

“Does 2 hours of PE and 2 hours of school sport make a difference to children’s health?”

# A-CLASS PROJECT

## Research Findings Executive Summary



# A-Class Project



With the epidemic of childhood obesity and apparent decreasing levels of children's physical activity and fitness, the Government have attempted to put into place policies to stem the tide toward poor health (DH,2004, Foresight Report, 2007). These policies have focused on reducing childhood obesity (PSA 12), and increasing physical activity through physical education and school sport to 4 hours per week (PSA22, subsequently increased to 5 hours in 2007). The Sportslinx programmes of health promotion, and fitness and lifestyle assessment have worked in tandem with schools sports partnerships to deliver 4 hours of physical education and school sport. Unfortunately there is no robust scientific evaluation of the effects of the 4 hour promise on children's health, lifestyle and fitness. The A-CLASS (Active City of Liverpool, Active Schools and Sportslinx) project was designed to assess the effectiveness of the extra 2 hours of after school sport on the health, fitness, skill and fatness of 160, 9-10 year old Liverpool girls and boys who lived in deprived areas of the city.



# Introduction

## Aims

The aim of the A-CLASS project was to assess whether:

**“the 4 hour promise could improve the health and fitness of 9-10 year old children in Liverpool?”**



## Objectives

### Baseline

To take baseline measures of: maturity, body composition, cardiovascular health, fitness, physical activity, skill and physical self-perceptions/self esteem, and to compare results between boys and girls, and non-overweight and overweight children. We also wanted to assess levels of health risk against criterion measures (where available).

### Intervention

To compare the effect of 3 types of intervention (2 structured, 1 unstructured) on the body composition, cardiovascular health, fitness, physical activity, skill and physical self-perceptions/self esteem of 9-10 yr. old Liverpool children at baseline, 9 and 12 months.

## Project design

Based on preset criteria of school size (>400 primary schools: >250 junior schools) and deprivation (IMD>40) we randomly selected 16 schools and invited them to a meeting to discuss the project. After this meeting 8 schools were randomly selected to participate.

## Description of the Interventions

Two schools were allocated to 1 of four conditions:

### Condition 1: High intensity physical activity (HIPA);

Children in these schools were provided with a twice-weekly, 1 hour high intensity multi-activity after-school club, which was delivered by qualified multi-activity coaches. Heart rates were kept above 75% of maximum during these sessions.

### Condition 2: Fundamental Movement Skills (FMS);

Children in these schools were provided with a twice-weekly, 1 hour after-school multi-skill club, which was delivered by qualified multi-activity coaches. These sessions focused on developing locomotor and object-control skills.

### Condition 3: Physical Activity Signposting Scheme (PASS);

Children in these schools were provided with a weekly, 30 minute classroom session where weekly physical activity tasks were discussed and set. Four 4-6 week blocks of challenges were delivered alongside a reward system.

### Condition 4: Control;

Children in these schools received basic information on physical activity and health provided by the British Heart Foundation.

## Programme Duration

Pilot project ran January to April 2006.

The intervention project ran from October 2006 to November 2007.



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## What did we measure?

### Cardiovascular health:

We measured the lining of the main artery of the neck (carotid intima-media thickness), the hydraulic power of the heart (diastolic function), the mass of the left ventricle, blood pressure, and heart rate.

### Fitness and physical activity:

We measured aerobic fitness on a treadmill, and physical activity every 5 seconds over 7 days using an accelerometer. We also measured heart rate during the structured FMS and HIPA sessions.

**Body Composition:** We assessed bone mineral content and density, muscle mass and body fat using a DEXA scanner. We measured height and weight, sitting height and we estimated maturity. We also measured 8 skin folds, and waist and hip circumference.



### Fundamental Movement Skills:

We measured 4 locomotor (hop, jump, sprint and dodge) and 4 object-control skills (catch, throw, kick and strike) using detailed video analysis.

**Physical self-perceptions and self-esteem:** We measured self-esteem and physical self-perceptions including sports competence, body image, strength, and body condition.

**Qualitative research:** We assessed the effectiveness of the PASS scheme by interviewing children, parents and teachers.



**Questionnaire:** We assessed children's sports participation, parental activity and other aspects of lifestyle via questionnaire although these data are not included in this report.

## How often were the measurements taken?

The measurements were taken at baseline in September and October 2006, then at mid-point in June and July 2007 then finally between mid-October and November 2007 immediately after the intervention had finished (post test).

## How many children completed all measurements?

Of the 160 children who initially agreed to take part, 152 started and 145 completed the project respectively. Ten boys and 24 girls in the HIPA, 17 boys and 20 girls in the FMS, 16 boys and 25 girls in the PASS and 15 boys and 18 girls in the Control group completed the project.

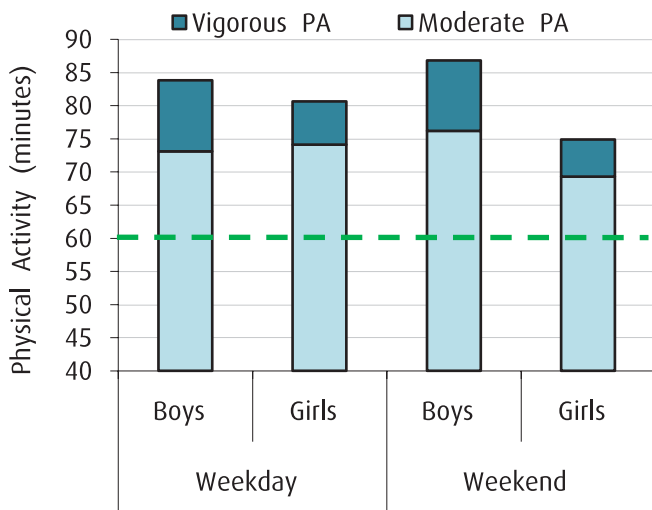
## Reward Scheme

To aid compliance A-CLASS branded T-Shirts, water bottles, baseball caps, Frisbees, yoyos, pedometers and music CDs were presented at various stages throughout the project.



# Results

## Physical Activity



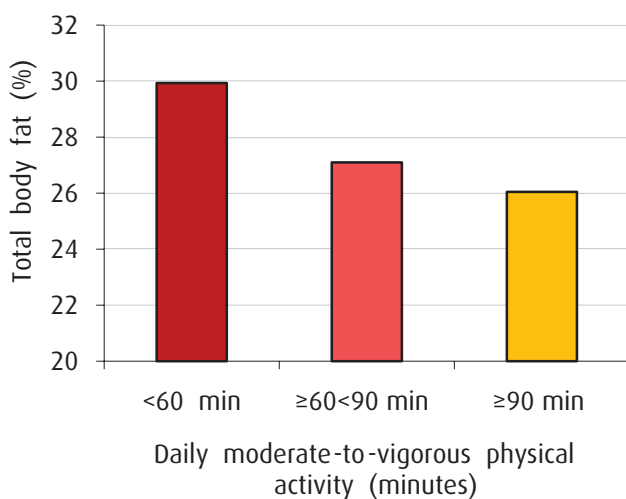
### Boys and girls' physical activity levels during weekdays and weekends

Boys and girls engaged in similar amounts of moderate-to-vigorous physical activity (MVPA) during weekdays, though boys engaged in more vigorous activity than girls. At the weekend, boys engaged in more MVPA, moderate and vigorous physical activity than girls.

### Baseline

#### Physical Activity during the week and at weekends in girls and boys:

Boys engaged in slightly higher levels of physical activity during the weekend compared to the week, whereas girls activity levels were higher in the week compared to the weekend. On average children in Liverpool exceeded the 60 minutes of recommended activity by between 15 and 25 minutes per day. Boys were more active than girls and a



### Tertiles of time spent in moderate-to-vigorous physical activity per day and percent total body fat.

Children who participated in over 90 minutes of physical activity per day had the lowest percent body fat. Participation in 60-90 minutes of activity was also associated with significantly lower body fat than those who failed to meet the recommended guidelines.



higher proportion of their physical activity (approx 12%) was vigorous compared to girls (approx 7%).

### Body fat and Physical Activity:

Children who engaged in less than 60minutes of physical activity carried approximately 30% body fat compared to 27% in children who engaged in >60 but less than 90 minutes, and 26% in children who engaged in >90 minutes.

**This data is very important as it clearly shows that 60 minutes is not enough physical activity to maintain a healthy amount of body fat.**

### Intervention

**Boys:** Physical activity in all boys groups increased from baseline to 9 months, with greatest increases seen in the intervention groups (15-22 minutes increase). Weekend activity only increased in the FMS group by about 10 minutes although this group was the least active at the weekend. At post-test (12 months) physical activity decreased significantly in all groups to a point below baseline. At all testing points all groups exceeded the 60 minute recommended dose of physical activity with only the FMS group failing to meet this target on weekends.

**Girls:** At 9 months there was no change in week or weekend activity for all groups with the exception of the control group who significantly increased their weekend activity. All groups exceeded the dose of 60 minutes physical activity with the exception of the Control group at baseline and FMS group at baseline and 9 months. At post test physical activity decreased significantly in all groups to a point where the control group failed to meet the 60 minutes criterion whereas the intervention groups just exceeded it.

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On weekends the girls in the Control and FMS groups had very low levels of physical activity compared to the PASS and HIPA groups who just exceeded it.

The key messages are that even if children attain 60 minutes of daily physical activity they may still be over fat and that more active children have greater lean mass. We have also demonstrated that these programmes increased or maintained physical activity in boys and girls respectively. Although these activity levels were not sustained after the project had finished.

## Cardiorespiratory Fitness

### Baseline

At baseline boys were over 10% fitter than girls and data suggests that both boys and girls were of average fitness compared with other Western groups of similar aged children (Bar-Or and Rowland, 2004). Non-overweight children had cardiorespiratory fitness levels that exceeded overweight children's scores by over 20%.

### Intervention

**Boys:** Cardiorespiratory fitness decreased in all groups from baseline to mid-test. At post test, HIPA and FMS cohorts fitness levels returned to baseline values, which were greater than 50 mlO<sub>2</sub>/kg/min<sup>-1</sup>, compared to declines in fitness for the Control and PASS groups over the project.

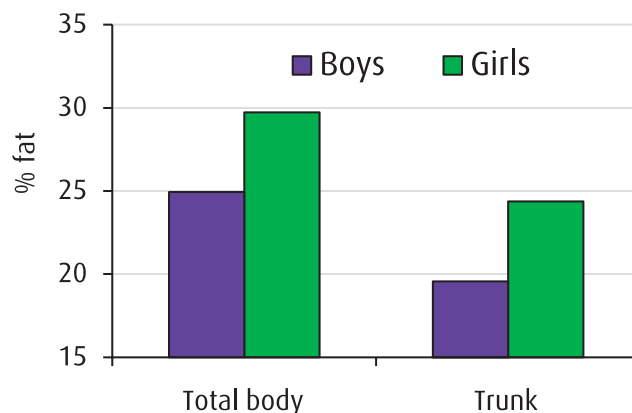
**Girls:** Cardiorespiratory fitness remained constant from baseline to mid-test in the Control and PASS groups, whilst FMS and HIPA cohorts' fitness declined. At post test, HIPA fitness scores had returned to baseline values and were similar to the control group. HIPA and Control group participants had higher fitness values than PASS and FMS groups at post test.

The direction of cardiorespiratory data are opposite to the physical activity data and may demonstrate an interesting deviation between the dose of physical activity (frequency x intensity x duration) and cardiorespiratory fitness and/or reflect difficulties in measuring physical activity. These data show that the intervention did not provide enough stimulus to improve fitness.

## Body Composition

### Baseline

Using age specific cut points for BMI data 28% of boys and 34% of girls were overweight and 18% of boys and 8% of girls were obese. Using DEXA data girls were 30 and boys 25 percent total body fat. Trunk fat was also higher in girls at nearly 25% compared to almost 20% in boys. Boys also had significantly greater bone mineral content and density and greater lean mass than girls. Differences in boys and girls results are partly biological and partly behavioural in that boys engage in more vigorous activity than girls.



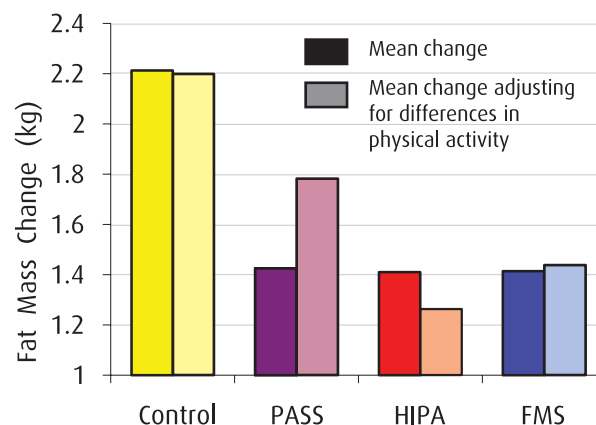
### Differences in percent total body fat and trunk fat between boys and girls

Girls had significantly higher (~5%) total body fat and trunk fat than boys

### Intervention

All children increased in total fat mass by the end of the 12 month intervention. However, the greatest rate of increased total fat mass was in the control group. This rate of increase was at least 50% greater than all intervention groups. The control group gained 2.2 kg, compared to the PASS, HIPA and FMS groups that all gained around 1.4 kg over 12 months. Furthermore differences were maintained in the structured exercise groups, even after adjusting the data for physical activity. Similar results were found in percent trunk fat with participation in the structured exercise groups (FMS and HIPA) being most effective. There were no differences in changes in lean body mass, or bone mineral content or density between the groups.

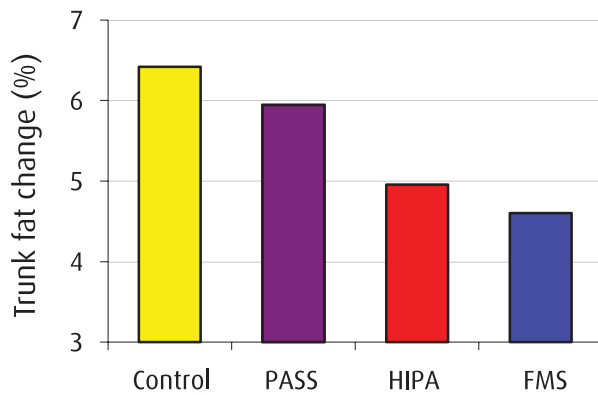
First the results confirm Sportslinx data that a significant proportion of Liverpool children are overweight and obese. However they also indicate the problems of using BMI to predict overweight. These results from the intervention programmes were encouraging and demonstrated that



### Changes in total body fat mass from baseline to post test

All interventions observed significantly smaller increases in fat mass than the Control group. Following adjustments for time spent in physical activity, only HIPA was associated with significant differences.

# Results



Changes in percent trunk fat from baseline to post-test  
FMS participants increased trunk fat significantly less than control participants (4.6% vs. 6.4%).

accumulation of body fat could be limited by appropriate physical activity programming.

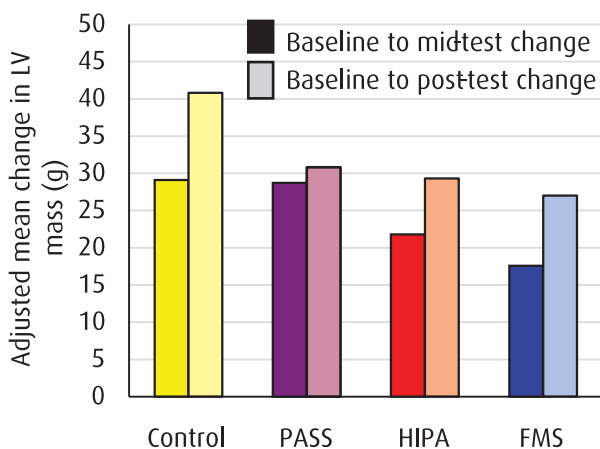
## Cardiovascular Health

### Baseline

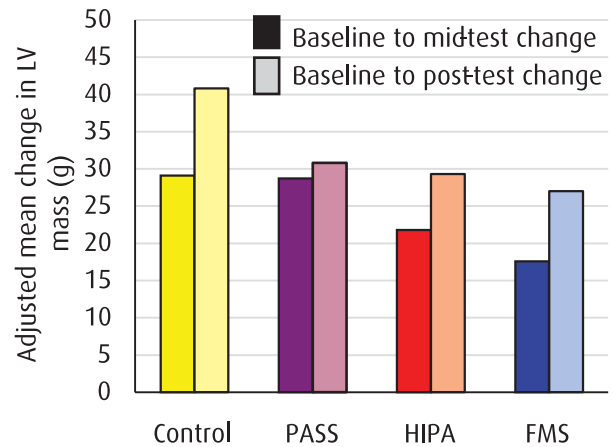
Physical activity was not related to any cardiovascular measure. Heart function and carotid intima-media thickness (a marker for atherosclerosis) were not related to physical activity, cardiorespiratory fitness or body composition. The size of the left chamber of the heart (left ventricular mass) was positively related to body fatness and cardiorespiratory fitness.

### Intervention

Smaller increases in left ventricular mass were apparent in the intervention groups compared to the control thus prevented unwarranted gains in heart size at this age. Furthermore reductions in blood pressure were noted in the intervention groups as well as positive improvements in



Mean changes in heart size (LV mass) (adjusting for changes in maturation and fat mass)  
FMS participants heart size increased over the project in all children. Change in heart size was significantly smaller in HIPA and FMS than the Control group.



Mean changes in carotid intima-media thickness (adjusting for changes in maturation and fat mass)  
Carotid intima-media thickness increased in all groups. The intervention groups changed less than CON, with PASS significantly smaller.

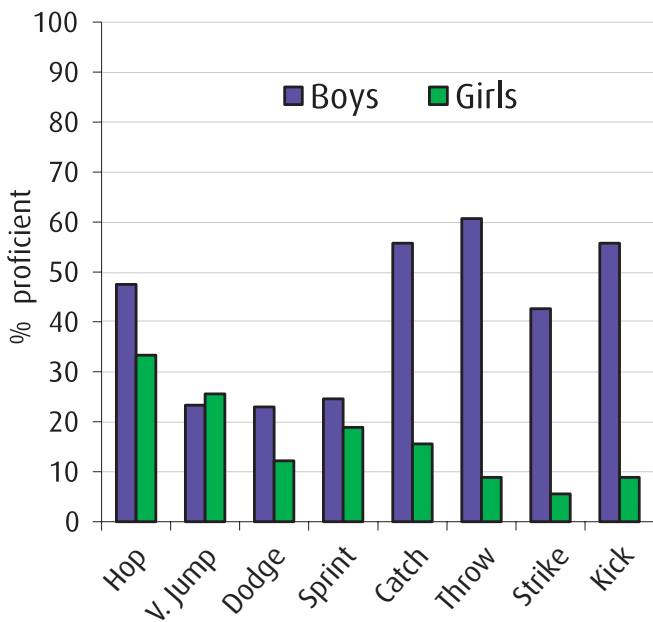
diastolic function. Increases in carotid intima-media thickness were smaller in the intervention groups than the control.

Positive changes in cardiovascular health were apparent without changes in fitness or physical activity suggesting that some local vascular adaptation may have taken place as a result of the intervention. There were little differences in the changes in cardiovascular measures between different intervention groups, with the exception of the PASS group that revealed smaller changes in carotid intima-media thickness than the HIPA or FMS groups. This was surprising given that we hypothesized that the HIPA group would demonstrate the greatest changes in cardiovascular measures.



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## Fundamental Movement Skills



### Gender differences in skill proficiency

Boys were more advanced than girls in seven out of the eight skills; however these differences were only significant in the four object-control skills – the catch, overarm throw, strike and kick.

### Baseline

In boys the prevalence of proficiency did not exceed 60% except in the over arm throw whilst only 30% of girls were proficient at the hop. Fundamental movement skills should be mastered by the age of 8 and thus low levels of skill at baseline were particularly worrying. Boys and girls had similar proficiency levels in locomotor skills (hop, vertical jump, dodge, sprint) but boys were between 4 and 6 times more proficient in object-control skills (catch, throw, strike, kick). Percent body fat was also negatively related to locomotor skills performance.

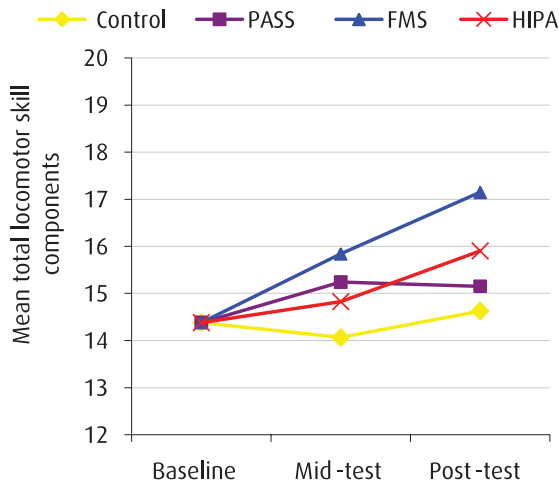
### Intervention

The number of locomotor skill components increased at mid-test in all intervention groups with further increases noted at post test in the FMS and HIPA groups. The greatest improvement occurred in the FMS group where the number of locomotor skill components achieved increased by more than 15%, which was significantly higher than the Control group. HIPA participants also had higher locomotor skill competence at post test than their Control counterparts, whilst PASS had no effect.

The number of object-control skill components increased in all groups at mid-test with greatest increases noted in the FMS group. At 12 months, the FMS group had increased the number of object-control skill components by over 30%, scoring significantly higher than all other groups.



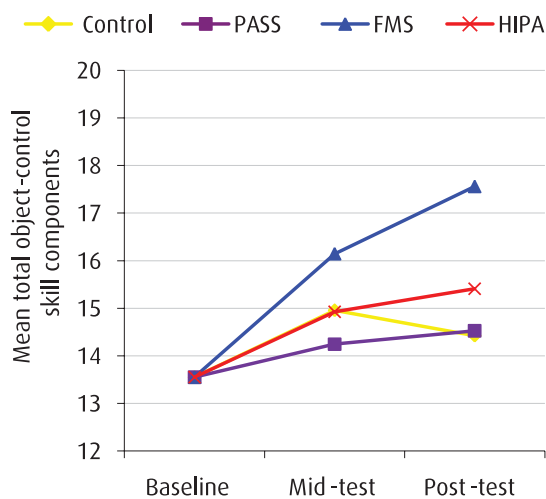
# Results



## Intervention effects on locomotor skills

(adjusting for baseline differences) Locomotor skills improved the most in the FMS intervention, whilst participation in HIPA was also associated with small gains.

Baseline results reveal poor-to-moderate levels of fundamental movement skill proficiency. The intervention results were particularly encouraging as they demonstrated that fundamental movement skills are malleable and sensitive to change. They also demonstrated that after school clubs need a clear focus on skill as opposed to high-intensity activity to increase competence in all skills. Further, interventions should be aimed at younger children to maximise the potential for skill development.



## Intervention effects on object-control skills

(adjusting for baseline differences) Object-control skills improved the most in the FMS intervention, scoring significantly higher than all other groups.



## Physical Self-Perceptions

### Baseline

Self-esteem and physical self-perception profiles including sports competence, physical condition, body attractiveness, physical strength, physical self-worth and self-esteem reflected encouraging aspects of mental health in participants. Boys always scored slightly higher than girls whereas physical strength and body attractiveness recorded the lowest scores in the profile.

Overweight children had significantly lower perceptions of sports competence, physical condition, physical self-worth and self-esteem than non-overweight weight children, whilst there was a strong trend for a difference in body attractiveness also.

### Intervention

**Boys:** The FMS and HIPA interventions positively impacted on physical self-perceptions compared to the Control group, whilst the PASS group declined from mid-test to post test thus had no effect.

**Girls:** The PASS group increased self-esteem. No positive intervention effect was observed for physical self-perceptions through the project. Unfortunately participation in the FMS group was associated with more negative physical self-perceptions, as scores in the FMS group declined at mid-test, with deficits stabilising to post test. These results suggest that levels of self-esteem and physical self-perceptions in girls and boys are relatively healthy. In boys, structured exercise sessions stimulated increases in perceptions of physical condition and sports competence as well as smaller changes in body

# Summary

attractiveness. Unfortunately all intervention groups caused more negative perceptions of body attractiveness and physical competence in girls. This may be a result of co-educational sessions in which girls may have assessed competence by means of social comparison with boys. Alternatively participation in the intervention may have increased focus on physical abilities, drawing attention to lack of competencies, thus causing lower self-perceptions.

## Summary

Baseline data demonstrated that Liverpool children need physical activity programmes to stem the tide of rising obesity, declining levels of fitness and poor levels of skill. Even though children's levels of physical activity exceeded the 60 minutes recommendation they were still over fat. Fitness levels were adequate but fundamental movement skills were much lower than expected especially girl's object-control skills. Cardiovascular measures and self-esteem/physical self-perceptions were good reflecting low risk of heart and mental health respectively. Fatter children generally scored lower on most tests compared to their normal weight peers.

The intervention programmes had a larger effect on boys results compared to girls. Boy's physical activity increased at mid-test but decreased at post test. Girl's physical activity levels were maintained at mid-test but declined at post test. The intervention did not improve girls or boys fitness.

An encouraging finding was the slower increase in body fat in all intervention groups compared to control and there were also positive effects on heart function, heart size and blood pressure. The most malleable aspect of children's health was their fundamental movement skills as children in the FMS group demonstrated large changes in object-control skills and moderate increases in locomotor skills. Physical self-perception scores changed positively in boys who participated in FMS and HIPA interventions. All interventions may have had a negative effect on the perceptions of body attractiveness in girls, whilst other physical self-perceptions were also lower in girls who took part in the FMS group.

In summary, the national investment of 2 hours of PE and 2 hours of school sport has a positive effect on some aspects of children's health although some improvements are difficult to maintain. Further investigations are warranted to follow up this programme of research. We recommend that further investigations are required into the effects of activity programmes using larger groups of girls and boys of different ages. In particular, high levels of body fat and poor fundamental movement skills require more urgent attention as does the effect of activity programmes on girls' health and well being. Finally, the effects of these programmes on children's health require longer term investigations in studies that are longitudinal in design.



# References & Acknowledgments

## References

Bar-Or, O., Rowland T., (2004) Pediatric exercise medicine: From physiologic principles to health care application. Leeds: Human Kinetics

Department of Health (2004) Choosing Health: Making healthy choices easier. London: Stationery Office

Foresight (2007) Tackling obesities: future choices—modelling future trends in obesity and their impact on health. Stationery Office: London

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## Acknowledgements

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Anfield Junior School

Blueberry Park Primary School

Rice Lane Junior School

Holy Cross Primary School

Lawrence Community Primary School

Florence Melly Junior School

Leamington Community Primary School

Longmoor Junior School

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