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Influence of a health education intervention on physical activity and screen time in primary school children: 'Switch Off–Get Active'

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Summary Low levels of physical activity coupled with high levels of television viewing have been linked with obesity in children. The objective of this study was to assess the efficacy of 'Switch Off–Get Active', a 16-week controlled health education intervention, in increasing physical activity and reducing screen time and BMI in primary school children. A secondary objective was to compare children with high and low screen time. Participants were 312 children aged 10.2 ± 0.7 years, attending nine schools in areas of social disadvantage. The 10-lesson, teacher-led intervention, conducted in spring 2003, emphasised self-monitoring, budgeting of time and selective viewing. Differences, adjusted for baseline values by ANCOVA, existed between intervention and control children at follow-up for self-reported physical activity (intervention +0.84 30 min blocks/day, 95%CI 0.11–1.57, $p < 0.05$) and self-efficacy for physical activity ($p < 0.05$) but not self-reported screen time (intervention −0.41 blocks/day, 95%CI −0.93–0.12, $p = 0.13$) or BMI ($p = 0.63$). Cross-sectional comparisons at baseline indicated lower physical activity, self-efficacy for physical activity and aerobic fitness and a higher BMI in children with high screen time. In conclusion, health education interventions can increase physical activity in primary school children but follow-ups of longer duration may be needed to demonstrate intervention effects on BMI.

Introduction

High levels of television viewing[1] coupled with low levels of physical activity[1,2] are behaviours that have been linked to weight gain and obesity in children. There is concern that extensive time spent watching television and playing computer games may be impacting on children's physical activity levels by reducing the time available for traditional active pursuits. In addition, there is some evidence that active and sedentary behaviours track

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into adolescence and adulthood.[3] Television viewing may be particularly problematic, as it has been linked with child requests for, and intake of highly advertised snack foods.[4] An American College of Sports Medicine expert panel has recommended a focus on decreasing sedentary behaviours as well as increasing physical activity in obesity prevention programmes.[5]

Schools have been identified as a suitable environment to influence behaviour change.[6] 'Switch Off–Get Active' was specifically designed as a low cost, sustainable intervention that complemented the existing health education curriculum. The programme was targeted at 9–11 year old children attending schools in areas of social disadvantage. There is evidence that the prevalence of childhood obesity,[7] low physical activity[7] and high TV viewing[8] is greater in lower socioeconomic groups.

Only a small number of school-based interventions to prevent weight gain in children of similar age have been undertaken, and mostly in the US. These have targeted changes in diet,[9,10] physical activity[9,10] and screen time.[9–11] None have demonstrated increases in physical activity. The only comparable UK-based study failed to effect changes in either sedentary behaviour or physical activity.[12] The primary objective of this study was to determine the efficacy of a health education intervention on BMI, targeted sedentary behaviours and physical activity in Irish primary school children. A secondary objective was to examine baseline differences among children with high and low screen time.

Methods

Overview

'Switch Off–Get Active' was a controlled health education intervention, conducted over a 16-week period between February and June 2003, which aimed to increase physical activity at the expense of screen time (television viewing and computer game use) in children attending schools in areas of social disadvantage. It was intended to be a cost effective, teacher-led intervention that could be incorporated easily into Irish school structures. It was designed to complement the existing Social Personal and Health Education (SPHE) curriculum. This health education approach fosters positive self-esteem, develops decision-making skills, provides opportunities for self-reflection and discussion, and promotes personal development. The intervention emphasised two key messages, the need to minimise the time spent watching television and playing computer games and the need to increase physical activity. Given the evidence (albeit not universally held) that reducing sedentary behaviours may increase physical activity,[13] these messages were considered complimentary.

Schools and participants

A total of 312 children were recruited for the study with 91% successfully followed up post-intervention. All were in the fourth class year group in participating schools. The nine schools (five intervention, four control) were located outside of major Irish urban centres, in towns (maximum population 13,000) and rural areas of the South-East region. The local health authority classifies the social status of each small geographical area in its region on a five point scale from national census data, based on unemployment rates, social class, proportion of rented accommodation, overcrowding and car ownership. All schools were in areas of greatest social disadvantage. Written parental consent was obtained for all participants with 99% of the eligible children agreeing to participate. Ethical approval was obtained from the Waterford Institute of Technology Ethics Committee, with the project conforming to the Code of Ethics of the World Medical Association.

Recruitment of schools to the study was on the basis of willingness to implement the 'Switch Off–Get Active' programme into the SPHE curriculum and to facilitate project evaluation, regardless of allocation to experimental or control conditions. Nine school principals, none of whom taught the fourth class year group, were approached initially in no particular order. As all agreed to take part, no others were recruited. After ascertaining the number of boys and girls in the participating classes, schools were assigned to the control or intervention condition by the investigators in a manner that ensured a balance between boys and girls, urban and rural schools in each group.

Intervention implementation

Prior to commencement, a 3-h briefing was provided for intervention schoolteachers. Lesson materials consisted of teacher resources with stated learning objectives, pupil workbook materials for each lesson and pupil diaries to record leisure time activity/screen time. These materials were developed by a health promotion specialist and primary school teacher following discussion with the research team. All teachers were non-specialist health educators but had received

inservice training in Social Personal and Health Education. The SPHE curriculum and inservice training was designed by the national education authorities in partnership with health promotion specialists and is based on effective health education pedagogy that includes self-reflection, responsibility for own learning, skill development, and a commitment to the democratic process.

After baseline measurements were made, each intervention school was visited once every 2 weeks for the duration of the project to offer support to the teacher and check compliance. The programme was implemented with fidelity in all schools. Implementation was verified by checking completed workbooks (evidence of lesson delivery) and pupil diaries (evidence of continuous self-monitoring and goal setting). Parents were encouraged in writing to support children in their attempts to switch off and get active and to verify behaviour by signing diaries. Control schools did not receive the 'Switch Off–Get Active' intervention but were promised first refusal should the intervention be extended to the rest of the health authority region. Control schools continued to deliver the prescribed health education curriculum that does not teach activity modification techniques and in which physical activity is just one component of lifestyle health.

Intervention lessons and materials

Ten lessons (Table 1) of 30 min duration, were delivered as part of the SPHE programme. In lessons 2–5, the children were required to reflect on how they spend their leisure time and challenged to identify realistic alternatives to television viewing and computer game usage, culminating in a night without any television or computer games. A continuous aspect of the intervention, introduced in lesson 4, was the self-monitoring, budgeting and goal setting practised to decrease screen time and increase physical activity. Children were taught how to use an 'activity points system' in conjunction with a project diary to keep track of the time spent in active and screen pursuits. One point was awarded for every 5 min of physical activity with one point deducted for every 15 min of screen time. An explanation of the system was placed on a poster in every classroom. The diaries formed part of the child's homework and were signed by parents. They were also used for minor intra- and inter-school competitions. Children were encouraged to set personal targets for physical activity and screen time and to 'budget' their screen time points allowance by prioritising in advance the programmes they actually wanted to watch. The focus in lessons 6–9 was on increasing physical activity and included an attempt to revive traditional playground and street games, popular with previous generations of children, but that had fallen into decline.

Intervention philosophy

The classroom based sessions and accompanying activity-modification tasks addressed specific concepts of social cognitive theory for behaviour change.[14] Self-control of screen time was addressed by requiring children to regulate their own viewing and budget their screen time points allowance. Self-monitoring, budgeting and goal setting skills were taught in class as this approach has been shown to be effective in changing diet and activity habits in children.[15] Self-control of physical activity was enhanced by addressing barriers to increased activity. It was

Table 1 'Switch Off–Get Active' lesson content

Lesson	Title	Focus
1	Healthy lifestyles	Explore meaning of health and its relationship with lifestyle
2	My time	Self-monitor leisure time with particular emphasis on physical activity and screen time
3	Intelligent television viewing	Explore TV viewing habits and encourage selective viewing
4	Switch Off–Get Active diaries	Explain the activity points system used to encourage the substitution of activity for screen pursuits
5	Television turnoff	Plan for a night without TV
6	Benefits of physical activity	Explore social, mental and physical benefits of being active
7	New games	Introduce fun, non-competitive street and playground games suitable for small and larger groups
8	Barriers to increased activity	Identify barriers to increased activity and ways of overcoming these barriers
9	Local activity opportunities	Identify local activity opportunities
10	Poster and slogan competitions	Advocacy of increased activity and decreased screen time by children

intended that a successful TV switch off evening would enhance self-efficacy to manage with less television. Behavioural capacity for increased physical activity was enhanced via the learning of new street and playground games and the identification of local opportunities for physical activity. Small prizes were used to reinforce individual improvement and class achievement.

Outcome measures

Physical activity and screen time

Physical activity and screen time were measured using the 1-day Previous Day Physical Activity Recall (PDPAR) instrument validated with this age group.[16] This divides the day into 30 min time blocks and with the aid of contextual cues, requires the principal activity during each block and the intensity of activity to be identified. The difference between low intensity activities and moderate to vigorous activities was explained in terms of the breathlessness and sweating that resulted, with examples given. Blocks of time and not minutes are the outcome measure for this instrument. Some practice in recalling previous day activities took place in all schools, with the help of class teachers, before the investigation team arrived on site. The PDPAR instrument was administered on three separate occasions to reflect behaviour on a Sunday and 2 other weekdays. Data for weekday and weekend activities was averaged with the number of 30 min blocks/day of moderate to vigorous activity (MVPA) and 30 min blocks/day of screen time recorded. Screen time comprised of TV, videotape/DVD viewing and computer game usage. Access to screen technology in the home was investigated with a short questionnaire.

Physical activity self-efficacy

Physical activity self-efficacy was ascertained using a previously validated instrument,[17] with minor modifications. This tool contained 10 Likert-type statements with a three-category response to each. A self-efficacy rating between 0 (low) and 20 (high) was computed.

Physical measurements

Stature and body mass (Seca Leicester Height Meter and Seca Digital Floor Scales, Bodycare, UK) were recorded barefoot and with excess bulky clothing removed, by a member of the research team with training in anthropometry. Children were categorised as normal- or overweight using the International Obesity Task Force definitions.[18] Aerobic fitness was measured using a 20 m shuttle test, validated for use in youth.[19]

Data analysis

The efficacy of the intervention for the main outcome variables was determined using analysis of covariance (ANCOVA) with the post-intervention value as the dependent variable, experimental group as the independent variable, and the baseline value as a covariate. As no experimental group $\times$ sex or experimental group $\times$ BMI category interaction was evident for MVPA or screen time (all $p > 0.30$), sex and BMI category were not added as covariates. Subgroup differences at baseline were determined using ANCOVA with subgroup as the independent variable and sex as a covariate. These analyses were performed using SPSS 13.0 Complex Samples, which takes account of the lack of independence between subjects due to clustering within schools. The significance of the baseline to post-intervention changes was determined by paired t-test on a school-by-school basis. It was estimated that with a sample size of 300, the study would have 80% power to detect post-intervention between-group differences in MVPA and screen time of one 30 min block (effect size of 0.33). All data are presented as mean $\pm$ standard error of mean (S.E.). The standard errors presented take account of clustering. Significance was set as $p < 0.05$.

Results

The baseline characteristics of the control and intervention children are presented in Table 2. These were similar on all major categorical and continuous variables. The changes in the control and intervention groups from baseline to post-intervention are summarised in Table 3. Post-intervention values for MVPA and self-efficacy for physical activity were higher in the intervention children ($p < 0.05$). Post-intervention values for screen time were not significantly different ($p = 0.13$) with values for BMI and aerobic fitness similar between intervention children and controls. Sample size was not large enough to ascertain the efficacy of the intervention in boys and girls or in normal and overweight children separately. Analysis of individual school changes [median school change (range)] demonstrated significant increases ($p < 0.05$) in MVPA between baseline and follow-up in all intervention [+3.05 blocks/day (+2.19 to +4.01)] and all control [+2.21 blocks/day (+1.32 to +2.87)] schools. Significant screen time decreases occurred in four intervention [−1.25 blocks/day (−0.51 to −1.63)] and two control [−0.7 blocks/day (−0.24 to −1.56)] schools.

Table 2 Comparison of control and intervention groups at baseline

	Control	Intervention	*p*-Value
Children (*n*)	130	182	
Girls (*n*)	55 (42%)	80 (44%)	0.81
Age at baseline	10.3 (0.8)	10.2 (1.2)	0.52
% Overweight[a]	32%	35%	0.70
% With bedroom TV	51%	57%	0.43
% With ≥4 TV sets in home	38%	46%	0.22
MVPA (30 min blocks/day)	3.04 (0.41)	3.11 (0.37)	0.67
Screen time (30 min blocks/day)	5.97 (0.25)	5.90 (0.48)	0.64
Aerobic fitness (laps)	34.6 (1.6)	37.2 (3.7)	0.52

Continuous variables are mean (S.E.) and compared by ANOVA; categorical variables compared by Chi-square.

[a] Based on International Obesity Task Force cutoffs.[18]

Table 3 Changes in control and intervention groups from baseline to post-intervention

	Control group		Intervention group		Adjusted difference (95%CI)	*p*-Value
	Pre	Post	Pre	Post		
MVPA (30 min blocks/day)	3.04 (0.41)	5.14 (0.33)	3.11 (0.37)	5.94 (0.30)	0.84 (0.11–1.57)	0.03
Screen time (30 min blocks/day)	5.97 (0.25)	5.18 (0.27)	5.90 (0.48)	4.68 (0.57)	−0.41 (−0.93–0.12)	0.13
Self-efficacy (0–20)	12.5 (0.4)	13.3 (0.4)	12.2 (0.5)	14.2 (0.2)	0.86 (0.16–1.56)	0.03
BMI (kg/m^2)	19.2 (0.4)	19.3 (0.4)	19.0 (0.2)	18.8 (0.3)	−0.08 (−0.38–0.22)	0.63
Aerobic fitness (laps)	34.6 (1.6)	46.2 (1.2)	37.2 (3.7)	49.6 (2.5)	1.7 (−3.5–6.9)	0.55

Adjusted difference is the difference between control and intervention groups post-intervention adjusted for baseline value; pre and post values are mean (S.E.) and reflect clustered sampling.

The American Academy of Pediatrics recommends that children's television viewing be limited to 2 h daily.[20] Baseline comparisons, presented in Table 4, were made between children with screen time values greater than (high users) and less than (low users) four time blocks/day. The high users had a higher BMI combined with lower levels of MVPA, lower self-efficacy for physical activity and lower aerobic fitness (all $p < 0.05$).

Table 4 Profile of high and low screen users at baseline[a]

	High users	Low users	*p*-Value
MVPA (30 min blocks/day)	2.88 (0.24)	3.62 (0.27)	<0.01
Aerobic fitness (laps)	33.7 (1.6)	41.7 (3.1)	0.03
Self-efficacy (0–20)	11.8 (0.4)	13.4 (0.4)	<0.01
BMI (kg/m^2)	19.4 (0.2)	18.2 (0.3)	0.02

Comparison of high and low users by ANCOVA adjusting for sex.

[a] High and low screen usage defined as > and < four 30 min time blocks daily.

Discussion

We have shown that a 10-lesson, 16-week health education intervention, in conjunction with simple behaviour modification techniques, can be effective in increasing physical activity and self-efficacy for physical activity in Irish primary school children. We were unable to demonstrate a significant intervention effect on screen time. The intervention period was not sufficiently long to see changes in physical activity translate into changes in BMI or aerobic fitness. In contrast, other school-based interventions have demonstrated positive influences on TV and videotape viewing[9–11] and in some cases BMI[10,11] with interventions lasting the course of the school year, but not on physical activity.[9–12] The outcome evaluation of the Australian-based "Switch-Play" intervention is currently awaited.[21]

A unique success of 'Switch Off—Get Active' was its effect on MVPA and self-efficacy for physical activity. One of the challenges in identifying changes in children's physical activity relates to difficulties in obtaining an accurate assessment of activity at a given point in time. Although accelerometry may provide a more objective measurement of physical activity than self-report, it was not considered feasible in this instance as physical activity had to be quantified in 312 children, on multiple occasions, within a short space of time, pre- and post-intervention. In addition, accelerometry cannot be used to measure screen time. Although self-report generally overestimates levels of physical activity in youth, it can be useful in determining how activities change in response to an intervention.[22] Previous school-based interventions of this nature that have failed to demonstrate increases in physical activity have used a variety of self-report instruments. However, surveys that require children to identify the frequency of various activities in the preceeding week or month, may not be sufficiently sensitive to detect changes in physical activity. In the present study the 1-day PDPAR was administered on three occasions pre- and post-intervention to reflect both weekday and weekend activity.

The magnitude and consistency of control school changes in MVPA between the February baseline and the June follow-up was surprising. Seasonality is one possible explanation as sunset occurred 4 h later at follow-up. The magnitude of the changes may relate to the access of these largely rural children to organised indoor recreation in winter months. Another possibility is that teachers with a keen interest in health promotion issues, and motivated to action by the baseline measurements, took steps to effect lifestyle change, even though allocated to the control condition. However, if the latter explanation is the case, the post-intervention between-group difference should be regarded as a conservative estimate of the intervention effect on intervention children.

The post-intervention screen time difference between control and intervention children did not reach statistical significance ($p = 0.13$). Although approaching significance, it is unlikely that a screen time decrease of 0.41 blocks/day would be of clinical relevance. It could be argued that the failure of the intervention to effect significant changes in screen time is not overly important, as the freeing up of screen time was not necessary for increases in physical activity to occur. Opponents of the displacement hypothesis argue that children have sufficient free time for both active and screen pursuits.[23] Screen time appears to be particularly resistant to change, at least in children from low socio-economic backgrounds. The effects of seasonality (based on control group changes) on screen time are considerably lower than on MVPA. The easy access of many children to television may have been an obstacle to change as bedroom TV has been linked to increased viewing.[24] Attempts to reduce TV viewing and computer game usage may only meet with limited success without consideration of the environment in which the behaviour is occurring.

The co-existence of lower MVPA, lower aerobic fitness, lower self-efficacy for physical activity and a higher BMI in the high screen users is a cause for concern, particularly as the children were only 9—11 years in age. While the displacement hypothesis may be an oversimplification of the relationship between active and screen pursuits, further investigations are warranted. High screen usage may not displace activity but could serve as a marker of children with lower self-efficacy for physical activity and consequently lower levels of physical activity. In a recent study, the clustering of negative psychosocial correlates with low physical activity was demonstrated for both boys and girls, similar in age to the current cohort.[25] The authors recommended tailored interventions for children with the most negative correlates in order to prevent a further decline in physical activity between childhood and adulthood.

A major concern that exists with one-off interventions of this nature relates to the long-term sustainability of the behavioural changes achieved. More age-specific follow-up materials need to be developed for other year groups to reinforce key intervention messages. In addition, change is only likely to be sustained with support from the wider school, home and community environments.[6] However, the creation of such environments was considered beyond the scope of this curriculum-based intervention.

Conclusion

In summary, the supplementation of a health education curriculum with specific lessons and activity-modification techniques has the potential to increase physical activity in primary school children. However, behavioural modification techniques alone may not be sufficient to have a major impact on screen time without consideration of the environment in which the behaviour occurs. Follow-ups of longer duration are needed to explore intervention effects on aerobic fitness and BMI.

Practical implications

- Primary school health education programmes that utilise strategies including self-monitoring and goal setting, can be effective in increasing physical activity.
- Large reductions in children's screen time can be difficult to achieve from health education programmes, particularly when TV is so readily accessible in the home environment.
- The clustering of high screen time, high BMI, low physical activity, low aerobic fitness and low self-confidence for physical activity in a subgroup of children is a cause for concern and may indicate the need for tailored approaches to health and physical education.

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