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Factors associated with physical activity in a sample of British secondary school students

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ABSTRACT

Background: The purpose of this study was to investigate the demographic, social and psychological factors associated with moderate-to-vigorous physical activity (MVPA) among a sample of secondary school students (N = 402).
Methods: Students completed a questionnaire which examined their level of participation in MVPA and sedentary behaviours along with a number of potential correlates. Hierarchical regression was used to explore the relationship between hypothesised factors and MVPA.
Results: Approximately a third of students (31.9%) reported involvement in at least five sessions of MVPA in the previous week. The students reported an average of 2.8 hours per day watching television and 1.7 hours per day using the computer. In the final regression model, 33% of variance in MVPA was explained. Perceived barriers, peer support and family support were statistically significant predictors.
Conclusions: This study confirmed a number of factors to be associated with participation in MVPA. No relationship was found between sedentary behaviour and MVPA.

INTRODUCTION

Cardiovascular disease (CVD) is one of the leading causes of death in England and accounts for almost 60% of premature deaths (Department of Health & Department for Culture Media & Sport, 2004). Risk factors for CVD can be described as either non-modifiable (genetic) or modifiable (behavioural & physiological). Modifiable risk factors are of most interest to health promoters and physical educators due to their alterable nature and preventive potential. Consistent epidemiological evidence has recognised physical inactivity and obesity as key modifiable risk factors associated with chronic diseases (Boreham, Twisk, Savage, Cran, & Strain, 1997; Department of Health & Chief Medical Officer, 2003; Raitakari et al., 1997; Twisk, Mechelen, Kemper, & Post, 1997; U.S.

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Department of Health & Human Services, 1996). Physical inactivity and obesity may predispose individuals to an increased risk of mortality and morbidity from conditions such as: non-insulin dependent diabetes, coronary heart disease, hypertension, hyperlipidemia and certain cancers (Armstrong & Welsman, 1997; Barnard & Wen, 1994; Department of Health & Chief Medical Officer, 2003; Must, Jacques, Dallal, Bajema, & Dietz, 1992).

Unfortunately, the majority of the British population are not active enough and only 31% of adults in the UK meet the guidelines of at least 30 minutes of physical activity on five or more days a week (Department of Health & Department for Culture Media & Sport, 2004). Similarly, the most recent national survey in England found that only 50% of girls and 69% of boys met the physical activity guidelines of one hour a day (Sproston & Primatesta, 2003). Low levels of physical activity are estimated to cost £8.2 billion per year in the UK alone including both direct and indirect health care costs (Department of Health, Physical Activity, & Health Improvement & Prevention, 2004).

Although there is considerable evidence for the physical, psychological and social benefits of childhood and adolescent physical activity (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004; Hillsdon & Foster, 2003; Steptoe & Butler, 1996), the findings from longitudinal or tracking studies of physical activity have been inconsistent. In a longitudinal study of Finnish youth, participation in organised sports during childhood was found to be a significant predictor of physical activity in young adulthood (Telama, Yang, Laakso, & Viikari, 1997). However, Boreham et al., (Boreham et al., 2004) concluded that physical activity behaviour during adolescence is unlikely to predict physical activity levels in adulthood. It appears that physical inactivity tracks at a higher level than physical activity (Raitakari et al., 1994). Furthermore, certain sedentary behaviours appear to be more stable across time than others. In a study involving 181 rural youth, television and playing video games were found to track well from grade five to grade seven. While other sedentary behaviours, such as listening to music and talking on the phone, tracked poorly over the study period (Pate et al., 1999).

It is important to develop an understanding of the influences on physical activity among youth to identify potential mediators of behaviour (Baranowski & Jago, 2005) and develop effective interventions (Bungum, Dowda, Weston, Trost, & Pate, 2000). Understanding the influences on physical activity behaviour change is difficult because they change over the life course (Sallis & Hovell, 1990). While these influences are often referred to as determinants of physical activity, most studies have been cross-sectional and therefore factors should only be considered as correlates rather than causes (Sallis & Owen, 1999). The most comprehensive review of physical activity correlates in young people examined a total of 108 studies and 48 variables (Sallis, Prochaska, & Taylor, 2000). Sallis and colleagues reviewed studies published between 1970 and 1998, using the following selection criteria: subjects aged 3-18 years, physical activity as the dependant variable and variables were tested for their association with physical activity. The authors reviewed both cross-sectional and prospective studies from school and community samples. Although findings were often inconsistent, 14 variables were confirmed to be consistently associated with adolescent physical activity. They included: age, gender, ethnicity, achievement orientation, perceived competence, depression (inverse relationship), intention to be active, sensation seeking, previous physical activity, participation in community sports, support from parents and significant others, sibling physical activity and opportunities to exercise. Cavill and Biddle (2003) completed a more recent review and found similar results. However, both reviews identified an abundance of research from the United States and a shortage of physical activity surveys conducted elsewhere. Cavill and Biddle (2003) highlighted the need for caution when applying the findings to the British context as previous research has established racial and ethnic differences in physical activity correlates (e.g. Gordon-Larsen, McMurray, & Popkin, 1999; McKenzie et al., 2002; Schmitz et al., 2002).

Therefore, the aim of this study was to investigate the factors associated with physical activity among a sample of secondary school students from the UK. The factors chosen for the present study included some established factors including, age, gender and parent support for physical activity. The study sought to include a number of factors that have been reported to have inconsistent associations with physical activity including peer support for physical activity, perceived barriers, perceived benefits and physical activity personal rating.

METHOD

Participants

The study methodology was approved by the University of Oxford's Department of Educational Studies Ethics Committee and all students and parents/guardians provided informed consent. Eight year seven classes and eight year ten classes were randomly selected from four Oxfordshire government schools. The sample size was 402, comprising 207 year seven students (ages 11-12) and 195 year ten students (ages 15-16). Oxfordshire is less ethnically diverse than other counties in the UK but government schools are attended by students from a range of social classes. Specific details regarding the demographics of the study sample are described in the results section.

Measures

A questionnaire was used to identify (i) the amount of time spent in physical activity, (ii) the amount of time spent in sedentary behaviour and (iii) the factors associated with physical activity. Students completed questionnaires in their registration period at the start of the day.

Moderate-to-vigorous physical activity (MVPA) was measured using an item modified from the *Health-Behaviour in School-aged Children (HBSC)* study, which was found to have acceptable reliability and validity (Booth, Okely, Chey, & Bauman, 2001). Respondents were asked to report the number of times a week they engaged in MVPA for 20 minutes or longer. Students were provided with the following definition of MVPA; '*activity that makes you breathe heavily and increases your heart rate'.* Time spent in sedentary behaviours was assessed using two commonly used items; hours/day spent watching television and hours/day using the computer.

A number of demographic variables were also assessed in the current study. These included gender, language spoken at home, siblings/no siblings, living with both parents and social class. Social class was based on the highest parental occupation using the *Registrar General Classification* system (Office of Population Censuses & Surveys, 1980).

The following constructs from Bandura's Social Cognitive Theory (SCT) were assessed in the study: social support for physical activity, outcome expectancy and perceived barriers to physical activity. Social support was assessed using the *Parent Support Scale* and *Peer Support Scale* developed by Prochaska, Rodgers and Sallis (2002). Both scales employ a 5-point Likert scale anchored by 0 (*Never*) and 4 (*Daily*). Students are asked to report how many times during a typical week they receive various forms of support from their family or friends e.g. '*encouraged you to do physical activities or play sport*.' The *Parent Support Scale* was found to have high internal consistency ($\alpha = .68$) and good test-retest reliability ($r = .88$). The *Peer Support Scale* has similarly adequate psychometric properties ($\alpha = .73$, $r = .86$). Outcome expectancy of physical activity was assessed using Taylor and colleagues' *Health Benefits of Physical Activity Scale* (Taylor et al., 2002). The 13-item scale includes the common stem: '*If I participate in regular physical activity or sports.'* The scale includes statements relating to the benefits of physical activity e.g. '*I will improve my heart and lung fitness*.' The scale is anchored by 1 (*Strongly disagree*) and 5 (*Strongly agree*) and has acceptable psychometric properties ($\alpha = .83$, $r = .63$). Perceived barriers were assessed using a modified version of the *Perceived Barriers to Exercise Scale* developed by Tappe, Duda and Ehrnwald (1989) and adequate psychometric properties have been reported ($\alpha = .89$, $r = .90$).

Analysis

The data were examined using SPSS version 12.0. Data were examined for normality and transformations were made when possible. Variables that satisfied normality criteria were examined using parametric methods. Those variables that did not satisfy normality criteria were analysed using non-parametric tests. Independent samples t-tests and Mann-Whitney U tests were used to compare differences in MVPA for gender and age groups. Comparison of means used a two-tailed hypothesis with the alpha levels set at $p < .05$. Spearman's *Rho* correlation was used to analyse the relationship between MVPA and potential correlates. Factors associated with MVPA were entered into hierarchical regression models.

RESULTS

The demographics of the study sample are presented in Table 1. The mean age of students was 13.1 years (SD = 1.5) with 54.1% of the sample male and 45.9 % female. The majority of students lived with both parents (73.6%) and spoke English at home (96.8%). Approximately half of the sample was from social classes 1 and 2, 30% of the sample were classified as belonging to social class 3 and the remainder were classified as 4 and below.

Table 1: Demographics of study sample

Variable		N (%)
Gender	Males	217 (54%)
	Females	184 (46%)
Age group	Year 7	206 (51%)
	Year 10	195 (49%)
Language spoken at home	English	388 (97%)
	Other	13 (3%)
SES	Social class < 3	211 (57%)
	Social class ≥ 3	161 (43%)
Living arrangement	Both parents	295 (74%)
	Other	106 (26%)
Siblings/no siblings	Siblings	369 (92%)
	No siblings	32 (8%)

The means and standard deviations are presented in Table 2 separately for year 7 & and year 10 male and female students. The students reported participating in an average of 4.5 (± 1.4) physical activity sessions of greater than 20 minutes each week. On average, students reported 2.8 (± 1.2) hours/day watching television and 1.7 (± 1.0) hours/day using the computer. Mann-Whitney U tests confirmed statistically significant differences in participation in MVPA between males (4.7 sessions/week) and females (4.2 sessions/week, $p < .001$). Year seven students (4.8 sessions/week) were more active than year ten students (4.2 sessions/week, $p < .001$). Males reported significantly more hours per day using the computer than females (1.94 versus 1.37, $p < .001$). However, no significant differences were found for TV watching. Furthermore, no significant differences were found between year groups for either of the sedentary behaviour measures.

Table 2: ***Means and standard deviations for study variables grouped by age and gender***

Variables	Male		Female	
	Year 7	Year 10	Year 7	Year 10
Behaviour				
MVPA sessions/week	4.9 (1.3)	4.6 (1.3)	4.6 (1.2)	3.9 (1.5)
Television hours/day	2.9 (1.3)	2.7 (1.0)	2.7 (1.3)	2.7 (1.1)
Computer usage hours/day	2.0 (1.3)	1.9 (1.1)	1.3 (0.6)	1.5 (0.7)
Social				
Perceived family support	2.7 (0.8)	2.0 (0.9)	2.3 (0.8)	1.7 (.0.9)
Perceived peer support	2.5 (1.0)	2.1 (0.9)	1.8 (0.9)	1.6 (0.9)
Psychological				
Barriers to physical activity	1.9 (0.5)	2.2 (0.6)	2.2 (0.5)	2.3 (0.5)
Outcome expectancy	2.1 (0.5)	2.0 (0.4)	2.0 (0.3)	1.9 (0.4)

Note. Means reported and standard deviations in brackets.

The associations were grouped by gender and year at school (Table 3). There were no statistically significant associations between MVPA and any of the demographic variables. However, a number of significant relationships were found between MVPA and social and psychological factors. Perceived family support had a moderate positive correlation with MVPA for

all subgroups except year seven girls. However, perceived peer support for MVPA correlated moderately across all four subgroups r = .45 ($p < .01$). Perceived barriers to activity was inversely related to MVPA in all four subgroups. More active students perceived fewer barriers to physical activity. Outcome expectancy of physical activity was positively correlated with MVPA within all four subgroups r = .426 ($p < .01$). However, the relationship was weaker for younger males r = .24 ($p < .05$).

Table 3: Correlations between MVPA and various factors using Spearman's Rho

	Male		Female		Total
	Year 7	Year 10	Year 7	Year 10	
Demographics					
Language spoken at home	.052	-.023	N/A	-.029	.003
SES	-.140	.035	.092	-.174	-.020
Living arrangement	.016	-.163	.019	-.103	-.067
Siblings/no siblings	.182	-.007	.134	-.065	.062
Behavioural					
Television hours/day	.021	-.042	-.202	-.036	-.052
Computer hours/day	.021	-.026	-.038	.084	.046
Social					
Family support	.399**	.406**	.040	.426**	.406**
Peer support	.437**	.428**	.336**	.473**	.446**
Psychological					
Barriers to physical activity	-.374**	-.337**	-.459**	-.507**	-.433**
Outcome expectancy	.237*	.460**	.434**	.518***	.426**

Note. Significance, * p < .05, ** p < .01, *** p < .001

In the final regression model (Table 4), the demographic block accounted for 7.2% of the variance in MVPA ($p < .001$), with all factors significant predictors except for the sibling variable. Both gender (partial r = -.14, $p < .05$) and age (partial r = -.20, $p < .01$) were statistically significant predictors in the model. The social block was then entered and accounted for an additional 18.5% ($p < .001$) of the variance. Both family support, (partial r = .26, $p <.001$) and peer support, (partial r = .31, $p < .001$) explained large portions of the variance. Finally, the psychological block was entered into the model and explained an additional 7.3% ($p < .001$) of the variance. While perceived barriers to activity accounted for a statistically significant portion of the variance r = -.28 ($p < .001$), outcome expectancy did not. The final model accounted for 33% of the variance in MVPA ($p < .001$).

DISCUSSION

The identification of physical activity correlates can help to develop effective physical activity interventions (Sallis et al., 2000). In the current study, a number of demographic, psychological and social variables were examined in an attempt to understand their relationship with participation in physical activity among a sample of British secondary school students. While it has been suggested that findings from international studies may not necessarily be applied to the British context (Cavill & Biddle, 2003), the findings from this study largely correspond to those completed elsewhere. Social support from both parents and peers were both strongly and consistently associated with physical activity. Previous research suggests that encouragement from significant others is associated with increased activity participation (Sallis, Taylor, Dowda, Freedson, & Pate, 2002; Saxena, Borzekowski, & Rickert, 2002; Taylor et al., 2002; Vilhjalmsson & Thorlindsson, 1998). In this study, students who were living with both parents reported more positive behaviour and beliefs regarding a number of physical activity influences. Similarly, in their examination of child and parent reported vigorous physical activity, Sallis and colleagues (Sallis et al., 2002) found that the most consistent influences on physical activity participation were peer support and use of afternoon time for active rather than sedentary recreation.

Table 4: Hierarchical regression analyses explaining MVPA

Blocks of variables	Variable	Partial r
Demographic	**Adjusted R^2 = .07*** **	
	Gender	-.014*
	Year at school	-0.20**
	Living with both parents/other arrangement	-0.14*
	Siblings/no siblings	0.04
Social	**Δ adjusted R^2 = .19*** **	
	Family support for physical activity	0.26***
	Peer support for physical activity	0.31***
Psychological	**Δ adjusted R^2 = .07*** **	
	Barriers to physical activity	-0.28***
	Outcome expectancy	0.09
	Total Adjusted R^2 = .33* **	

Note. Significance, * $p < .05$, ** $p < .01$, *** $p < .001$

Additionally, statistically significant associations were found between outcome expectancy of physical activity (positive) and perceived barriers to physical activity (inverse) in all four subgroups. These findings indicate that those students who recognise the benefits of activity and identify fewer barriers are more active than those students who do not. In previous epidemiological research, both variables have been found to have inconsistent associations with physical activity (Sallis et al., 2000).

This study did not identify a strong relationship between MVPA and sedentary behaviour, as measured by hours spent watching television and using the computer. From their review of the literature, Caroli and colleagues (Caroli, Argentieri, Cardone, & Masi, 2004) claimed that television watching replaces more vigorous activities and that there is a positive correlation between time spent watching television and being overweight or obese. Although there is evidence for their latter conclusion, there is very little testimony to suggest the former. Sallis and colleagues (Sallis et al., 2000) concluded that time spent watching television is generally unrelated to activity levels, while use of afternoon and weekend time for sedentary pursuits is a consistent correlate for adolescents. Similarly, Biddle and colleagues (Biddle, Gorely, & Stensel, 2004) reached the conclusion that physical activity was unrelated to TV viewing.

While it is generally accepted that young people are not sufficiently active (Pushka, Benaziza, & Porter, 2003), the quality of data on the physical activity levels of youth has been criticised. In a consensus statement on youth physical activity, Cavill, Biddle and Sallis (2001) claimed that it is difficult to determine objectively whether there has been a decline in young people's physical activity in recent years. However, there is evidence that general activity levels have declined in response to lifestyle changes (Department of Health & Department for Culture Media & Sport, 2004). For example, in the UK the proportion of children walking to school declined from 62% to 54%, between 1989 and 2001 (Office for National Statistics, 2001). These findings do not correspond to the latest data from Australia, where the *New South Wales Schools Physical Activity and Nutrition Survey* (SPANS: NSW Centre for Obesity & Overweight, 2006) found that participation in physical activity increased by approximately 15-25% from 1985 to 2004 among school students.

It is important to note that prevalence estimates for reaching physical activity guidelines may depend on the type of assessment used (Sarkin, Nichols, Sallis, & Calfas, 2000). Furthermore, inconsistencies of recall period and timing of questionnaire administration can further complicate comparisons between surveys (Stephens & Casperson, 1994). The current study's reliance on self-reported data is a limitation. It has been suggested that questionnaires are not appropriate for use with young children (Kohl, Fulton, & Caspersen, 2000), who are thought to overestimate their activity levels (Warnecke et al., 1997). However, the students involved in the study were adolescents (mean age = 13.1), who are capable of recalling physical activity behavior at a satisfactory level. Additionally objective measures are quite expensive and the physical activity

measure used in the current study was similar to those used in other large-scale studies of youth physical activity (Booth et al., 2001; Utter, Denny, Robinson, Ameratunga, & Watson, 2006).

CONCLUSIONS

In the current study, social support and perceived barriers to physical activity were key predictors of participation in physical activity. Interventions designed to increase adolescent physical activity should incorporate strategies to include family and friends in physical activity pursuits. Similarly, adolescents need to develop the necessary skills and knowledge to overcome potential barriers to an active lifestyle.

While time spent in sedentary pursuits may be used for physical activity, watching television and using the computer were largely unrelated to participation in physical activity among adolescents. Consequently, future interventions to promote physical activity and reduce sedentary behaviour should target the two behaviours separately.

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