a child grows. Rather the development of fundamental movement skills is influenced by a range of environmental and social factors and it is important that children are taught these skills from an early age as they are essential for later physical activity participation. In addition, interventions that aim to improve fundamental movement skills may be promising as a strategy to increase participation in activity as children become older. The SPANS report found that students in all grades were found to be more proficient in fundamental movement skills in 2004 than their counterparts in 1997. Boys were found to be more proficient at running, kicking and throwing, while girls were more proficient at the vertical jump, side gallop and leap. Proficiency also increased with socio-economic status, particularly in girls.

It is essential that the recent gains in children’s physical activity participation and fundamental movement skills be maintained. There continue to be many factors that pose as barriers to children being regularly physically active, including lack of knowledge about the benefits of physical activity, lack of time and motivation to be active, lack of confidence to be active, having no facilities or places for activity, insufficient encouragement or practical support from adults, and parental concerns about safety and injury. It is therefore important that physical activity promotion programs address barriers to children engaging in physical activity. Increasing participation in structured activities, engagement in play and games during school and out of school, as well as active commuting are components of an active lifestyle.
3 Available intervention evidence

A total of 29 interventions to increase physical activity among children between five and twelve years of age were identified. These have been summarised in the Appendix. They are organised and presented according to the type of intervention, as follows:

- Encouraging active transport through policy and infrastructure
- Creating school environments that facilitate physical activity engagement
- Developing teachers’ skills to deliver enhanced health and/or physical education in school
- Developing children’s skills to engage in self-directed physically active through school health and/or physical education programs
- Involving the family or community in health and physical education interventions
- Using rewards to increase children’s physical activity
- Using social marketing to promote physical activity in children

3.1 Encouraging active transport through policy and infrastructure

3.1.1 California Safe Routes to School legislation

The California Safe Routes to School (SR2S) legislation provided funding for construction projects near schools with the aim of encouraging active transport to and from school and to increase pedestrian and bicycle safety (e.g., sidewalks, traffic lights, pedestrian crossings, bicycle paths). A cross-sectional retrospective evaluation was conducted in 2002-2003 at ten elementary schools from a range of locations, with different demographic characteristics and neighbourhood types. Children in the third and fourth grades were recruited and at baseline there were 862 children enrolled in the study. Data were collected one to 18 months after the completion of construction projects (mean=1 year). Children in the intervention group were those who passed by a SR2S area on the way to school. Children who did not pass by a SR2S area on the way to school were in the control group. A SR2S area was an area with increased construction of sidewalks, traffic lights, pedestrian crossings and bicycle paths. SR2S areas were grouped into three types – traffic control, pedestrian crossing improvements, and sidewalk improvements. Parents reported on how often their child walked or cycled to school compared to before the SR2S project. The proportion of children whose parents reported that they walked or cycled to school after SR2S project construction was significantly greater among children who passed by SR2S projects on the way to school, compared with those who did not. The increase in walking or cycling among children who passed by SR2S projects along their usual route to school was significantly greater for sidewalk improvements and traffic control projects.

Appraisal

There was a reliance on parental self-report of children’s travel behaviours and the same individuals could not be tracked before and after SR2S project construction due to funding limitations. This reduced the strength and accuracy of the data from parents about whether their child’s transport to school had changed. Nonetheless, improving sidewalks or implementing traffic control measures appear to be promising measures for promoting children’s active transport to school. Given that a range of locations, types of neighbourhoods, demographic characteristics and schools were assessed in the SR2S program, there is good potential for such environmental modifications to be successful across a variety of school areas.

3.1.2 Providing site-specific advice on school travel patterns

In the UK, the government developed ‘Best Practice’ guidelines recommending the formulation of school travel plans to encourage active transport to and from school among children. As part of this strategy the government provided funding for school travel coordinators to help develop and implement site-specific travel plans for schools. Rowland and colleagues conducted a cluster RCT over one year in 21 London schools (11 intervention, 10 control) to investigate the impact of providing site-specific advice on the travel patterns of children attending the schools. Intervention schools were offered expert assistance from a travel coordinator with
experience in education and road safety. These schools held parental focus groups to identify road safety issues and established school travel working groups. Each group worked towards the development and implementation of a school travel plan with the assistance of the travel coordinator. Control schools did not receive expert advice, but they received monetary reimbursement for their participation in the study. The adjusted odds of children walking, cycling or catching public transport to school were almost identical in intervention and control schools at the end of the intervention. There was an increase in the number of intervention schools reporting they had travel plans at the end of the intervention (from two to nine out of 11 schools). Overall, the authors reported a poor uptake of the intervention in schools (only 50% of schools invited took part), and in light of the lack of enthusiasm from schools, questioned the potential for the implementation of the government school travel plan policy at the national level.

Appraisal
These data were collected post-intervention only and so it is difficult to determine whether any changes occurred. While there was an increase in the number of schools with travel plans, those schools only implemented some of the activities recommended by the government. The poor uptake of the intervention may indicate that key schools did not view the program as feasible or relevant to their settings. In fact, the authors reported that most schools that declined cited busy schedules or a reluctance to take on the additional responsibility of school travel as their reason for not participating.

3.2 Creating school environments that facilitate physical activity engagement

3.2.1 Introducing multicoloured playground markings
Stratton and Mullan conducted an eight-week study in eight disadvantaged primary schools in the UK to assess the effects of multicoloured playground markings on children’s physical activity during playtime. Prior to the intervention, none of the schools had markings on their playgrounds and their outdoor play areas were either tarmac or grass. The playground areas of intervention schools were painted in bright fluorescent colours according to the preference of individual schools, while playgrounds in control schools were not modified. Both intervention and control schools had small pieces of sports equipment such as skipping ropes and footballs available. In the intervention schools the amount of play time spent in moderately-vigorous activity increased from 36.7% to 50.3% of play time and vigorous activity from 7.9% to 12.4% of play time. In contrast, children in control schools decreased the amount of play time spent in moderate-to-vigorous activity.

Appraisal
This resulted in short term increases in moderate-to-vigorous and vigorous activity levels of children exposed to the intervention. This relatively inexpensive, flexible and low-intensity approach to increasing activity can potentially reach large numbers of children at any given time. Creating environments with different types of markings to encourage physical activity can address the needs and interests of various age groups and the playground markings can be altered periodically to prevent boredom and maintain children’s interests. This study had a duration of eight weeks and therefore the longer-term impact of this approach has not been determined.

3.2.2 Colour-coding playground areas for activity
Using a similar approach Ridgers et al looked at the effects of playground redesign on recess and lunchtime physical activity levels of children from 26 elementary schools in the UK. Intervention schools created three colour-coded playground areas: a red sports area; a blue multi-activity area; and a yellow quiet area. Intervention schools also received physical structures for each of these areas which included fencing, seating goal posts and basketball hoops. Small pieces of equipment such as skipping ropes and soccer balls were available in both intervention and control schools. Six weeks following playground redesign, children in the intervention schools were found to engage in significantly more moderate-to-vigorous and vigorous activity than children in the control schools when activity was measured by heart rate monitoring and accelerometry. Follow-up measurements six months after playground redesign found that these effects were maintained over time. In addition, the effect of this intervention on children’s moderate-to-vigorous physical activity was found to be stronger in children who were less active at baseline and in younger children.
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**Appraisal**

This resulted in medium term increases in moderate-to-vigorous and vigorous activity levels in children exposed to the intervention. This approach is somewhat more costly than the use of playground markings, but is still a relatively flexible and low-intensity approach to increasing activity with potential for reaching large numbers of children at any given time. Creating environments that facilitate physical activity can address the needs and interests of children in various age groups. The playground designs can be altered at regular intervals to prevent boredom and maintain children's interests. The six-month follow-up period does not allow for the longer-term impact of this approach to be determined.

### 3.2.3 Providing game equipment to primary school children at recess and lunch

The effects of providing game equipment on children's activity levels during recess and lunch were investigated in this Belgian study. A quasi-experimental study was conducted in seven primary schools over a period of three months. Schools were randomised to either receive game equipment or no additional equipment. Participating classes were given a set of equipment as well as activity cards outlining games and activities that could be played with the equipment. Children were allowed to play with the equipment during recess and lunch. Teacher involvement included encouraging children to play with the equipment, exchanging equipment to prevent loss of interest and establishing rules for using the equipment. Children's physical activity levels were measured objectively with accelerometers. Children in the intervention group showed a significant increase in the amount of time they spent being active during break time. The greatest change in the proportion of time children in the intervention spent being active was measured during lunchtime. During lunch break the intervention helped to increase the proportion of time children engaged in moderate-to-vigorous physical activity by increasing the time they spent engaged in moderate and vigorous intensity activities, while decreasing the time they spent on low intensity activities. Lunchtime moderate-to-vigorous activity increased from 48% to 61% (+13%) of available time in the intervention group, compared to the decline seen in children in the control group from 56% to 43% (-13%). The effect of this intervention on girls is noteworthy. During lunchtime, the intervention was as effective among girls as in boys. During recess, girls in the intervention group increased their moderate-to-vigorous activity time and decreased the amount of time in which they engaged in low-intensity activity, while boys showed little change.

**Appraisal**

This approach is sustainable, relatively economical and has potential for a wide reach. It is well suited to schools where teachers can influence rules around the use of equipment and rotate equipment to ensure boredom does not result in a decline in activity. It does, however, require commitment from teachers. The influence of teacher involvement on activity levels was not measured in this study and should be considered when looking at the results. Unfortunately this intervention was short and the longer-term effects have not been measured. The longer-term impact of what appears to be a successful strategy in the short term warrants investigation. One of the encouraging outcomes of the study was its positive effect on girls. Girls have generally been found to be less active than boys at school, so this strategy may serve to address this difference.

### 3.3 Developing teachers’ skills to deliver enhanced health and/or physical education in school

Three studies aimed to increase participation in physical activity by offering teachers training or professional development so that they may deliver enhanced health and/or physical education through the school setting. Some intervention activities were integrated into the formal curriculum while others were delivered through activities offered out of class time. These studies targeted the skills and knowledge of general classroom teachers rather than physical education teachers as a way of promoting physical activity in children.
3.3.1 Energizers program

Mahar et al. studied the effects of a physical activity program with 243 children from kindergarten to fourth grade. Classes in one South Carolina school were randomly allocated to an intervention or a control group. Over a period of 12 weeks, teachers of the intervention classes led one 10-minute activity each day with their class. To support the implementation of this pilot policy, teachers received training and copies of Energizer activities. Children in the intervention classes were exposed to Energizers, short classroom-based activities about ten minutes in length. Children in the control classes received Energizers eight weeks later in the semester. Pedometers were used to measure effects of the program on children’s step counts while at school. Children in the intervention group took, on average, 782 more steps a day while at school than children in the control group; a significant difference. The authors reported that teacher compliance with the policy during the week of pedometer data collection was good but suggested that teachers can play a role in the overall activity level during activities as they controlled the duration of activities.

Appraisal

While the overall average number of steps taken by the intervention group was significantly greater than the control group, there was great variation across year groups and between classes in the actual step counts taken by individual children. Successfully implementing a classroom-based physical activity program such as this depends on teacher compliance to ensure that children participate in prescribed Energizer activities each day. Given this was a short-term intervention it is unclear whether teacher compliance could be maintained in the longer term or whether there are any carry-on effects of the program into children’s out-of-school physical activity. Furthermore, it is not clear whether teachers were provided with additional training or ongoing support. The short intervention duration provides little indication of the long term impact of the Energizers program. Nonetheless, this novel strategy may integrate well with aspects of the Personal Development, Health and Physical Education Syllabus in Australian schools.

3.3.2 Action Schools! BC!

Action Schools! BC! was an 11-month program implemented across ten schools in Canada. Schools were allocated to one of three conditions: liaison school; champion school; or usual practice. Generalist teachers in liaison schools received professional development as well as support from a facilitator. One generalist teacher in each champion school received professional development and provided support and encouragement to their colleagues. Action bins containing equipment to encourage activity were placed in classrooms in the liaison and champion schools. Action bins in the liaison schools were enhanced with additional resources as required, while those in champion schools contained basic resources. At the end of 11 months, teachers in liaison schools delivered 160 minutes of activity each week while teachers in the champion schools delivered 147 minutes each week. This was significantly higher than the usual practice schools in which teachers delivered 105 minutes of activity each week. The teachers who participated in the study reported high levels of satisfaction with the program. Ninety-eight percent were very or extremely satisfied with the delivery of training, 75% indicated they would use the content of the training they received and 70% were confident in their ability to use the activities in their classroom. The outcomes of the program (increased physical education time) were well received by students.

Appraisal

The data were based upon self-reported duration of physical activity taught by teachers as recorded in their activity logs. Activity logs were collected monthly from teachers leaving a possibility for inaccuracies to arise if, for example, teachers did not complete their logs daily as requested. Stronger evidence from objective monitoring with devices such as pedometers or accelerometers would help clarify whether the intervention was in fact effective. Furthermore, the schools were likely to be more motivated than average schools as they volunteered to participate in the study. Action Schools was implemented in Canada with 61% of children in the sample speaking a language other than English at home (mainly Chinese). While this may reduce the applicability of this program to schools in NSW on the whole, it also suggests that the approach may be effective with children from non-English speaking backgrounds, some of whom are less active.
3.3.3 Move It Groove It

On the North Coast of NSW, a whole-of-school approach was taken in the Move It Groove It program. This program aimed to increase students' fundamental movement skills and participation in moderate-to-vigorous physical activity in physical education lessons. The program, targeting children in third and fourth class, was implemented in 18 schools over one year and was evaluated using a quasi-experimental design. A range of strategies were implemented at intervention schools, including establishing a project team within each school; providing teachers with a buddy for support and information; developing a web-site with teacher resources; funding the purchase of equipment for the program; and conducting regular teacher workshops. At follow-up, boys and girls in the intervention schools had significantly improved their overall fundamental movement skills mastery in comparison to children in control schools. In addition, the intervention was associated with a nonsignificant 4.5% increase in moderate-to-vigorous physical activity and a significant 3.0% increase in vigorous physical activity in children during physical education lessons.

Appraisal

Established methods for observing children's physical activity in physical education classes and determining mastery of fundamental movement skills were used, which give strength to the findings. However, it is not clear whether observers were blinded to the school conditions, giving rise to potential bias. Another strength of Move It Groove It is that training and support were provided to teachers throughout the program, and the program appeared to be responsive to teachers' needs as they changed. The buddy system in particular allowed teachers to develop their own capacity with respect to encouraging their students to be active. Furthermore, schools established their own project teams which customised policy and environmental strategies for their school. This element of adaptability lends promise to this intervention for application in non-rural schools, despite the program being piloted in rural NSW schools. Although the change to children's physical activity levels during physical education class time was small, the overall mastery of fundamental movement skills exhibited by children in intervention schools compared with children in control schools is promising.

3.4 Developing children's skills to engage in self-directed physical activity through school health and physical education programs

Five interventions integrated school health and physical education programs to teach children skills to engage in self-directed physical activity.

3.4.1 Interactive Multimedia for Promoting Physical Activity (IMPACT)

In a quasi-experimental study with matched controls, Goran and Reynolds implemented an eight-week multimedia curriculum with 209 fourth grade children (average age 9.5 years) in four elementary schools. Two intervention schools received a CD-ROM which was developed as an interactive learning game. Children in the intervention schools participated in a series of interactive lessons in addition to regular classroom lessons, and these were supplemented by family assignments. Children's activities covered the outcomes of being active, skills to change activity patterns, goal-setting, tracking individual progress, reinforcement and self-efficacy. Children in the control group received CD-ROMS that were unrelated to health. Measurement by accelerometry found no significant changes in total physical activity in either boys or girls in the intervention or control groups.

Appraisal

It is difficult to determine whether this apparent lack of effect was the result of the content of the intervention or the mode of delivery. It may be the case that fourth grade children are not yet able to effectively set physical activity goals and assume some responsibility for their own progress towards meeting these goals. Another issue worthy of consideration is the resource capacity within the school to deliver a computer-based strategy.
3.4.2 Switch Off-Get Active

The 16-week teacher-led health education program Switch Off-Get Active was delivered to 312 fourth class children attending nine schools in high socially disadvantaged areas of towns and rural areas in the south east region of Ireland (Harrison et al 2006). Using a quasi-experimental design, the intervention was planned to complement the existing health education curriculum and aimed to reinforce the need to increase physical activity and limit small screen recreation. During the ten lessons delivered as part of this program, children reflected on their use of leisure time, identified alternatives to small screen activities, set their own leisure time goals, monitored their achievement of these goals and identified opportunities to be physically active in their local area. After the intervention period, there was a significant increase in the time spent engaging in moderate-to-vigorous physical activity in children in both the intervention and the control schools. Furthermore, the change from pre to post-intervention in children's time spent participating in moderate-to-vigorous activity was significantly greater in the intervention group (approximately 85 minutes) than in the control (approximately 63 minutes). There were no differences in screen time between children in intervention and control schools post-intervention.

Appraisal

While only the short-term effects of the program have been reported, it appears that this approach was effective in increasing physical activity levels in children in mid-to-upper primary school in the short term. In addition, non-specialist teachers delivered the program, and were supported with professional development. This builds capacity within schools, as well as increasing the potential long-term sustainability of the program. This study provides an example of building partnerships between different stakeholders to develop and implement health education interventions in schools. Health promotion specialists, national education authorities and school teachers were involved in the program, which is likely to have played a role in its incorporation into the school curriculum. Having analysed the cost-effectiveness of the program adds to the strengths of this strategy. Information from process evaluation would help clarify whether any issues arose from the implementation of the program. Given that this was a quasi-experimental study and that all schools were recruited based on their willingness to implement the ‘Switch Off-Get Active’ program, it is possible that results may be quite different if the program was implemented in other less motivated schools that were not aware of their study allocation.

3.4.3 PLAY program

The PLAY program promotes moderate-to-vigorous physical activity in children in the late primary years and aims to shift the focus from fitness to daily participation in activity. It also aimed to develop in children self-efficacy to be active. Pangrazi et al (2003) assessed the PLAY program with 606 children in fourth grade and their teachers from thirty-five schools using a post-only design. The schools were allocated to PLAY only, PE (physical education) only, PLAY and PE, or a no treatment control group. The PLAY component of the program involved providing children with a 15-minute physical activity break during the school day, facilitated by their classroom teacher. The program was implemented in three stages: 1) promoting and raising awareness of positive behaviours; 2) participation in specific games and activities; and 3) encouraging self-direction in meeting physical activity recommendations. The PLAY only and PLAY and PE groups accumulated significantly more steps than the PE only and control groups. This was also found among girls in the PLAY only and PLAY and PE groups of the study.

Appraisal

While this study had a larger sample size than that of ‘Switch Off-Get Active’, the intervention was short in duration and baseline measurements were not taken. Therefore, the effects of the intervention on physical activity cannot be determined. Given the principles of school based health promotion practice applied in ‘Switch Off-Get Active’, it may represent a more viable option for promoting self-directed activity in this age group. PLAY appeared to have a greater effect on girls than on boys. However the use of a post-only design precludes the drawing of causal inferences that PLAY had an effect on children’s physical activity as it does not rule out the possibility of differences between the groups at baseline.
3.4.4 A comprehensive physical activity promotion program at elementary school\textsuperscript{31}

Based on the existing US program, SPARK, this program aimed to increase children’s level of physical activity in physical education classes and outside of school. The intervention was implemented with 764 children from 16 elementary schools in Belgium over two school years. The schools were randomised to the intervention or control conditions. Intervention schools implemented strategies that included a health-related physical education program, classroom-based health education lessons and an extra-curricula physical activity promotion program. The intervention had an effect on reducing the decline in children’s total moderate-to-vigorous physical activity participation, and increased children’s self-reported time spent in moderate intensity leisure time physical activity slightly.

**Appraisal**

This RCT resulted in significant differences in daily activity between children in the intervention and control schools whereby children in the intervention schools showed a smaller decline in total time in moderate to moderate physical activity compared to children in control schools. Although the program was delivered over two school years, there was no follow-up after the end of the intervention and so conclusions cannot be drawn about the effectiveness of this approach over a longer period of time. The program was delivered by specialist physical education teachers limiting its generalisability to other teachers and increasing its potential costs somewhat. However, there is potential for the curriculum to be altered to meet the needs of non-specialist teachers, giving the program greater flexibility and increasing its sustainability. Alternatively, a train-the-trainer element could be introduced so that physical education teachers teach other classroom teachers to deliver the program.

3.4.5 Be Smart Pilot\textsuperscript{32}

An obesity prevention program, Be Smart, piloted with 213 children aged between five and seven years was conducted in Oxford, UK. Children were randomly allocated to one of four groups: nutrition only; physical activity only; nutrition and physical activity; or control. The program was delivered during interactive lunch-time clubs run for eight weeks each term, over one school year. The physical activity component of the program promoted incorporating physical activity into daily life and minimising sedentary time and encouraged children to be active while at school. Children allocated to the combination of physical activity and nutrition group were exposed to half the physical activity and half the nutrition program each term. The proportion of children reporting running at recess and lunch increased in the physical activity only and the combined physical activity and nutrition groups. The proportions of children in the nutrition only and control groups who reported running during recess increased while those reporting running during lunchtime decreased. Parental report indicated no difference in children’s out of school activity patterns. The program structure and materials were well rated by parents and teachers. There was no clear intervention effect on patterns of physical activity, although children in the intervention groups may have been more active in the playground at the conclusion of the intervention.

**Appraisal**

This study measured children’s patterns of activity rather than their total activity. As a consequence, it is not possible to measure the extent to which the lunchtime clubs had an effect on actual activity levels. While this intervention has the potential to reach a large population group, it was not delivered by school staff, limiting its generalisability and increasing implementation costs. While teacher delivery of this strategy is ideal, this would place extra burden on teachers and may require the provision of professional development and this would also increase costs. This intervention was delivered over a short time frame and contamination across groups may have occurred because all intervention strategies were implemented within each school. Another limitation is that it is not clear whether a valid and reliable questionnaire had been used to measure children’s physical activity participation.
3.5 Involving the family or community in health and physical education interventions

In 11 studies, a school based intervention was supplemented with a family and/or community component. These interventions included curriculum components with additional strategies to target the parents of children and/or the communities in which children lived. The nature and intensity of the parental and community components of these interventions varied between studies.

3.5.1 Pathways obesity prevention trial

The Pathways obesity prevention trial was conducted over three years among third to fifth grade American Indian children. Forty-one schools from seven American Indian communities were involved and 1704 children were recruited at baseline. The trial had a cluster RCT design. The components of the intervention targeting physical activity included classroom based health education and physical education lessons each week, as well as home and school-based family activities to promote a healthy lifestyle. Accelerometry indicated that the intervention group was more active at the three-year follow-up than the control group, but this difference was not significant. However, self-reported physical activity levels were significantly higher in children in the intervention group compared with controls at the three-year follow-up. There was no difference between the intervention and control groups on physical activity self-efficacy at the end of three years. The family-related components of the intervention appeared to be quite successful in engaging parents. The proportion of parents (58%) attending events conducted at intervention schools over the three years was good in comparison to other school events. The majority of the intervention was delivered by school staff who received regular training and continual support from the research team.

Appraisal

The intervention components were developed with formative and feasibility testing at each site and was almost entirely delivered by school staff, with the research team providing regular training and continual support. Process evaluation indicated good implementation and adherence. The effects of the intervention itself are promising. While there was an increase in self-reported activity, this was not evident when activity was measured by accelerometry. The non-significant difference is likely to be due to insufficient power arising from the relatively small sample size of children who were monitored with accelerometers compared with the number of children who completed questionnaires (278 versus 1503 respectively). However, this program was designed specifically for American Indian children and so is not directly applicable to Australian populations. Some modifications are likely to be needed to intervention components if this were to be implemented in NSW.

3.5.2 A goal-oriented health education program

The short-term effects of a nine-month health education program on attitudes and behaviours of 78 Greek children were investigated by Christodolous et al using a RCT design. Sixth grade children were recruited from two schools in one district and the schools were randomised to either the intervention or control condition. The intervention consisted of a modified physical education program focusing on individual goal setting. Children were encouraged to learn skills, practise and to set learning and improvement targets. In addition to physical education lessons, children in the intervention group received a health lecture once a week and health was integrated across the general curriculum. Teachers received training and materials about implementing the new program. The curriculum-based activities were supported by providing guidelines on physical activity for families, disseminating information on local sport programs and advising parents on how they could encourage their children to incorporate physical activity into their daily lives. Control group children received no health education and had regular PE lessons. After one school year (9 months), the children in the intervention group reported a significantly more positive attitude towards physical activity, scored significantly higher on their intention to be physically active and reported spending more hours each week engaged in organised physical activity. Furthermore, there was a significant difference between the proportions of children in the intervention group reporting that they met national physical activity recommendations (77.8%) compared to the control (55.1%) at the end of nine months.
While there were no differences detected between groups in total moderate-to-vigorous activity, there were positive short-term effects on participation in organised activities outside of school hours as well as the number of children meeting physical activity recommendations in the intervention group. Despite being implemented over a relatively short time-frame, with a small sample of children from only two schools, the results of this school and family-based approach to increase physical activity participation in Greek children are encouraging. The parental component included provision of information to encourage and facilitate children’s participation in physical activity outside of school. In this respect it was not overly time or resource intensive, perhaps rendering it more sustainable than the approach reported by Manios and Kafatos (2006). However, it is not known whether these outcomes were maintained beyond the end of the school year. Further evidence is needed from longer term follow-up and larger sample sizes to determine the effectiveness of this program more clearly. This intervention could be tailored to meet the needs of individual schools, is both flexible and potentially sustainable and may present a successful approach to increasing physical activity outside of school hours. This approach might also result in opportunities to link in with local government or sporting organisations to promote activities available in the local area. This could result in sustainable, community-based strategies to increase participation in physical activity.

3.5.3 El Paso coordinated approach to child health

In the El Paso coordinated approach to child health, Coleman et al translated the national Child and Adolescent Trial for Cardiovascular Health (CATCH) program to eight low-income elementary schools involving 896 third grade children (93% Hispanic). Children taking part in the study were followed-up for two years. The study had a quasi-experimental design with repeated pretest-posttest and matched controls. The components of the CATCH program focused on food and physical activity. Intervention schools were encouraged to adapt and modify the CATCH materials to meet the needs of their individual school settings and student populations. The amount of physical education time in which the intervention group engaged in vigorous activity significantly increased over time and was significantly higher at the two-year follow-up than the control group.

While the amount of time spent in moderate-to-vigorous physical activity during physical education lessons significantly increased in the intervention group over the two years, the same was found in the control group, and there was no difference between the two groups.

Appraisal
The positive impact on the proportion of physical education time spent engaging in vigorous physical activity was sustained at two years post-intervention. Physical education lessons provide considerable time in which children can be active and this study has demonstrated that it may be possible to maximise this time, which may in turn make a contribution to meeting daily physical activity recommendations. The effects on moderate-to-vigorous physical activity in physical education lessons were less consistent.

3.5.4 JUMP in, kids in motion

JUMP in, kids in motion, targeted individual factors as well as physical and social environments that influence activity. Using a quasi-experimental design, the program was implemented and evaluated over one school year and included strategies such as: school sports activities; a follow-up system to encourage activity; regular activity breaks during class time; activities to raise awareness of the importance of activity and increase self-efficacy; provision of parent information; and an activity week to combine all JUMP-in, kids in motion components. While the program was developed for children from first to sixth grades, measures of the intervention effects were taken on children in fourth to sixth grades in this study. The effects of this intervention on activity levels varied across the year groups within the intervention schools. Post-intervention, children in intervention schools spent significantly more minutes per day in at least moderate physical activity than children in control schools who showed a much smaller decline from baseline to follow-up. No significant changes were measured in physical activity in fourth and fifth grade children in both intervention and control schools. Sixth grade children in intervention schools showed a slight drop in their physical activity time post-intervention (4 minutes) while those in the control schools showed a larger decline in minutes of physical activity (26 minutes). At the end of the intervention, sixth
grade children in intervention schools were four times more likely to meet physical activity recommendations than those in control schools.

**Appraisal**

The use of a quasi-experimental design and a physical activity measure that appears unvalidated in this study may have influenced the effects detected. The intervention did not contain a curriculum component but focused on school policies and environments as well as provision of parental information.

### 3.5.5 Four-year follow-up of a six-year healthy eating and physical activity intervention

Manios and Kafatos reported on the four-year follow-up of a six-year intervention promoting healthy eating and physical activity among 441 primary school children in Crete. The physical activity component of the program involved theory and practical lessons delivered by physical education teachers as well as a range of parent-focused strategies. At the conclusion of the six-year long program, the average weekly time spent in moderate-to-vigorous physical activity increased by 315 minutes in the intervention group and 197 minutes in the control, with the intervention group showing a significantly greater increase from baseline than the control group. Follow-up measures were taken four years after the end of the program. The amount of moderate-to-vigorous physical activity had decreased in both the intervention and control groups, consistent with patterns of activity in twelve to sixteen year old adolescents found in other studies. Despite this decrease, some significant program effects had been maintained at the four-year follow-up. In comparison to baseline, weekly time spent in moderate-to-vigorous physical activity had increased by 38 minutes in the intervention group while it decreased by 13 minutes in the control group.

**Appraisal**

This trial provides good and long term evidence of the effects of the intervention on children’s physical activity, with some of the intervention effects maintained, even into adolescence when participation is known to decline. The six year duration of the intervention allowed for a sequential learning process, appropriate reinforcement of key themes and full integration into the existing curriculum. Provision of professional development to teachers as well as intensive and ongoing family involvement, particularly in programs targeting primary school aged children also represents good practice. This study was implemented in Greece and so, consideration should be given to potential cultural factors that influenced its success and may impact on its transferability to NSW schools.

### 3.5.6 Kahnawake Schools Diabetes Prevention Project

The Kahnawake Schools Diabetes Prevention Project was implemented among Kanien’keh:ka (Mohawk) elementary school children from first to sixth grade. The Canadian program was evaluated using a pre-post repeated measures design with a comparison group. The intervention group consisted of two elementary schools from one Kanien’keh:ka community and involved 458 children at baseline in 1994 who were followed up until 2002. The comparison group involved 199 children at baseline from one school in another Kanien’keh:ka community. Children in the comparison group were followed up for two years. Children in the intervention participated in ten health education lessons each year on various topics including diabetes, physical activity, nutrition and healthy lifestyles. This was supported by community strategies to promote the project, build capacity, as well as to create healthy environments within the community. Findings from the initial two-year follow-up of both the intervention and comparison groups indicated children in both groups reported an increase in the number of 15-minute sessions of activity each week (23%). Children in the intervention group also marginally decreased the amount of time they spent watching television during the week in relation to the comparison group. At the eight year follow-up, the number of sessions of physical activity reported by children in the intervention community had returned to baseline levels. Initial improvements in the amount of time spent watching television had also been lost.
Module 5 - Physical activity interventions in children aged 5 to 12 years

Appraisal
The initial two year results showed some promise although changes were no longer evident at the eight-year follow up. Furthermore, the eight-year follow-up collected cross-sectional data on the intervention community only and therefore comparisons between children in the intervention and control groups could not be made. Consequently it is not possible to determine whether this intervention had any long-term effects, and would be difficult to recommend as a school based strategy. The program was also designed to be culturally appropriate to Kanien’kehá:ka children’s learning styles leading to possible issues with applying this approach in an Australian context. Another strength of this program was that it focused on a socially disadvantaged population and aimed to address health inequalities.

3.5.7   Active Winners program in rural communities
Active Winners, a community-based physical activity intervention, was designed to increase physical activity and improve the psychosocial determinants of physical activity in children of mainly African-American backgrounds and low socioeconomic status. Fifth grade children from six schools in two rural communities in South Carolina, USA were recruited. The study had a comparative study with concurrent control group design. One school received the intervention and the other school acted as the comparison. The study was conducted over 18 months and data collection took place at baseline (fifth grade), mid-intervention (sixth grade) and post-intervention (seventh grade) in the spring. Four hundred and thirty six children were involved at baseline. The intervention included intensive summer and after school physical activity programs and home, school and community-based components that aimed to promote physical activity in children. Children reported their previous day physical activity at each of the three data collection points. At the end of 18 months, results indicated that the intervention had no effect on children’s physical activity.

Appraisal
Process evaluation of Active Winners indicated that the program had not been implemented fully as planned and that it had reached only a small proportion of the target group. Furthermore, the researchers did not engage with community members and so were not aware of inter and intra-community issues such as school rivalries or insufficient resources, which in turn affected the implementation of the program. In sum, the intervention did not take place as designed, lacked community consultations and engagement, and were insufficiently resourced, so that it cannot be concluded definitively that the program was ineffective.

3.5.8   The Girls health Enrichment Multi-site Studies (GEMS)
GEMS is an American multi-centre research program that aims to develop and test four interventions that were designed to prevent excess weight gain in eight to ten year old African-American girls. Four field centres independently developed and assessed their own interventions following a set of common eligibility criteria and key measurements. All centres tested interventions using a RCT design, based interventions on Social Cognitive Theory, and measured physical activity using accelerometers and the same self-report instrument. All interventions were of 12 week duration. The program was supported by funding from the US National Heart, Lung, and Blood Institute.

The Baylor GEMS pilot study was a RCT with physical activity data collected at pre and post-intervention (12 weeks). Thirty-five eight year old African-American girls with Body Mass Index (BMI) greater than or equal to the 50th percentile of CDC growth charts and with internet access at home were recruited at baseline. Girls in the intervention group attended a special four-week summer day camp consisting of interactive multimedia activities, including buddy groups, problem-solving, dancing, educational games, physical activity skills and exposure. An eight-week home internet program for girls and their parents then followed and this covered topics such as parental modelling, self-monitoring of physical activity using pedometers, and physical activity opportunities. Girls in the control group attended a generic four-week summer camp followed by an eight-week general health internet program for them and their parents. Girls’ physical activity was measured with accelerometers and with self-report questions about previous-day and usual physical activity. At the end of 12 weeks, the results indicated that the intervention had no effect on girls’ physical activity.
The Memphis GEMS pilot study 40 was a RCT targeting eight to ten year old African-American girls with BMI greater than or equal to the 25th percentile of CDC growth charts. Sixty girls and their parents were recruited at baseline with physical activity measured at pre and post-intervention (12 weeks). Girls in the intervention group attended weekly child-targeted 90-minute interactive sessions involving activity components that focused on knowledge, behaviour change skills, and dance or aerobics. Similarly, parents of girls in the intervention group attended weekly parent-targeted 90-minute interactive sessions involving knowledge, behaviour change skills, and dance or aerobics. Parents and girls in the control group attended three monthly 90-minute sessions that aimed to enhance and prevent decline in self-esteem, while being neutral with respect to diet and physical activity. Girls' physical activity was measured using accelerometers and previous day’s activities were assessed using self-report. At the end of 12 weeks, girls and parents in the intervention group showed a combined non-significant increase of 11.7% in moderate-to-vigorous physical activity.

The Stanford GEMS pilot study 41 had a RCT design with data collected pre and post-intervention at 12 weeks from African-American girls, aged eight to ten years, and with BMI greater than or equal to the 50th percentile of CDC growth charts and had at least one overweight parent or guardian. Sixty-one girls were recruited at baseline and randomised to the intervention or control group. Girls in the intervention group were provided with after-school dance classes five days per week (45-60 minutes in duration) at three community centres. As well, intervention group girls and their families received a five-lesson home visiting program that aimed to decrease sedentary behaviours. Girls in the control group received an information-based education program that promoted healthy eating and physical activity in the form of newsletters and lectures only. Girls’ physical activity was measured using accelerometers and previous day’s activities were assessed using self-report. Girls were also asked about their television and video viewing, and computer gaming; while their parents were asked about the overall household television viewing. At the end of 12 weeks, there was a significant overall decrease in household television viewing in the intervention group. A slight increase in after school physical activity and decreases in self-reported television sedentary behaviours were found but these were not significant.

The Minnesota GEMS pilot study 42 recruited 54 African-American girls with BMI greater than or equal to the 25th percentile of CDC growth charts and their parents or caregivers at baseline. The majority of participants were from low-income households. Girls were recruited at baseline and randomised to the intervention or control. Data was collected at pre and post-intervention at 12 weeks. The intervention consisted of two one-hour after-school programs per week focusing on environmental, personal and behavioural factors related to engaging in physical activity, goal setting and participating in different activities (e.g., dancing, jump rope, relay races). Weekly family packs were also provided to reinforce and support messages from the school program. Family nights were organised to deal with family goal setting. Participants in the intervention group received one phone call and one tailored letter that provided motivation and checked progress. The control program was unrelated to nutrition and physical activity. Control participants were provided with three monthly meetings involving art crafts, self-esteem activities, African instruments and memory books. Girls’ physical activity was measured with accelerometers and with self-report questions about previous-day and usual physical activity, as well as questions about physical activity self-concept, outcome expectancies, self-efficacy, and home environment. Parents’ motivation and self-efficacy for physical activity, their support of their daughter’s activity levels and the amount of television viewed by their daughter were also assessed. At 12 weeks, there were no differences between the intervention and control groups on physical activity measures. Accelerometer counts and moderate-to-vigorous physical activity was slightly higher in the intervention group, but this was not significant.

Appraisal

These pilots were not designed to have sufficient power to test for significant differences between intervention and control groups. Rather, the pilots were conducted to test the feasibility of the programs and whether they had potential for efficacy in RCTs. Comparisons between the different methods can be made due to the use of objective monitoring with accelerometers and a common physical activity questionnaire (GEMS Questionnaire). Other strengths of these pilots include formative and feasibility research to develop the pilot interventions, theoretical underpinnings in social cognitive theory, and high retention rates (probably due to the monetary incentives provided for completion of baseline and follow-up measures; except Minnesota GEMS, where participants
received gifts like water bottles, pedometers and t-shirts). These pilots also had several limitations. The main limitation was the use of the GEMS Questionnaire to measure children’s self-reported physical activity engagement. Research on the validity and reliability of the GEMS Questionnaire indicates that the measure has acceptable to low validity (43, 44). Furthermore, the GEMS pilots targeted African-American girls and their families and had culturally-specific components, making the interventions less generalisable to Australian families.

3.6 Using rewards to increase children’s physical activity

3.6.1 Providing feedback plus reinforcement

In this RCT, 30 overweight or obese children aged eight to 12 years old were randomised to an intervention or control group. In the intervention group, children wore pedometers and were rewarded for every 390-400 counts with two tokens that gave them access to the television, VCR and DVD players (1 token = 30 minutes). Children were not allowed to watch television with family members unless it was from time earned. Families attended biweekly meetings with research staff to download data from monitors and parents were provided with feedback about their child’s television time earned. In the control group, children were provided with feedback only. They wore pedometers but had free access to television. Control families also attended biweekly meetings to have pedometer data downloaded. Pedometers were worn by all children during out of school hours until bedtime on weekdays and during waking times on the weekends. Average daily counts and time spent in moderate-to-vigorous physical activity, and vigorous physical activity were determined. Children also reported on their physical activity and sedentary behaviours. At the end of eight weeks, children in the intervention group showed significantly greater increases in their total counts per day and in minutes per day spent in moderate-to-vigorous physical activity compared with to children in the control group. Children in the intervention group also showed a significantly greater decrease in minutes per day engaged in sedentary behaviours compared to the control group.

Appraisal

The study had several limitations including having a small sample size, participants were overweight or obese children, study duration was short, and there was no true control group.

3.6.2 An activity-contingent computer game

MetaKenkoh is an activity-contingent computer game that is played via the internet. Over 200 children aged nine to 11 years old were recruited to the study and randomised to either an intervention or control group. Children in the intervention group were provided with pedometers and asked to play MetaKenkoh for four weeks. Children’s parents uploaded data from the pedometer daily onto an internet database, where their child’s steps were converted to energy units required for children to play the game. If children acquired no steps, then their character in the game had no energy units. Control group children were provided with pedometers only. Children’s physical activity was measured using pedometers (steps per day). Data were collected from all children at baseline for one week prior to randomisation and a sub-sample was followed-up three months post-intervention. Preliminary results (n=63) suggested that the intervention had no effect on children’s physical activity engagement.

Appraisal

Only preliminary findings are available; it is possible that with time and a larger sample, results may prove different.
3.7 Using social marketing to promote physical activity in children

3.7.1 HeartSmart Family Fun Pack

This Canadian pre-post study targeted families with children aged between six and 12 years old. The Family Fun Pack emphasised several themes, one of which was active play everyday, and contained games, posters, a children’s health quiz, and brochures. The pack was publicised via a major media campaign, which provided a toll free number for people to call and request a pack. From those who received packs, 1387 families agreed to complete a short questionnaire and to participate in a follow-up call three months later. Parents reported on the frequency of their child’s active play. At the three-month follow-up, the proportion of families reporting active play on one or more days increased from 28% to 55%.

Appraisal
The pre-post study had several limitations including having a self-selected sample, using measures with undetermined reliability and validity, and pre and post responses were not linked. There was high attrition rate over the three-month study period. The intervention does not appear to be effective.

3.7.2 The VERB national physical activity intervention for children

VERB is a multiethnic campaign that encourages American children aged nine to 13 years old to be physically active everyday. A combination of paid advertisements, school and community promotions and internet activities were used to promote physical activity participation in children in this age group.

The study population was a nationally representative cohort of children and their parents, who were interviewed annually by telephone using the Youth Media Campaign Longitudinal Survey (YMCLS). There were 3120 children recruited at baseline surveys (response rate=43%) which were conducted from April 2002 through June 2003. At the Year 1 follow-up, 2729 (71%) of the baseline respondents competed telephone interviews. At the Year 2 follow-up, 2257 (83%) of Year 1 respondents completed telephone interviews.

VERB was assessed by Huhman and colleagues using a pre-post quasi-experimental design at one and two-year follow-ups. Children who were aware of the VERB mass media campaign were treated as being part of an intervention group, while children who were not aware of VERB were treated as a comparison group. Children’s self-reported engagement in free-time physical activity and organised physical activity in the past seven days, and their self-reported participation in any physical activity in the day before the interview were assessed at each interview.

At the Year 1 follow-up, the campaign had no significant effect on children’s physical activity at the population level, although certain subgroups showed higher free-time and organised physical activity compared with comparison group children. At the Year 2 follow-up, a significant dose-response effect of exposure was detected. The more children reported seeing VERB messages, the more physical activity they did on the day before the interview and the more positive their attitudes towards the benefits of being physically active. Children who were aware of VERB reported participating in significantly more physical activity than children who were unaware of the campaign.

Appraisal
Overall response rate from the three data collections was low (32%). However researchers say that this was comparable to other large-scale telephone surveys. A particular strength of this evaluation was that the same group of children were followed over the two years. This study demonstrates how a national-level media campaign can have positive impacts on children’s participation in physical activity.
4 Evidence appraisal

4.1 Encouraging active transport through policy and infrastructure

The two studies comprised quite different approaches. The UK government’s school travel plan policy, in which schools were offered site-specific advice on school travel patterns, had poor uptake and did not appear to affect children’s travel modes to and from school, nor affect parents’ fears about their children’s safety on the journey to school\(^\text{21}\). The Californian SR2S legislation showed more positive outcomes\(^\text{20}\). The cross-sectional retrospective evaluation of the project suggests that urban design changes, such as those implemented by the SR2S program, may be associated with increases in children’s active transport to school. It is not known to what extent these measures may be implemented in other areas, although there is potential for such environmental modifications to be successful across a variety of school areas.

Active transport policy measures need to be supported by sufficient resources (e.g., time, funding, and expertise) so that they may be fully realised and assessed. The current available evidence is too limited to determine the effectiveness of transportation policy and/or infrastructure changes to promote active transport to and from school in children.

4.2 Creating school environments that facilitate physical activity engagement

There is some evidence to suggest that creating environments that facilitate physical activity is effective for increasing physical activity levels of children between five and twelve years of age. Modifying school playgrounds with coloured markings and zones, and providing equipment for children to play with during break times, show potential as approaches for encouraging physical activity engagement in primary school-aged children during school hours in the short term. Modifying playgrounds, in particular, is relatively low-cost and may be carried out in a variety of non-school settings. However, evaluation is needed to examine the long term effectiveness of these strategies.

These strategies have the potential to reach large groups of children, of varying ages, at a minimal cost and, therefore, may constitute a wise allocation of funds. They are flexible and potentially sustainable without being intensive or costly. It is feasible that these could be implemented across a large number of schools for an extended period of time and in a manner that suits the requirements of individual schools.

Although all these studies were implemented in the school setting, they may be applicable to community parks and leisure centres. Local governments could adopt these approaches as a means of increasing the use of parks and other public spaces in which children might be active during their leisure time.

4.3 Developing teachers’ skills to deliver enhanced health and/or physical education in school

There is some evidence to indicate that providing professional development and support for general classroom teachers can result in increases in the amount of activity delivered as part of the school day for children. Interventions that have shown the most potential are those which have included continual support for teachers in the form of train-the-trainer or buddy systems over one year. A lack of follow-up after the immediate post-intervention period precludes the conclusion that this approach leads to sustained changes in teachers’ skills and knowledge for increasing their students’ physical activity levels.

Action Schools\(^\text{26}\) with a train-the-trainer approach as part of the program, was the simplest version which achieved promising results. The Energizers intervention\(^\text{25}\) involved small physical activity sessions embedded into the school day and were led in the classroom by general teachers who had received training on Energizers activities. The Move It Groove It\(^\text{27}\) program involved more strategies, with a buddy system, web based teacher resources and equipment grants. It specifically demonstrated that physical education lessons can be modified to achieve improvements in fundamental movement skills without compromising the time spent engaging
in physical activity. Better fundamental movement skills may have future benefits on children’s physical activity engagement as they become older, such as improved confidence or ability about engaging in physical activity. Both Action Schools and Move It Groove It give encouraging results and suggest that providing training, ongoing support and resources can increase teachers’ capacity to provide quality health and physical education experiences for their students.

Providing teachers with professional development and training can increase non-specialist teachers’ skills and confidence in delivering physical education classes and accordingly maximise opportunities to engage in physical activity during class time. This not only up-skills individual teachers but also builds capacity within schools to provide appropriate physical education experiences to their students. While providing training to large numbers of teachers may be potentially expensive and resource intensive, programs which have used train-the-trainer approaches offer an alternative that has good potential for teacher empowerment and program sustainability. In particular, the Move It Groove It model is suitable for application in NSW because it was developed and evaluated in the state with sound results.

The models that were implemented were well received by teachers and students. These may be viable and sustainable approaches to increasing activity in children during the school day. Longer-term follow-up of teachers would provide an indication of the extent to which reported changes in delivery of physical activity and increased confidence are maintained over time. Examination of children’s out-of-school physical activity participation is also necessary to see whether greater engagement in physical activity in school translates to out-of-school times.

4.4 Developing children’s skills to engage in self-directed physical activity through school health and physical education programs

Interventions integrated into formal health and physical education curricula and which target children and their skills related to being physically active have shown mixed results. Those interventions that have shown the most promising results are those which taught children skills on how they may engage in physical activity on their own. This encompassed elements such as providing children with information about the benefits of being active, providing them with opportunities to try different types of activities, teaching children to set physical activity goals and coaching them in how to monitor their own physical activity.

Most of the studies taking this approach have yielded moderate-quality evidence due to the quasi-experimental and post-only designs (e.g., Switch Off-Get Active and the PLAY program respectively). The use of multi-media to deliver an interactive learning program to children about being active did not appear to be effective in increasing activity in children. The effect of delivering physical activity curriculum via lunchtime clubs as a means of increasing physical activity engagement is also unclear. In this study it appears that children ran more at lunchtime but there was no impact on activity patterns outside of school hours. Only one RCT has been conducted in recent years and results suggest that a comprehensive physical activity promotion program in schools may slow the decline in children’s total moderate-to-vigorous physical activity participation.

4.5 Involving the family or community in health and physical education interventions

When targeting children between five and twelve years of age, it makes good sense to involve the family and/or community. A number of studies identified were school-based interventions complemented with family and/or community components and several studies have produced encouraging results.

Caballero et al used a multicomponent approach to promote physical activity and healthy eating in American Indian children with Pathways and provides a good example of best practice when implementing programs in schools and with indigenous communities. Similarly, Paradis et al used a participatory approach and emphasised community ownership, as part of their diabetes prevention program in a socially disadvantaged population group.
One of the more encouraging studies was an extensive RCT, with school and family components. Manios and Kafatos reported that the positive effects of this intervention on moderate-to-vigorous physical activity appeared to have been somewhat maintained 10 years after the program commenced. Other studies have used goal-setting. Christodolous and colleagues used an individual goal-setting program delivered by teachers through the Greek school PE curriculum and showed some success. The GEMS pilots constitute a good strategy with different centres independently developing and assessing their own interventions following a common set of criteria and outcomes. They demonstrate a useful collaborative strategy for determining effective or ineffective components of interventions. Future research into whether the effects of the studies on participation in organised activities can be maintained and, if total activity increases with time, would be of value.

Altogether using school, family and community settings in combination to promote physical activity in children is an approach that has been taken by numerous researchers. The current available evidence is of moderate to good quality and there have been some promising results. Many of the studies identified demonstrate good practice in program design, implementation and evaluation and illustrate useful concepts, such as ensuring process evaluation is carried out, consulting community members, providing support to teachers and parents, having long term follow up, and focusing on disadvantaged communities.

**4.6 Using rewards to increase children’s physical activity**

The two studies which used positive reinforcement to increase children’s physical activity yielded limited results. Goldfield et al used pedometer feedback combined with positive reinforcement and Southard et al reported preliminary results on an activity-contingent game.

In addition, using rewards to encourage children to engage in physical activity may have long term drawbacks. Positively reinforcing children with television or computer gaming time for being active may encourage children to be more active in the short term but this strategy is not likely to lead to sustained behaviour change. Physical activity may not be maintained if television or computer game time are no longer restricted, or if the rewards (television time or gaming time) are no longer appealing. Furthermore, it is possible that by offering rewards to encourage children to be active, the intrinsic value of physical activity to children may be reduced, leading to less intrinsic motivation among children to be active.

Overall, there is insufficient evidence that rewarding children for being active is an effective strategy for promoting physical activity in children.

**4.7 Using social marketing to promote physical activity in children**

On the whole, there is insufficient evidence to draw clear conclusions on the effects of social marketing campaigns for promoting physical activity in children. The VERB campaign demonstrates that a mass media campaign may be effective in augmenting children’s physical activity participation, and that effects take time to become evident. The limited evidence base suggests that a social marketing campaign using a range of media continuously over several years may lead to positive changes in physical activity at the population level. Although no changes may be evident in the short term, if a campaign is conducted for a longer period of time, changes may come about.

**4.8 Gaps/clusters**

Finally, much of the evidence regarding physical activity promotion in children aged five to twelve years has been derived from work conducted in the school setting. Further exploration of strategies involving home and community settings, as well as environmental modifications, are required to expand the domains in which children’s physical activity may be fostered. It will be important to continue to build the capacity of health services, schools, families and communities to help children to participate in physical activity. Attention needs to be given not only to children’s structured physical activity during school hours, but also to their unstructured and incidental activity in school, as well as, out of school times. This includes delivering structured physical activity programs, creating activity-
friendly environments, involving parents and community members, and providing children with the skills, ability and confidence to engage in physical activity on their own. Possible compensatory effects between children's physical activity in school and out of school, and children's access to and their use of open space also need to be addressed in future research. Providing children with sound foundations for engaging in self-directed physical activity and to lead active lifestyles will help them to carry these good habits through adolescence and into adulthood for lifelong health benefits.
5 Promising and appropriate strategies

A range of strategies targeting children aged five to twelve years have been outlined and discussed in this module. Decisions about which particular strategies to include in any portfolio of interventions will depend on the needs of the target population as well as the capacity of Area Health Services or health organisations.

The following table presents the types of strategies that have been discussed in this module and the degree of promise each strategy shows for promoting physical activity in children at the population level.

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<tr>
<td>Encouraging active transport through policy and infrastructure</td>
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<tr>
<td>Using rewards to increase children's physical activity</td>
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<td>Promoting access to and use of open space</td>
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6 Implications for policy and practice

This module has identified several strategies that are promising or worthy of consideration for NSW Area Health Services and other public health practitioners to use in their work promoting physical activity in children aged five to twelve years. The most promising approaches reviewed in this module were those which involved enriching children’s play areas and equipment, and those which entailed multiple components (school, family, community) over a relatively long period of time. School-based approaches which focused on the professional development of teachers to give them the skills to deliver enhanced health or physical education during school or helped children to develop skills to be active themselves were also promising. Using mass media campaigns to promote physical activity participation in children is a strategy worthy of consideration. These strategies should be considered as priorities for implementation, while further evidence is gathered regarding the effectiveness of other approaches such as active transport policies and infrastructure, and using rewards.

6.1 Implementation considerations

Relevant principles for best practice comprise:

- Clear, concise and appropriate objectives.
- Specific strategies which address the identified objectives.
- High quality implementation of specified interventions.
- Intervention and follow-up time frames should be of sufficient length to detect positive effects and determine the extent to which these effects are, or are not, maintained over time.
- Sufficient sample size and appropriate comparison groups when evaluating interventions.
- Use of valid and reliable measurement tools.
- Measure total physical activity of children as well as types of activity in which they take part.

As the majority of the interventions discussed in this module were conducted overseas and many were tailored to specific communities and population groups, modifications will be required when translating these approaches to the NSW context. It will be important to conduct thorough expert and stakeholder consultations and pilot testing to ensure that modified approaches are feasible and appropriate for implementation in NSW.

The difficulty of gaining valid and reliable measurements of physical activity in children has been acknowledged and while there are a number of measurement tools, each has its advantages and limitations. Using a combination of objective measures (accelerometry or pedometry), parent-proxy report and self-report, even if only on a sub-sample of the study population, is likely to provide a more reliable overall assessment of children’s physical activity.

6.2 Portfolio approach

It is likely that no single strategy will lead to increases in population levels of physical activity in children and it will be necessary to apply a variety of strategies in order to achieve this outcome. Taking multiple and complementary approaches will help to address physical activity in a range of domains in children’s lives, from different settings to different developmental stages. This is consistent with recommendations for best practice, such as Getting Australia Active.

Generally, the implementation and effectiveness of programs will be enhanced by supplementary initiatives, such as communication and public education through local media and other channels, promotion and reinforcement through health professionals’ capacity to opportunistically provide accurate information and consistent advice.
### 6.4 Translating evidence into cross-sector actions

Approaches identified as promising and worthy of consideration have been interpreted into practical actions/programs that may be relevant to areas within NSW and Australia. The relevant sectors that could contribute to implementation have also been identified.

<table>
<thead>
<tr>
<th>Physical activity in children aged five to twelve years</th>
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<tr>
<td><strong>DO</strong></td>
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<tr>
<td>Playground markings &amp; equipment</td>
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<td>PDHPE implementation with family and community involvement</td>
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<td>Teacher professional development</td>
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<td>Teaching children skills to engage in self-directed physical activity</td>
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<td>E, H</td>
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<td>L, P, E</td>
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**Sectors**

- A - Agriculture
- C - Community services
- E - Education sector
- H - Health
- L - Local government
- P - Planning
- R - Recreation
- RTA - RTA
- T - Transport
7 References


### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>C</td>
<td>Control</td>
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<tr>
<td>CATCH</td>
<td>Child and Adolescent Trial for Cardiovascular Health</td>
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<td>EE</td>
<td>Energy expenditure</td>
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<td>GEMS</td>
<td>Girls health Enrichment Multi-site Studies</td>
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<td>IV</td>
<td>Intervention</td>
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<td>MIGI</td>
<td>Move It Groove It primary school intervention</td>
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<td>MPA</td>
<td>Moderate intensity physical activity</td>
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<tr>
<td>MVPA</td>
<td>Moderate-to-vigorous physical activity</td>
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<tr>
<td>n.s</td>
<td>not significant</td>
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<td>NSW</td>
<td>New South Wales</td>
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<td>PA</td>
<td>Physical activity</td>
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<td>PE</td>
<td>Physical education</td>
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<td>RCT</td>
<td>Randomised controlled trial</td>
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<td>SOFIT</td>
<td>System for Observing Fitness Instruction Time</td>
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<tr>
<td>VPA</td>
<td>Vigorous intensity physical activity</td>
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<td>Ref</td>
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<tr>
<td>Boarnet et al 2005</td>
<td>Cross-sectional retrospective evaluation.</td>
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<td>Data were collected 1-18 months after the completion of SR2S project construction (mean=1 year). Setting: Community-based</td>
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<td>Rowland et al 2003</td>
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### Table A2. Interventions that modified the school environment to encourage physical activity

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<tr>
<th>Ref</th>
<th>Design</th>
<th>Participants</th>
<th>Intervention description</th>
<th>Outcome variables</th>
<th>Key findings/ Outcomes</th>
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<tbody>
<tr>
<td>Ridgers et al 2007</td>
<td>Quasi- experimental</td>
<td>Children from 26 elementary schools in areas of high deprivation in one large city in England. N=470 children (232 boys, 238 girls) n(IV)= 256 children (130 boys/126 girls) from 15 schools n(C)= 214 children (102 boys/112 girls) from 11 schools</td>
<td>IV schools received funding to redesign the playground based on the sporting playground zonal design. School playgrounds are divided into three specific areas: a red sports area; a blue multi-activity area; and a yellow quiet zone. The markings were relevant to the PA and social behaviours desired for each area. IV schools also received physical structures including fencing, seating, goal posts and basketball hoops. Small pieces of equipment such as soccer balls, skipping ropes and tennis balls were available in all intervention and control playgrounds. Teachers supervised morning and afternoon recess and lunchtime assistants supervised the lunch break.</td>
<td>Proportion of time children engaged in MVPA and VPA during their breaks measured by heart rate monitors and accelerometry. All children wore a heart rate monitor. A sub-set of children (n=298; 149 boys, 149 girls) wore an accelerometer as well. Heart-rate monitors and accelerometers were worn for one school day at each measurement point.</td>
<td>Activity measured by heart rate monitors found a significant effect across time for both MVPA (p&lt;0.05) and VPA (p&lt;0.05). Children in the IV schools engaged in 4.0% more MVPA and 2.4% more VPA during break times than in the C schools. The IV effect on MVPA and VPA was found to be stronger as the length of break times increased (p&lt;0.05). The IV effect for MVPA was stronger for children who were less active at baseline (p&lt;0.05). Accelerometry also found significant intervention effects. Children in IV schools engaged in 4.5% more MVPA (p&lt;0.05) and 2.3% more VPA (p&lt;0.05) than in C schools. The intervention effect was stronger for MVPA in younger children (p&lt;0.05). The intervention effect for VPA also became stronger with time (p&lt;0.05).</td>
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<td>Stratton &amp; Mullan 2005</td>
<td>Pre-post study with concurrent controls. Schools matched on playground dimension and socioeconomic status. Duration: 8 weeks Data collected at baseline for 4 weeks in June prior to redesign, and for 4 weeks in Sep- Oct after redesign.</td>
<td>Primary school-aged children from areas of deprivation in Northeast Wales and Northwest England. N= 8 schools (4 IV, 4 C); 99 children Each study arm consisted of 2 early primary (4 -7 years) and 2 late primary (7 – 11 years) schools. 15 boys and 15 girls (5 from each age group) in each school were randomly selected to participate in the study.</td>
<td>Prior to the IV, none of the participating schools had playground markings and the outdoor areas of each had tarmac and grassed areas for play. The playgrounds of IV schools were painted in bright, fluorescent colours according to school preference. In early primary schools this included castles, mazes, dragons, hopscotch, snakes and ladders and so on. In late primary schools it included markings for games such as netball or tennis and targets for games related skills. Both IV and C schools had small pieces of sports equipment such as skipping ropes and footballs.</td>
<td>Time spent in MVPA and VPA during playtime increased using heart rate monitoring during play time. Measurements were taken during one morning, lunch and afternoon play period on 3 separate days during the same week.</td>
<td>Time spent in MVPA and VPA during playtime increased significantly in children in IV schools at post-test. MVPA increased from 36.7% to 50.3% of playtime in IV schools and decreased from 39.9% to 33.4% of play time in C schools (F=13.7, p&lt;0.01). VPA increased from 7.9% to 12.4% of playtime in IV schools compared to an unchanged 8% of play time for the C group (F=4.05, P&lt;0.03). Both boys and girls in the intervention group increased their MVPA and VPA (n.s.). Boys were found to be more active than girls (n.s.). Physical activity decreased with age (n.s.).</td>
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<tr>
<td>Ref</td>
<td>Design</td>
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<tr>
<td>Verstraete et al 2006</td>
<td>Quasi-experimental, controlled pre-test and post-test design</td>
<td>Children in the 5th and 6th grades.</td>
<td>IV: Each IV class received a set of game equipment and cards which included examples of games and activities that could be performed with the equipment. A research staff member presented the equipment and cards to each class group before they were provided with the resources. Children were allowed to play outdoors, with the equipment during recess and lunch. Teachers encouraged children to play with the equipment and divided equipment into sets and exchanged regularly to prevent loss of interest. They also agreed on rules with the children for use of the equipment to ensure its endurance. C: Did not receive game equipment.</td>
<td>Proportion of time engaged in light, moderate, moderate-to-vigorous and vigorous activity during recess and lunch breaks. Accelerometry was used to record children’s activity levels.</td>
<td>Children in IV group increased the time spent in MPA from 41% to 45% during recess at 3 months from baseline. In the C group time spent in MPA decreased from 41% to 34%. Time spent in MVPA and VPA decreased in both groups, but the proportion of time spent in PA was greater among IV children than C at post-IV (p&lt;0.01). During lunch, children in IV group increased the proportion of time in MPA (from 38% to 50%), in VPA (from 10% to 11%), and in MVPA (from 48% to 61%) The time spent in MPA VPA and MVPA decreased in the control group. IV children spent significantly more time in all intensities of PA at post-IV compared to the C group (p&lt;0.001). There were some gender differences. Girls in the IV group increased their MPA and MVPA and decreased their LPA during recess and lunch.</td>
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### Table A3. Interventions that developed teachers’ skills to deliver enhanced health and/or physical education in school

<table>
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<tr>
<th>Ref</th>
<th>Design</th>
<th>Participants</th>
<th>Intervention description</th>
<th>Outcome variables</th>
<th>Key findings/ Outcomes</th>
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<tr>
<td><strong>Mahar et al</strong> 2006</td>
<td>Quasi-experimental</td>
<td>Classes were randomly assigned to IV or C condition. Duration: 12 weeks</td>
<td>Children from kindergarten to 4th grade in 1 school in North Carolina. n(IV)=135 children; 9 classes n(C)=108 children; 6 classes</td>
<td>IV: A classroom-based physical activity program called Energizers. Energizers are short classroom-based physical activities, about ten minutes long. They integrate age appropriate materials and require no equipment and very little teacher preparation. Teachers led one activity each day over a period of 12 weeks and were able to choose which activity to do with their class each day. They also received training and copies of the activities. C: Teachers delayed teaching Energizers until the eighth week of the semester.</td>
<td>Number of steps taken at school measured by pedometers. Children in the IV took more steps each day while in school (5587±1633) than the control classes (4805±1543)(p&lt;0.05) after 12 weeks. The size of the difference (approximately 782 steps) was moderate (ES=0.49) Teacher compliance with performing the energising activities during the week of pedometer data collection was good.</td>
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<td><strong>Naylor et al</strong> 2006</td>
<td>Cluster randomised trial with comparison group. Schools stratified randomly to groups by size and geographic location. Duration: 11 months. School-based,</td>
<td>Teachers of 4th-6th grades from 10 elementary schools in British Columbia. Liaison schools, n=4 Champion schools, n=3 Usual practice schools, n=3 Schools volunteered to participate and those that were not carrying out PA initiatives already were selected. 61% of school children spoke a language other than English at home (mainly Chinese).</td>
<td>Liaison schools: Following training, teachers received weekly contact from a facilitator, who provided mentoring and demonstrated activities. Classroom actions bins were enhanced with resources as requested. Support was provided to each classroom. Champion schools: Action bins in champion schools contained a basic set of resources. One teacher in these schools received training. They then provided support and encouragement to their colleagues. Support was not provided to each classroom. Usual practice schools: Carried on with typical delivery of physical education.</td>
<td>Type, frequency and minutes of physical activity delivered by teachers each week as recorded by teachers in daily Activity Logs. At the end of 11 months, teachers in the liaison schools delivered an average of 160 minutes of activity each week (+67.4min/week) and teachers in champion schools, an average of 147 minutes each week (+55.2min/week). This was significantly higher (p&lt;0.001) than in usual practice schools, where teachers delivered an average of 105 minutes of activity each week. There was no sig. difference between liaison and champion schools. Training was well rated by teachers; 96% were very or extremely satisfied with the workshop delivery, 75% indicated they would use the workshop content and 70% were confident in their ability to use the activities in their classroom.</td>
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<td>Ref</td>
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<td>Intervention description</td>
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<td>Van Beurden et al 2003</td>
<td>Quasi-experimental.</td>
<td>Children in 3rd and 4th class (aged 7-10 years).</td>
<td>IV: A whole-of-school approach was taken, including strategies to provide teacher support and create supportive environments and healthy school policies. IV schools established a project team to select and customise policies and environment strategies to suit the school. Teachers in IV schools were matched with a buddy to provide support, information and strategies for increasing activity during PE lessons and improving FMS. A web site contained resources for teachers. IV schools were offered nominal funding to purchase equipment. Teachers in schools attended four workshops throughout the intervention phase. C schools did not receive the program.</td>
<td>Mastery of fundamental movement skills. Students were asked to perform a skill 5 times and were rated by a trained tester. Time spent in activity during PE lessons was measured using SOFIT. At each PE class, 4 randomly selected children were observed for 12 periods of 20 sec and detail recorded on the activity level and lesson context.</td>
<td>At 1-year follow-up boys and girls in IV schools showed significant overall improvement in all fundamental movement skills combined compared to the boys and girls at C schools (16.8%, p&lt;0.0001). IV schools significantly increased the time spent in vigorous PA by 3.3% compared to control schools (z=2.43, P=0.008). IV schools also showed a non-significant increase in MVPA (4.3%) compared to C schools (z=1.33; p=0.09). Having a male teacher was found to be predictive of being more active while participating in PE.</td>
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<td>Ref</td>
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<td>Goran &amp; Reynolds 2005 Interactive Multimedia for Promoting Physical Information (IMPACT) in Children USA</td>
<td>Quasi-experimental with matched control group. Schools selected on basis of computer lab availability and close match of ethnicity and SES composition. Randomisation by school. Duration: 8weeks</td>
<td>4th grade boys and girls (mean age 9.5 years) from 4 schools (2 intervention and 2 control) Baseline N=209 Final n(IV)=60 (27 boys,35 girls) Final n(C)= 62 (24 boys,36 girls)</td>
<td>Intervention schools received a CD-ROM developed as an interactive learning game. Students received: 8 interactive animated lessons (45-minutes each lesson) and 4 family-based assignments (45-minutes each assignment). Over the intervention period, students had 12 contact hours. The activities provided information on outcomes of being active, skills to change activity patterns, setting goals, tracking individual progress, reinforcement, self-efficacy and environmental aspects. The control schools received CD-ROMS that were unrelated to health. Intervention was based on Social Cognitive Theory.</td>
<td>Total physical activity and average time spent in light, moderate and vigorous physical activity measured by accelerometry Accelerometers worn for five consecutive days.</td>
<td>Valid accelerometer data was available from 122 children post-IV. No significant treatment effects on total physical activity in either boys or girls by accelerometry at 8 weeks post-IV. Self-reported amount of time spent in MVPA was significantly lower in IV children compared with C children (from 18.5% to 15.0%; p=0.03). Boys in the intervention reduced their proportion light PA time from 78% to 75%. Girls in the intervention increased their proportion of light PA time from 78% to 81%.</td>
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<td>Harrison et al 2006 Influence of a health education intervention on physical activity and screen time in primary school children: ‘Switch Off- Get Active’. Ireland</td>
<td>Quasi-experimental study. Allocation to IV or C was carried out to ensure a balance between boys and girls, and urban and rural schools in each group. Duration: 16 weeks</td>
<td>Children in 4th class (mean age 10.2 years) from 9 schools in towns and rural areas of high social disadvantage in south east Ireland Baseline N=312 n(IV)=182 children; 5 schools n(C)=130 children; 4 schools Retention rate=91%</td>
<td>IV: A sixteen week teacher-led health education program to increase physical activity and decrease sedentary screen time. It was designed to complement the existing curriculum and was based on Social Cognitive Theory. Ten 30-minute lessons were delivered as part of the program. Children reflected on their use of leisure time, were encouraged to set activity goals, increase their physical activity and monitor their own progress. Participating teachers were non-specialist health educators but received training, resources to support lesson delivery and student materials including workbooks and activity logs. C: Teachers delivered usual health education curriculum.</td>
<td>Number of 30 mins blocks of MVPA and screen time measured by 1-day self-reported recall. This measurement was taken on occasions pre- and post-intervention to reflect 2 week days and 1 weekend day.</td>
<td>Daily 30-minute blocks of MVPA increased by 2.83 blocks/day (approx. 85 mins) in the IV group and 2.1 blocks/day (approx. 63 mins) in the C group from pre to post-intervention (16 weeks). The increase was significant for both groups (p&lt;0.05). Post- intervention the number of 30-minute blocks of MVPA in the IV group was significantly higher than in the C group (Adjusted difference=+0.84 blocks/day; p=0.03). There were no differences post-intervention between IV and C school children in self-reported screen time (Adjusted difference=-0.41 blocks/day; p&gt;0.05).</td>
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<td>Ref</td>
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<td>Pangrazi et al 2003</td>
<td>Post-only study with a no treatment control group. Duration: 12 weeks</td>
<td>35 primary schools divided into four study arms: PLAY and PE (10 schools, 185 children); PE only (10 schools, 176 children); PLAY only (9 schools, 150 children); and no treatment (6 schools, 93 children). N= 606 children in the 4th grade (291 boys /315 girls); mean age 9.8 years.</td>
<td>Children in the PLAY and PE, and PLAY only groups participated in a 12-week program conducted during the school day. Phase one (one week) promoted play behaviour by discussing the importance of activity and participating in fifteen minutes of activity each day. Phase two (three weeks) introduced a variety of games and activities as children continued to participate in fifteen minutes of activity each day. Phase three (eight weeks) encouraged self direction to achieve the recommended thirty or more minutes of physical activity at least five days a week.</td>
<td>Steps per day measured with a pedometer.</td>
<td>Children in the PLAY and PE, and PLAY only program accumulated significantly higher mean step counts per day than children in the no treatment group at 12 weeks post-IV.</td>
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<td>PLAY+PE vs. C: mean difference=1583 steps, p=0.010</td>
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<td>PLAY only vs. C: mean difference=1418 steps, p=0.035</td>
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<td>Girls in the PLAY and PE, and PLAY only groups had significantly more mean steps than children in the no treatment group.</td>
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<td>Girls in PLAY+PE vs. C: mean difference=2277 steps, p=0.001</td>
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<td>Girls in PLAY only vs. C: mean difference=1954 steps, p=0.006</td>
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<td>Verstraete et al 2007</td>
<td>RCT</td>
<td>Elementary school children in East Flanders. N=16 elementary schools. n(IV)=8 schools. n(C)=8 schools Baseline: N= 810 children (399 boys, 411 girls); mean age=9.7 years. Post: N=764 children (373 boys, 391 girls); mean age=11.2 years</td>
<td>IV: This two-year program consisted of health-related physical education, health education lessons and an extra-curricula physical activity promotion programme. Specialist physical education teachers received a manual with guidelines and sample lessons to promote health related physical education and high activity levels. They were asked to implement the guidelines in all physical education lessons and give at least six of the sample lessons. Health education consisted of six lessons to promote lifelong physical activity through increasing knowledge and skills. Homework promoting activity outside of school was given to stimulate parent support. Information was given on local sports clubs to encourage participation in leisure time.</td>
<td>Total physical activity measured with accelerometry. Self-reported leisure time physical activity measured using a PA Questionnaire with parental assistance. A representative subsample was selected for accelerometry. 8 of 16 schools (4IV, 4C) were selected. n=111 children (49 boys, 62 girls).</td>
<td>Accelerometer data indicated that children’s engagement in moderate PA and MVPA decreased less in IV schools than in C schools (F=10.26, p&lt;0.01) at 2 years, The average time spent doing MVPA dropped by 9 min per day in IV schools, while in C schools MVPA time decreased 33min per day. Children's total PA engagement was higher at follow up in IV schools than in C schools (n.s.). In the PA Questionnaire, children in IV schools reported more moderate PA in leisure time than children in C school (F=5.23; P&lt;0.05). At 2 years follow-up, children in IV schools reported slightly increased time in moderate PA (+2.55 min per day), while children in C schools reported decreased time in moderate PA (-0.33 min per day).</td>
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<td>Ref</td>
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<td>Participants</td>
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<td>Outcome variables</td>
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| Warren et al 2003 | Comparative study with concurrent controls.  
Children randomly allocated within schools to 1 of 4 study conditions.  
Duration: 4 school terms  
Data collected at baseline and 1 month post-IV (14-16 months between measures). | Children in years 1 and 2 (aged 5 to 7 years) from 3 primary schools in Oxford.  
Baseline n=213 children; response rate=70%  
Final n=181 children; response rate = 45%  
Drop out rate = 17% | There were 4 study conditions.  
3 IV: Nutrition only, physical activity only or nutrition and physical activity.  
1 C: Non-nutritional education program.  
The program was delivered through lunchtime clubs.  
An age appropriate nutrition and/or physical activity program was delivered for eight weeks per term over four school terms.  
The physical activity component of the program promoted incorporating activity into daily life, decreasing time spent in sedentary behaviour, promoting activity in the playground and introducing the concept of energy expenditure.  
Children in the combined nutrition and physical activity group were exposed to half of the nutrition and half of the physical activity program each term.  
The control group learned about food in a non-nutrition sense and the human body. | Parental report of child’s frequency and duration of habitual activity, attendance of out of school clubs, outdoor play, computer time and television viewing.  
Child self-reported travel to and from school, and activities during break time. | After one year, there was a small increase in the number of children walking to and from school in all groups.  
An increase in playground activity during recess was reported by all groups, but was higher in the IV groups (including the nutrition only) compared to the C group.  
There was an increase in playground activity during lunchtime in the physical activity group and the nutrition/physical activity group. The other groups decreased activity during lunch time.  
No notable differences in the activity of boys and girls were observed at either baseline or follow-up.  
Parent responses indicated there was no effect on physical activity of children outside of school hours. |
### Table A5. Health and physical education interventions with family or community involvement

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<tr>
<th>Ref</th>
<th>Design</th>
<th>Participants</th>
<th>Intervention description</th>
<th>Outcome variables</th>
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<tbody>
<tr>
<td>Caballero et al 2003 Pathways: A school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren. USA</td>
<td>Cluster RCT  Setting: School Data was collected at baseline (end of 2nd grade) and at follow up (end of 5th grade). Duration: 3 years</td>
<td>American Indian children in 3rd to 5th grade. 41 schools in 7 American Indian communities. Baseline N=1704 children, 41 schools; n(IV)=879, n(C)=825; Mean age=7.6 years. 83% retention rate at follow up.</td>
<td>IV: The components in the intervention were classroom curriculum, food service, physical activity and family involvement. The IV was based on Social Learning Theory. Classroom curriculum: Children participated in two 45 minute health education lessons each week over 12 weeks in 3rd and 4th grade and eight weeks in 5th grade. These lessons promoted healthful eating and physical activity. Physical education: Children had three thirty minute sessions of MVPA each week based on the Sports Play and Active Recreation for Kids program (previously tested), with the addition of an American Indian games module. During class time, two 10-minute exercise breaks were provided to increase energy expenditure and promote PA in the classroom. Teachers and school staff were provided with training and mentoring. Family involvement: Families were provided with action packs that included take home materials related to the intervention. Family events at school included activities to promote a healthier lifestyle and directly involved children. C: Schools delivered usual curriculum and services.</td>
<td>Total activity over a 24 hour period measured with accelerometry. Self-reported physical activity (past 24 hour recall), and PA-related knowledge, attitudes and behaviours. Process evaluation: Attendance of teacher training and family sessions; student and parent evaluation forms, implementation of classroom curriculum</td>
<td>Accelerometry showed no difference in the total counts between intervention and control groups at 3 years post-IV. Levels of self-reported physical activity were higher in the children in the intervention schools than in the control at the end of 3 years (mean difference=0.04, p=0.001). There was no difference between the two groups in physical activity self-efficacy (mean difference 0.03, p=0.060). Intervention schools held an average of nine events over the three years with an average attendance of 58% of children in the study. This appeared to be good in comparison to anecdotal reports of parental attendance at other school events. Process: 94% of schools implemented classroom curriculum; 100% of schools had three sessions per week of PE by the third year; 56% had 5 sessions per week of PE by the third year, family events were rated as enjoyable by majority who also said they learned something new about PA.</td>
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<td>Christodoulos et al 2006</td>
<td>RCT</td>
<td>6th grade children from 2 schools in 1 district, aged 10 to 12.5 years. N=78; n(IV)= 29 (18 boys,11 girls); n(C)= 49 (24 boys; girls)</td>
<td>IV: PE classes (2 x 45 minutes per week) based on an individual goal setting program, where children focused on skills learning and practice. PE classes were supplemented with a health lecture once a week and integration of health into the general curriculum. Teachers received training sessions and materials beforehand. Family involvement was encouraged through homework assignments with family activities, provision of physical activity and nutrition guidelines, requesting that children be provided with healthy snacks for school. Extra curricula involvement in physical activity was encouraged by disseminating information on community based sports programs, and advising parents to encourage children to incorporate PA into their daily lives e.g. active transport. IV was based on Theory of Planned Behaviour. C: Children received usual the PE curriculum only (2 x 45 minutes per week).</td>
<td>Self-reported attitudes and intentions towards physical activity. Past-year recall of frequency, duration and total hours of MVPA and hours of organised MVPA each week.</td>
<td>IV group had a significantly more positive attitude to PA (6.65 vs. 6.42; p&lt;0.05) and scored significantly higher on their intent towards participation in PA (6.65 vs. 5.95; p&lt;0.05) than the C group. Average time each week spent in organised MVPA was significantly higher in the intervention (3.54 hrs) than the control (2.54 hrs; p&lt;0.05). No difference was reported in total time spent in MVPA between the groups. Both IV and C groups showed significant increases in the proportions of children meeting national PA recommendations after 9 months, with the proportion of the IV group significantly higher than that of the C group at 9 months (77% vs. 55%; p&lt;0.043).</td>
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<td>Coleman et al 2005</td>
<td>Quasi-experimental repeated pretest-posttest design with matched controls.</td>
<td>Children in 3rd grade in 8 low-income elementary schools in El Paso, Texas 4 intervention and 4 control schools Baseline: n(IV)=423 (224 boys,199 girls) n(C)=473 (249 boys,224 girls) 93% Hispanic n=152 lost to follow-up.</td>
<td>Aimed to translate the CATCH intervention to low-income elementary schools with predominantly Hispanic students. IV: The national CATCH program was implemented at IV schools. PA components included: increasing MVPA during PE lessons; health promotion classroom curriculum; and family based activities. Intervention schools were encouraged to adapt the national CATCH materials to meet the needs of individual schools and their students. Focus was on effectiveness, translation of evidence and institutionalisation rather than program fidelity. C: Usual curriculum; received $1000 for participating each year.</td>
<td>Time spent in MVPA activity in PE class measured by observation (SOFIT - 10 sec sampling). Observation took place over 2 non consecutive days in 2 non consecutive weeks each semester. Other outcomes were also measured e.g. weight, aerobic fitness.</td>
<td>VPA during PE was significantly greater in the IV group than C group in the fall of 4th grade and in both fall and spring of 5th grade. At the end of the two year follow-up, 12% of PE was spent in VPA in IV schools compared to 10% in C schools. This difference was significant. There was no consistent pattern in the difference in the proportion of time spent in MVPA during PE lessons between the intervention and control during the follow-up period. At the end of the two year follow-up there was no significant difference in the time spent in MVPA during PE lessons between the IV (60%) and C (63%), but both significant increases compared to baseline (fall of 3rd grade).</td>
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### Module 5 - Physical activity interventions in children aged 5 to 12 years

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<th>Participants</th>
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<tr>
<td>Jurg et al 2006</td>
<td>Quasi-experimental, pre-post controlled study</td>
<td>Children in 4th, 5th and 6th grades from 6 primary schools in Amsterdam. Post N=510 children. n(IV)= 369 children; 4 schools. n(C)=141 children; 2 schools. Low SES schools.</td>
<td>'JUMP-in, kids in motion' is based on the 'JUMP-in' program which aims to promote physical activity in primary school children. The IV focused on individual factors as well as the physical and social environments influencing activity. The components of the IV were school sports activities, a pupil follow-up system, in class activity breaks, awareness raising and self-efficacy activities, parental information services and an activity week. Attention was paid to making the program fun and the needs of various cultural groups.</td>
<td>Estimated total daily minutes (at least) of moderate activity from self-report.</td>
<td>Physical activity in 4th and 5th grade children in IV and C schools showed non-significant changes at one year post-IV. 6th grade children in IV schools showed a slight drop in their physical activity time post-IV (-3.52 min/day; p&gt;0.05), while those in the C group showed a larger decline in minutes of PA per day post-IV (-26.49 min/day; p&lt;0.01). Post-IV, the children in IV schools spent significantly more time per day in PA than children in C schools with a much smaller decline in PA min/day from baseline to post (standardised beta=0.22; p&lt;0.001). 6th grade children in IV schools were four times more likely to meet physical activity recommendations than those in the C schools post-IV.</td>
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<td>Manios and Kafatos 2006</td>
<td>RCT</td>
<td>Primary school pupils from schools in 3 counties. At four-year follow-up, a random sample of 24 schools participating in the study was selected. n(IV)= 250 children from 24 schools in 2 counties n(C)=191 children from 16 schools in 1 other county</td>
<td>IV: Children participated in the school based healthy diet and lifestyle habits program from 1st grade through to 6th grade. Each year students received a workbook covering a range of health issues. The PA aspect components were theory (four to six hours of classroom time a year) and practical (two 45-minute classes a week). Teaching resources were developed to assist with new material and reduce variation in delivery. Parents were given information booklets on physical activity and nutrition. They were advised on how to support their children in being active and making dietary changes. C: Schools in the control county did not deliver the program.</td>
<td>Minutes of leisure time MVPA/week measured by proxy report of leisure time activity at baseline and self reported physical activity at follow-up.</td>
<td>At baseline the average MVPA each week was 50.0 min/week in the IV group and 74.4 min/week in the C group. At 6 years from baseline, the average MVPA each week was 365.2 mins in the IV group and 273.0 mins in the C group. The 6-year change in time spent in MVPA was significantly greater in the IV group than in the C group (315.2min/week vs. 198.6min/week; p=0.03). At ten years from baseline, the IV group averaged 88.3 min/week of leisure time MVPA compared to 61.2 min/week in the C group. The IV group maintained a favourable change in weekly MVPA at the 10 years from baseline compared to the control group (36.3 min/week vs. -13.2 min/week; p=0.04). Between 12 and 16 years of age, average MVPA decreased in both groups.</td>
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<td>Paradis et al 2005</td>
<td>Pre-post study with repeated follow-up measures (1994, 1995, 1996, 1998, 1999, 2002). Non-equivalent comparison group in 1994, 1995 and 1996.</td>
<td>Children in 1st to 6th grade (6-11 years) At baseline in 1994, n(IV)=458 children; n(C)=199 children. In 1996, n(IV)=446 children; n(C)=195 children. In 2002, n(IV)=420.</td>
<td>The study reports the eight year follow-up of a diabetes prevention program for elementary school children, supported by community interventions. Health education was delivered to children from 1st grade to 6th grade each year (ten forty-five minute lessons a year). Topics included diabetes, physical activity, nutrition, and healthy lifestyles. Community strategies included newspaper and radio advertisements, media coverage of events, reporting results to community, promotional events and collaborating with other community organisations. The program also supported creating healthy environments and building capacity within the community. Based on social learning theory, the Precede-Proceed model, Ottawa Charter for Health Promotion and traditional learning styles of native children.</td>
<td>Number of 15-minute episodes of sport and other activity over the past 7 days measured by parental recall (grades 1 to 3) or self-reported recall (grades 4 to 6). Television and video watching on school days and Saturdays.</td>
<td>Between 1994 – 1996 children in the IV and C groups reported an increase in the number of fifteen minute episodes of activity each week (23%, n.s.). During this time, the IV group marginally decreased (n.s.) the amount of television they watched on week days but there was no overall change for television viewing on Saturdays (n.s.). At eight years follow-up in 2002 the number of episodes of 15 minutes of activity reported by the IV group had returned to baseline levels. The improvements in amount of time spent watching television present in 1996 were also lost in 2002. (C group data was not reported).</td>
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<td>Pate et al 2003</td>
<td>Comparative study with concurrent control group. Data collection took place at baseline (5th grade), mid (6th grade) and post-intervention (7th grade) in the spring. Duration: 18 months Setting: Community-based</td>
<td>Children in the 5th grade, mean age 11 years old, from 2 rural communities in South Carolina. Number of schools=6 Baseline N=436; n(IV)=175, n(C)=261. Final N=372; n(IV)=148, n(C)=224. Ethnicity : mainly African-American SES : low</td>
<td>IV county received the intervention while the C county acted as a comparison group. IV consisted of 4 components. 1. Active Kids: intensive summer and after school physical activity program. 2. Active Home: newsletters for families. 3. Active School: formation of committees to improve the school environment. 4. Active Community: newspaper articles and physical activity at local events. Based on Social Cognitive Theory and Pender’s Health Promotion Model.</td>
<td>Self-reported physical activity at 3 data collection points using the Previous Day Physical Activity Recall (PDPAR). Students reported their main activity in 30min blocks/day from 3pm to 11.30pm and rated its intensity level.</td>
<td>The intervention had no effect. Process evaluation indicated that the intervention had not been fully implemented as planned and that it had reached a small proportion of the target group of students.</td>
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<td>Baranowski et al 2003</td>
<td>RCT using urn randomisation procedure; 2 arm parallel group</td>
<td>8-year old African-American girls with BMI ≥ 50th percentile of CDC growth charts and had internet access at home, plus their parents or care-givers.</td>
<td>Recruitment was conducted via radio ads, a study recruitment website, presentations made at church or other social groups, postcards sent to names obtained from selected schools in the Houston area.</td>
<td>PA was measured with accelerometers (counts and MVPA 24 hours and 12-6pm); and with computer administered GEMS Activity Questionnaire (previous-day and usual PA).</td>
<td>This pilot study did not have sufficient power to test for significant differences between the IV and C groups. The IV had no effect on girls’ PA. A limitation was the low log-on rates of IV and C groups during the Internet phase of the study which suggests that participants received only a limited dose of the IV. At 8 weeks, the mean log-on rate for the IV group was 48% (girls) and 47% (parents); and for the C group 25% (girls) and 16% (parents).</td>
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<td>The Fun, Food, and Fitness Project (FFFP): The Baylor GEMS Pilot Study</td>
<td>Data collected at pre and post (12 weeks). BMI measured at pre, mid and post IV.</td>
<td>Setting: Family-based</td>
<td>IV: girls attended a special 4-week summer day camp [interactive multimedia activities including buddy group, problem solving, dance, educational games, PA skills and exposure], followed by 8-week home internet program for them and their parents [parental modelling, PA pedometer self-monitoring, PA opportunities]. C: girls attended generic 4-week summer camp followed by generic 8-week internet program.</td>
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<td>USA</td>
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<td>Intervention based on Social Cognitive Theory. Participants who completed baseline and follow-up assessments received monetary incentive (girls $10, parent $25). $100 lotto used to encourage logging onto IV and C websites.</td>
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No differences between the girls on SES.
C girls had sig. higher BMI and % body fat than IV girls. C girls also more likely to be at more advanced pubertal stage than IV girls.

Recruitment was conducted via radio ads, a study recruitment website, presentations made at church or other social groups, postcards sent to names obtained from selected schools in the Houston area.

IV: girls attended a special 4-week summer day camp [interactive multimedia activities including buddy group, problem solving, dance, educational games, PA skills and exposure], followed by 8-week home internet program for them and their parents [parental modelling, PA pedometer self-monitoring, PA opportunities].

C: girls attended generic 4-week summer camp followed by generic 8-week internet program.

Intervention based on Social Cognitive Theory.

Participants who completed baseline and follow-up assessments received monetary incentive (girls $10, parent $25). $100 lotto used to encourage logging onto IV and C websites.
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<td>Beech et al 2003</td>
<td>RCT with 3 arms, 2 parallel IV groups and 1 comparison group.</td>
<td>8-10 yr old African-American girls with BMI ≥ 25th percentile of CDC growth charts, and/or at least 1 overweight parent/guardian, plus their parent or guardian. Initial N=61; n(IV)=28; n(C)=33. SES: low</td>
<td>Recruitment was conducted through public service announcements on local African-American radio stations, segments on live radio talk shows and via flyers distributed at local elementary schools. Formative research and feasibility study were conducted prior to pilot. IV (child-targeted): interactive weekly 90 min sessions involving activity components that focused on knowledge, behaviour change skills and dance or aerobics. Activity components were selected through literature review and focus group data. IV (parent-targeted): interactive weekly 90 min sessions on knowledge, behaviour change skills and dance or aerobics. C: parents and girls received 3x 90 min sessions over 12 weeks that were designed to enhance and prevent decline in self-esteem and to be neutral with respect to diet and PA. Girls received $15 incentive for completing baseline and follow up assessments. Intervention based on Social Cognitive Theory.</td>
<td>PA was measured with accelerometers (counts and MVPA between 12-6pm on 3 consecutive days); and GEMS Activity Questionnaire (self-reported recall of previous day’s activities.).</td>
<td>This pilot study did not have sufficient power to test for significant differences between the IV and C groups. MVPA increased by 11.7% in the 2 IV groups combined (n.s.) at 12 weeks post-IV. 100% completion rate from baseline to follow up. Attendance of IV sessions was also high, 88% attended at least 80% of sessions (83% child-targeted, 94% parent-targeted, 89% comparison).</td>
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<td>Robinson et al 2003</td>
<td>RCT with 2 arm parallel groups.</td>
<td>8-10yr old African American girls with BMI ≥ 50th percentile of CDC growth charts, and/or at least 1 overweight parent/guardian, plus their parent or guardian.</td>
<td>Girls were recruited through community centres, after school programs, by community youth leaders and through presentations at schools, community events, churches and by posting flyers. IV: After school dance classes 5 days per week (45-60mins) at 3 community centres in target neighbourhoods, and a 5-lesson home visiting program with families to decrease sedentary behaviours (newsletters, self-monitoring tv budgeting, electronic tv manager). C: information-based education program to promote healthy eating and physical activity. (newsletters and lectures) Families received $25 for completing baseline measures and $75 after completing follow up measures. Based on Social Cognitive Theory.</td>
<td>PA was measured with accelerometers (counts and MVPA between 12-6pm on 3 consecutive days); and GEMS Activity Questionnaire (self-reported recall of previous day’s activities.). TV: self-reported tv viewing, video viewing and gaming (girls); overall household tv viewing (parent).</td>
<td>This pilot study did not have sufficient power to test for significant differences between the IV and C groups. After school PA increased slightly in IV group relative to the C group (approx. 13%). IV group girls self-reported approx. 12% more total minutes of MVPA on the previous day relative to C group girls. IV group girls showed increased counts/min by accelerometry compared to baseline. Non-sig. reduction in self-reported tv viewing, video viewing and playing video games were found in IV girls relative to C girls. There was a sig. overall decrease in household tv use in IV girls relative to C girls.</td>
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<td>Story et al 2003</td>
<td>RCT with 2-arm parallel groups. 3 interventions sites. Data collected pre and post (12 weeks). Setting: Family-based.</td>
<td>8-10 yr old African American girls with BMI ≥ 25th percentile of CDC growth charts, and their parents/care-givers. Initial N=54; n(IV)=27; n(C)=27. Final N=53; n(IV)=26; n(C)=27. Majority of low-income; 54% of parents reported incomes $30,000 per year.</td>
<td>Participants were recruited from 3 schools. IV: 2x 1 hr after school program per week with focus on environmental, personal and behavioural factors; did different activities (dancing, jump rope, relay races) and learned to goal setting. Weekly family packs designed to reinforce and support messages from school program. 2 family nights in 2nd and 9th weeks with family goal setting. 1 phone call and 1 tailored letter to motivate families and check progress. C: Program unrelated to nutrition and PA; 3x monthly meetings doing art crafts, self-esteem activities, African instruments, making memory books. Gifts given as incentives, e.g., water bottles, pedometers, t-shirts, jump ropes. Based on Social Cognitive Theory.</td>
<td>PA was measured with accelerometers (counts and MVPA between 12-6pm on 3 consecutive days); and GEMS Activity Questionnaire (self-reported recall of previous day's activities and usual activities.). Also measured girls' PA self-concept, PA preference, PA outcome expectancies, PA self-efficacy, PA home environment; and parents' motivation for PA, self-efficacy for PA with daughters, support of daughters' activity levels, daughters' tv watching.</td>
<td>This pilot study did not have sufficient power to test for significant differences between the IV and C groups. CSA counts and MVPA slightly higher in IV group than C group at 12 weeks (n.s.). No differences between IV and C group on other PA measures.</td>
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### Table A6. Interventions using rewards to increase children's physical activity.

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<td>Goldfield et al 2006</td>
<td>RCT</td>
<td>8-12 year old overweight or obese children. N=30</td>
<td>IV: Open-loop feedback plus reinforcement; children wore pedometers and were rewarded for every 390-400 counts with 2 tokens giving them access to tv/vcr/dvd; 1 token=30 mins tv; children were not allowed to watch tv with family members unless from time earned; attended biweekly meetings with research staff where data were downloaded from monitors, parents provided with feedback about tv time earned. Children received $10 for attending baseline assessment and each biweekly meeting, $20 for attending post-intervention follow-up.</td>
<td>Monitoring by pedometer, worn before and after school until bedtime on weekdays, and during waking times on the weekends; average daily counts, time spent in MVPA and VPA.</td>
<td>At eight weeks post-IV, the IV group showed a sig. larger increase in total PA counts per day (p&lt;0.05); sig. larger increase in minutes per day spent in MVPA (p&lt;0.05); sig. greater decrease in minutes per day spent in sedentary behaviours (tv/vcr/dvd viewing &amp; video games) than comparison group (p&lt;0.001).</td>
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<td>Southard et al 2006</td>
<td>RCT</td>
<td>Children aged 9-11 years old. N=120; Baseline and follow-up data available for 63 children.</td>
<td>IV: Participants were provided with a pedometer and asked to play MetaKenkoh, an internet-enabled futuristic adventure game. Kids' parents upload data from the pedometer daily onto an internet database and child's steps are converted to 'ergs', energy units needed for kids to play the game. No ergs = no play.</td>
<td>PA was measured using pedometers - steps/day</td>
<td>Only preliminary results were reported. The intervention does not appear to be effective. Number of steps/day at baseline (10,020 steps/day) was higher than at 3-month follow (8,791 steps/day).</td>
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<td>Cookson et al 2000</td>
<td>Pre-post</td>
<td>Families with children aged 6-12 years old.</td>
<td>HeartSmart Family Fun Pack was designed based on the transtheoretical model.</td>
<td>Parent-reported frequency of child’s active play (never, 1-2 times per week, 3 or more times per week; once a day or more)</td>
<td>Proportion of families reporting minimal levels (never or 1-2 times per week) of active play decreased, and proportion reporting active play on 1 or more days increased from 28% to 55%.</td>
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<td>Pre-test was in Feb 1998</td>
<td>Initial N=1387 parents; Final N=300 parents (21%)</td>
<td>A major media campaign was run to publicise the HeartSmart pack, with a toll-free number provided for people to call and request a pack. From those who requested packs, 1387 agreed to complete a short questionnaire and to participate in a follow-up call. The short questionnaire contained 1 physical activity item.</td>
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<td>Post-test was in late April 1998</td>
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<td>(3 months later)</td>
<td>Setting: Family-based</td>
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<td>Huhman et al 2005</td>
<td>Pre-post study; quasi-experimental design.</td>
<td>Children aged 9-13 years old.</td>
<td>VERB is a multiethnic campaign that encourages children aged 9-13 years old to be physically active everyday through a combination of paid advertisements, school and community promotions, and internet activities. This study assessed the effects of the national mass media campaign that was conducted in Year 1 of VERB from Apr 2002 through Jun 2003.</td>
<td>Self-reported number of days of free-time physical activity in the past 7 days.</td>
<td>At 1-year follow-up, the campaign had no effect on PA at the population level, but higher free-time physical activity and organised physical activity were found in certain subgroups compared with the C group (e.g. children who were categorised as low-active at baseline).</td>
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<td>Youth Media Campaign Longitudinal Survey; administered by CATI.</td>
<td>Baseline data were collected in Apr-Jun 2002, with follow up 1 year later.</td>
<td>IV: Mass media campaign; tv and print ads, in-school promotions, radio, internet.</td>
<td>Self-reported number of days of organised physical activity in the past 7 days.</td>
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<td>Setting: Community-based</td>
<td>Weighted nationally representative sample.</td>
<td>C: Children who were not aware of VERB were treated as a comparison group.</td>
<td>Self-report of any physical activity in the day before the interview.</td>
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<tr>
<td>Huhman et al 2007</td>
<td>Pre-post study. Youth Media Campaign Longitudinal Survey; administered by CATI. Baseline data were collected in Apr-Jun 2002, with follow ups at 1 and 2 years. Setting: Community-based</td>
<td>Children aged 9-13 years old Year 1 follow-up: n=2729 (71% response rate) Year 2 follow-up: n=2257 (83% of Yr 1 respondents responded). Overall response rate from 3 data collections=32%. Data weighted to nationally representative sample.</td>
<td>This study reported on the effects of VERB after 2 years of campaign interventions. In Year 2, campaign activities were expanded including delivering activity promotion kits to community-based organisations and schools, and increasing partnerships with national and local groups.</td>
<td>Self-reported number of days of free-time physical activity in the past 7 days; number of days of organised physical activity in the past 7 days; any physical activity in the day before the interview. Child’s belief about benefits of PA, self-efficacy to engage in PA, social influences (peers &amp; family).</td>
<td>At 2-year follow-up, among children who were exposed to the campaign, 96% reported understanding at least one key message. Statistically sig. dose response effect of exposure. As self-reported frequency of exposure increased, so did self-report of PA on the day before interview &amp; median number of weekly sessions of free-time PA (p&lt;0.05). The more children reported seeing VERB messages, the more positive their attitudes about benefits of PA. Children aware of VERB reported engaging in sig. more PA than those who were unaware of VERB.</td>
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