



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

### Longitudinal changes in physical self-perceptions and associations with physical activity during adolescence

**Citation for published version:**

Inchley, J, Kirby, J & Currie, C 2011, 'Longitudinal changes in physical self-perceptions and associations with physical activity during adolescence', *Pediatric Exercise Science*, vol. 23, no. 2, pp. 237.  
<[http://journals.humankinetics.com/AcuCustom/SiteName/Documents/DocumentItem/07\\_Inchley\\_pes\\_2011\\_0023.pdf](http://journals.humankinetics.com/AcuCustom/SiteName/Documents/DocumentItem/07_Inchley_pes_2011_0023.pdf)>

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Published In:**

Pediatric Exercise Science

**General rights**

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



## **Longitudinal Changes in Physical Self-Perceptions and Associations With Physical Activity During Adolescence**

**Jo Inchley, Jo Kirby, and Candace Currie**

The University of Edinburgh

The purpose of this study was to examine adolescents' physical self-perceptions and their associations with physical activity using a longitudinal perspective. Utilizing data from the Physical Activity in Scottish Schoolchildren (PASS) study, changes in exercise self-efficacy, perceived competence, global self-esteem and physical self-worth were assessed among a sample of 641 Scottish adolescents from age 11–15 years. Girls reported lower levels of perceived competence, self-esteem and physical self-worth than boys at each age. Furthermore, girls' physical self-perceptions decreased markedly over time. Among boys, only perceived competence decreased, while global self-esteem increased. Baseline physical activity was a significant predictor of later activity levels for both genders. Findings demonstrate the importance of physical self-perceptions in relation to physical activity behavior among adolescents. Among older boys, high perceived competence increased the odds of being active by 3.8 times. Among older girls, high exercise self-efficacy increased the odds of being active by 5.2 times. There is a need for early interventions which promote increased physical literacy and confidence, particularly among girls.

Increasing recognition of the health benefits of physical activity has led to renewed efforts to promote active lifestyles, with young people often identified as a key target group. Within Scotland, the national physical activity strategy (31) set the target that 80% of young people should meet the current recommended levels of physical activity (at least one hour of moderate physical activity daily) by the year 2022, but recent figures suggest that only 31% of girls and 61% of boys aged 13–15 years are achieving this level (27). Young people in Scotland are not unique in showing these lower than recommended levels of physical activity, with similar patterns seen across other European countries and North America (11).

To engage young people more effectively the factors which influence physical activity behavior must be better understood. Recent research among children and adolescents suggests physical self-perceptions are an important correlate of physical activity (10,18). Indeed, perceptions of the self are considered a core element in explanations of human behavior and are central to social learning and motiva-

---

Inchley, Kirby, and Currie are with the Child and Adolescent Health Research Unit (CAHRU), The University of Edinburgh, Edinburgh EH8 8AQ, UK.

tional theories of physical activity behavior. Self-concept has been described as an individual's perception of self, formed through experience with their environment, interactions with significant others, and attributions of their own behavior (32). It is, therefore, a dynamic construct and subject to change over time.

Self-esteem is the evaluative component of self-concept and relates to the degree to which an individual feels valued by others, experiences success in achieving their aspirations, and feels significant and competent (6). Global self-esteem is a multidimensional construct, made up of perceptions of the self in a number of different domains. In relation to physical activity behavior, perceptions in the physical domain are of particular interest. Physical self-perceptions range from the general to the more specific and, according to Fox's hierarchical model (15), include domain (physical self-worth) and subdomain (sports competence, physical condition, body image and physical strength) level perceptions. Crocker et al. (9) found that physical self-perceptions predicted 27–29% of the variance in physical activity among Canadian children aged 10–14 years. Gender differences were apparent, with boys reporting higher perceptions of sports competence and physical strength than girls. Perceptions of competence are thought to play a key role in physical activity motivation (3) and, according to Harter's Competence Motivation Theory (19), people with high perceived competence have higher expectations of success and achievement and therefore invest more effort and persistence in their pursuit of a specific behavior. Indeed, Sallis et al. (30) found perceived competence to be consistently associated with levels of physical activity among adolescents.

Self-efficacy relates to the confidence an individual has in their ability to perform a certain behavior in the face of internal or external challenges (1). Confidence and skills are closely connected; learning skills can help to build confidence in one's own ability, but confidence is required to develop skills (7). Thus, both are relevant to behavior and need to be reinforced within learning contexts. Self-efficacy is also likely to be critical to the extent to which children are able to maintain an active lifestyle in the face of increasing intrinsic and extrinsic barriers as they get older. The goal of promoting lifelong physical activity is dependent on enabling individuals to continue participating in physical activity despite changing circumstances, priorities and motivation.

While previous research suggests that physical self-perceptions have an important influence on physical activity participation among adolescents, evidence is still limited and inconsistent. Furthermore, most research has relied on cross-sectional data. The current study aims to add to the body of evidence, by examining changes over time in exercise self-efficacy, perceived sports competence, self-esteem and physical self-worth and their association with physical activity participation among adolescents in Scotland. It focuses on the primary-secondary school transition and the early adolescent years, during which important physical, emotional and social changes are known to occur. All data are analyzed separately for boys and girls.

## Methods

### Study Design

Data were collected as part of the Physical Activity in Scottish Schoolchildren (PASS) study, a longitudinal study tracking physical activity participation in a cohort

of adolescents between the ages of 11–15, from the final year of primary school (P7) to the fourth year of secondary school (S4). Eight school clusters (8 secondary schools and 52 associated primary schools) took part in the study; two from each of four diverse local authority areas across Scotland. Schools were selected according to school size and catchment area to allow for a varied socioeconomic profile across the whole sample. All P7 pupils in participating schools in 2002 were recruited to the study ( $n = 1632$ ). Ethical approval was gained from The University of Edinburgh School of Education Research Ethics Committee. Information sheets and consent forms were sent out to all parents in the first year and to parents of new pupils in subsequent years. Pupils were provided with information sheets and consent forms on the day of the survey and were able to withdraw if they did not wish to take part. Data were collected through self-report questionnaire survey during the Autumn Term.

The final longitudinal sample comprised 641 pupils who completed a questionnaire in all survey years (2002–2006). This represents a final response rate of 39.3%, which compares favorably with other longitudinal studies over a similar time period (2,21,28). Loss to follow-up occurred for various reasons, including parental withdrawal, pupil withdrawal, absence on the day of the survey, moving to another school, an incomplete or missing questionnaire, or another unspecified reason. The majority of pupil loss to follow-up occurred during the primary-secondary school transition due to study participants moving to other schools. The longitudinal sample were more likely than those lost to follow-up to report high physical self worth in P7 (54.4% compared with 48.9%,  $c=4.48$ ,  $p < .05$ ) and come from high affluent families (23.9% compared with 19.7%,  $c=9.75$ ,  $p < .01$ ) but did not differ by gender or other key variables. Of those included in the final sample, 48.8% were male and 51.2% were female, and 96.7% described themselves as white.

## Physical Activity Measurement

Physical activity was measured using the Physical Activity Questionnaire for Older Children (PAQ-C) which includes nine items to assess a child's physical activity during the last 7 days in a variety of contexts (e.g., school, PE, break times, after school, evenings and weekends). The PAQ-C has demonstrated good reliability and validity in previous research (8,23,36) and findings within a Scottish population have been comparable to other studies (22). To compare 'active' and 'low active' adolescents, a binary variable was created based on the PAQ-C median score.

## Physical Self-Perceptions Measurement

Physical self-perceptions were investigated specifically in relation to exercise self-efficacy, perceived sports competence, self-esteem and physical self-worth. Based on their survey responses, participants were classified into 'high' or 'low' groups. Cut-offs were determined using data on frequencies and median values in P7. Scores below the median value were classified as 'low' and scores equal to or greater than the median value were classified as 'high'. For cases with <25% missing items within scales, mean scores were computed based on the total number of valid responses. Cases with more than 25% missing responses in any scale were excluded from the analyses.

## Exercise Self-Efficacy

Exercise self-efficacy was assessed using the Children's Physical Activity Self-Efficacy Scale (16). This 8-item scale includes such statements as '*I could exercise even if I was tired*' and '*I could exercise even if I was not very good at it*'. Responses were based on a 4-point Likert scale, ranging from 'very true' to 'not at all true'.

## Perceived Sports Competence

Perceived sports competence was assessed using the Physical Ability subscale of the Self-Description Questionnaire 1 (25). The scale consists of 8 items measuring subjective assessments of athletic performance, for example, '*I can run fast*', '*I am good at sports*' and '*I am good at throwing a ball*'. Responses were based on a 4-point Likert scale, ranging from 'very true' to 'not at all true'.

## Self-Esteem

Global self-esteem was assessed using a ten-item scale based on the Rosenberg self-esteem scale (29) and previously adapted for use among Scottish adolescents (37). A 4-point Likert response scale was used with responses ranging from 'agree a lot' to 'disagree a lot'. Physical self-worth is a component of global self-esteem relating specifically to perceptions of self in the physical domain. It was measured using the global physical self-worth subscale of the Child and Youth Physical Self-Perception Profile (39). The subscale consists of six items, four of which represent positive self worth and two of which represent negative self worth. Due to difficulties for younger adolescents in understanding the original structured alternative response format, this was changed to a 4-point Likert response scale ranging from 'very true' to 'not at all true'. Previous research has shown responses on a similar scale to be psychometrically stronger when based on typical Likert responses rather than the structured alternative format (40).

## Other Covariates

Socioeconomic status was measured using the Family Affluence Scale (FAS), a validated measure which assesses the material conditions of the households in which young people live (12). A composite FAS score (range 0–7) was calculated, from which a three point ordinal scale was derived in which a score of 0–3 = low affluence, 4, 5 = middle affluence, and 6, 7 = high affluence.

## Data Analysis

All analyses were conducted using the statistical software package SPSS version 14 (SPSS Inc., Chicago, USA) Complex Samples for Survey Analysis package, to take account of the clustered nature of the data. This takes account of the fact that individuals are nested within schools and ensures that the standard errors of model parameters are not underestimated. Gender differences in proportions and associations between physical activity and self-perception variables were analyzed using chi-square tests. Temporal trends between P7 and S4 were assessed using the chi-squared test for linear trend, taking account of the effect of school clustering

on the precision of the estimates presented. Logistic regression analysis was used to investigate the way in which different self-perceptions were associated with young people's physical activity levels (active versus low active) at each age group. Multivariable logistic regression models were run for boys and girls separately, using the enter method, including only those independent variables with  $p < .05$  in the univariate regression analyses. The multivariable models adjusted for baseline physical activity (physical activity in P7). Odds ratios and confidence intervals are presented for each independent variable. Data are presented for the final year of primary school (P7), and the second and fourth years of secondary school (S2 and S4, respectively). These years cover the onset of adolescence and middle adolescent years, thus representing key developmental stages.

## Results

### Gender Differences and Longitudinal Trends

Descriptive statistics for physical activity and physical self-perceptions for boys and girls in each of the three school years are presented in Table 1. Boys were consistently more active than girls in each year and there was a significant decrease in the proportion of active boys and girls over time. Among boys, there was no significant change over time in the proportion reporting high exercise self-efficacy (EFF) or physical self-worth (PSW). The proportion of boys reporting high perceived competence (COMP) decreased between P7 and S2. Conversely, there was an increase in global self-esteem (EST) over the five year period. Among girls, there was a significant decrease in the proportion scoring high on all self-perception variables, with the most marked changes occurring across the primary-secondary school transition. Boys reported higher levels of perceived competence, self-esteem and physical self-worth than girls in all years. There was no difference between boys and girls in the proportion reporting high self-efficacy in P7. However, by secondary school, levels of self-efficacy were higher among boys than girls.

### Associations Between Physical Self-Perceptions and Physical Activity

Chi-squared associations between physical self-perceptions and physical activity participation for boys and girls in each year are shown in Table 2. High self-efficacy and high perceived competence were positively associated with physical activity among both genders across all time points. High self-esteem was associated with physical activity among P7 and S4 girls only. Physical self-worth was positively associated with physical activity among girls in all three years and among boys in S2 and S4.

### Logistic Regression Analyses

Tables 3 and 4 show the odds ratios and 95% confidence intervals for being active (compared with low active) at each time point according to physical self-perceptions and baseline (P7) physical activity for boys and girls respectively. Only those variables which were significant ( $p < .05$ ) at the univariate stage of analysis were added

**Table 1 Descriptives by School Year and Gender**

	P7	S2	S4	Time Trend
Mean age (years; <i>SD</i> )	11.28 (0.32)	13.26 (0.30)	15.29 (0.30)	-
FAS (%)				
Low	20.2	18.1	17.3	
Medium	55.9	55.1	55.7	-
High	23.9	26.8	27.0	
PA (% active)				
Boys	82.1	62.9	41.9	$p < 0.001$
Girls	61.1	30.5	16.6	$p < 0.001$
<i>Gender diff</i>	$p < 0.001$	$p < 0.001$	$p < 0.001$	
EFF (% high)				
Boys	54.2	59.2	58.5	$p = 0.201$
Girls	54.6	44.0	36.8	$p = 0.000$
<i>Gender diff</i>	$p = 0.912$	$p = 0.000$	$p = 0.000$	
COMP (% high)				
Boys	65.3	53.7	52.1	$p = 0.006$
Girls	39.8	23.6	15.9	$p = 0.000$
<i>Gender diff</i>	$p = 0.000$	$p = 0.000$	$p = 0.000$	
EST (% high)				
Boys	61.0	63.3	67.5	$p = 0.016$
Girls	50.8	36.4	34.3	$p = 0.001$
<i>Gender diff</i>	$p = 0.009$	$p = 0.000$	$p = 0.000$	
PSW (% high)				
Boys	61.6	59.0	54.2	$p = 0.104$
Girls	47.5	28.8	21.8	$p = 0.000$
<i>Gender diff</i>	$p = 0.000$	$p = 0.000$	$p = 0.000$	

EFF = exercise self-efficacy, COMP = perceived sports competence, EST = global self-esteem, PSW = physical self worth

to the multivariable logistic regression model. Socioeconomic status was adjusted for in the multivariable models. Results show gender and developmental differences in relation to the self-perception variables which are most likely to predict being active. Among P7 boys, only self-efficacy remained significant in the multivariable model with boys reporting high self-efficacy being 2.3 times as likely to be active than those reporting low self-efficacy. Among secondary boys, baseline physical activity and perceived competence were associated with being active at both time points. Baseline physical activity was the strongest predictor of being active in S2 and perceived competence was the strongest predictor of being active in S4.

**Table 2 Associations Between Self-Perceptions and Physical Activity, by School Year and Gender**

	% pupils reporting being physically active					
	Boys			Girls		
	P7	S2	S4	P7	S2	S4
EFF (%)						
High EFF	88.7	70.2	51.8	69.5	47.7	32.5
Low EFF	74.4	51.8	28.2	50.7	17.8	6.9
	p = 0.002	p = 0.002	p < 0.001	p = 0.001	p < 0.001	p < 0.001
COMP (%)						
High COMP	85.9	73.0	59.3	74.4	57.7	53.2
Low COMP	74.0	51.1	23.4	52.2	21.0	9.6
	p = 0.013	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001
EST (%)						
High EST	83.7	64.6	43.8	68.0	36.8	27.1
Low EST	79.8	60.2	37.8	54.4	26.7	11.0
	p = 0.403	p = 0.458	p = 0.337	p = 0.015	p = 0.070	p < 0.001
PSW (%)						
High PSW	84.5	68.1	50.3	67.8	45.3	38.2
Low PSW	77.6	55.1	32.3	54.8	24.7	10.4
	p = 0.138	p = 0.026	p = 0.002	p = 0.021	p < 0.001	p < 0.001

EFF = exercise self-efficacy, COMP = perceived sports competence, EST = global self-esteem, PSW = physical self worth

Among girls, high perceived competence increased the odds of being active in P7 and S2. Among S2 girls, baseline physical activity, self-efficacy and physical self-worth also remained significant in the multivariable model, with self-efficacy having the strongest effect. By S4, self-efficacy and physical self-worth remained significant, increasing the odds of being active by 5.2 and 3.4 times respectively. Global self-esteem was not a significant predictor of physical activity for either boys or girls in the multivariable analyses.

## Discussion

This study investigated changes in perceptions of the physical self among adolescent boys and girls, and associations with physical activity behavior, over a five year period. Longitudinal data were collected from a cohort of Scottish schoolchildren from the final year of primary school to the fourth year of secondary school. Thus, the data represent an important transitional stage for young people, including the physical and psychological changes associated with puberty and the move from primary to secondary school.



Table 3 Univariate and Multivariable Analyses of Self Perceptions and Physical Activity Among Boys: OR (95% CI)

Outcome measure: Physical activity (ref: low)	P7			S2			S4		
	Univariate	Multivariable		Univariate	Multivariable		Univariate	Multivariable	
Baseline PA (active)	-	-		3.87* (1.87, 8.01)	3.62* (1.75, 7.51)		2.99* (1.47, 6.08)	2.01* (1.06, 3.82)	
EFF (high)	2.70* (1.40, 5.18)	2.26* (1.11, 4.58)		2.19* (1.25, 3.84)	1.73 (0.93, 3.23)		2.73* (1.67, 4.46)	1.55 (0.88, 2.72)	
COMP (high)	2.15* (1.11, 4.17)	1.62 (0.79, 3.33)		2.45* (1.42, 4.23)	2.21* (1.11, 4.41)		3.41* (2.10, 5.55)	3.76* (1.93, 7.33)	
EST (high)	1.30 (0.75, 2.26)			1.21 (0.61, 2.37)			1.28 (0.78, 2.10)		
PSW (high)	1.58 (0.79, 3.15)			2.95* (1.50, 4.32)	0.82 (0.45, 1.50)		2.23* (1.28, 3.89)	1.08 (0.49, 2.40)	

PA = physical activity, EFF = exercise self-efficacy, COMP = perceived sports competence, EST = global self-esteem, PSW = physical self worth  
\* Significant at p < 0.05 level

**Table 4 Univariate and Multivariable Analyses of Self-Perceptions and Physical Activity Among Girls:  
OR (95% CI)**

Outcome measure: Active (ref: low)	P7		S2		S4	
	Univariate	Multivariable	Univariate	Multivariable	Univariate	Multivariable
Baseline PA (active)	-	-	3.78* (2.03, 6.98)	2.56* (1.04, 6.30)	2.44* (1.24, 4.82)	1.68 (0.65, 4.31)
EFF (high)	2.22* (1.27, 3.89)	1.62 (0.87, 3.00)	4.20* (1.73, 10.17)	2.95* (1.30, 6.71)	6.51* (2.92, 14.54)	5.20* (2.49, 11.20)
COMP (high)	2.66* (1.50, 4.72)	1.89* (1.00, 3.57)	3.00* (1.37, 6.59)	2.47* (1.15, 5.30)	1.74 (0.83, 3.66)	
EST (high)	1.78* (1.04, 3.07)	1.22 (0.62, 2.38)	1.60 (0.72, 3.55)		3.01* (1.27, 7.11)	1.20 (0.29, 5.00)
PSW (high)	1.74* (1.16, 2.62)	1.10 (0.71, 1.71)	2.55* (1.34, 4.88)	1.21* (1.02, 1.43)	2.09* (1.19, 3.65)	3.36* (1.33, 8.50)

PA = physical activity, EFF = exercise self-efficacy, COMP = perceived sports competence, EST = global self-esteem, PSW = physical self worth

\* Significant at p < 0.05 level

Consistent with much previous research, boys were more active than girls at all ages and age-related declines in physical activity were observed among both genders. The data also show important gender differences in physical self-perceptions, with boys consistently reporting more favorable psychological profiles in relation to physical activity than girls. The fact that many of these gender differences were already apparent in primary school suggests the need for early intervention to support the development of a more positive self-concept among girls, particularly in the physical domain. Furthermore, marked decreases in self-efficacy, perceived competence, self-esteem and physical self-worth suggest that girls' perceptions of the physical self are particularly vulnerable during the adolescent years. Adolescence is a critical period during which physical, social and emotional changes occur and, as such, negative self-perceptions may intensify (14,20). In particular, developmental changes associated with puberty may threaten girls' perceptions of their physical self (22).

By S4, only around one in three girls reported high exercise self-efficacy and self-esteem, and around one in five reported high physical self-worth. Levels of perceived competence were lower still. This demonstrates the need for teachers and coaches to focus on promoting adolescent girls' physical literacy, particularly in relation to their skills and confidence. Indeed, the need for interventions which target perceived competence in youth has previously been acknowledged (2). Similarly, it has been argued that the effectiveness of interventions aimed at increasing physical activity among adolescent girls might be enhanced by helping girls feel more confident about themselves and their ability to engage in physical activity (26).

Perceived competence was significantly correlated with physical activity for both boys and girls showing that adolescents who feel able to perform well within a sports context are more active. This finding is in agreement with a recent longitudinal assessment in children, which found that developing high perceived sports competence through early skill development was important for both boys and girls in determining adolescent physical activity participation and fitness (2). While perceived competence may be central to performance enhancement, from a public health perspective, a more important focus is that of personal development in relation to perceptions of one's own ability within the physical domain. If, at age 11 years, children already feel that they lack the physical skills required for physical activity and sport, it is not surprising that participation falls as they face the social and environmental changes associated with transition to secondary school and cope with the concurrent physical and psychological adaptations associated with puberty. This is likely to be a particular issue for girls, among whom levels of perceived competence were consistently lower than boys. There may also, however, be significant social consequences for boys with low perceived competence in cultures where athletic competence is related to peer acceptance and popularity among boys (35).

The relationship between physical activity and psychological wellbeing has been the subject of much previous research. Recent reviews provide evidence that exercise can be effective in increasing global self-esteem among adults (33) and young people (13) although effects are typically small. Spence et al. (33) suggest that a stronger effect may be observed at domain-specific levels. Furthermore, it is likely that enhanced self-esteem as a result of taking part in physical activity may lead to continued participation (33). Findings from the current study support the notion that domain-specific self-esteem is more important than global self-esteem in relation to physical activity behavior among adolescents. Univariate analysis showed

that global self-esteem was not significant for boys but was for girls in P7 and S2, although this effect disappeared in the multivariable model. In contrast, physical self-worth was associated with physical activity for girls in all three years and for boys in the secondary years. Among boys, it did not remain significant in the multivariable model, suggesting that other aspects of self-concept are more important. Among secondary girls, however, physical self-worth remained significant in the multivariable model; in S4, the odds of being active were over three times higher among girls reporting high physical self-worth than those with low physical self-worth. Some have argued that young women who lack confidence in their physical self become disempowered socially in a society where so much emphasis is placed on physical attributes (17). Furthermore, irrespective of associations with physical activity, the finding that boys had higher self-esteem than girls is important as high self-esteem is associated with a range of positive outcomes. These include well-being, life satisfaction, academic achievement, positive perceptions by peers and enhanced coping skills (4). Conversely, low self-esteem has been associated with health-compromising behaviors (24). Thus, the findings suggest that girls may be at greater risk of negative health outcomes as a result of poorer psychological status.

Baseline physical activity was a significant predictor of later activity levels for both boys (S2 and S4) and girls (S2 only). This concurs with much previous health behavior research which has shown past behavior to be the strongest predictor of present behavior (5,38), and highlights the need for early intervention to ensure that children are given maximal levels of support for being active from the very early years. Indeed, findings from a recent review of tracking of physical activity from childhood to adulthood reinforce the public health importance of promoting physical activity in children and adolescents (34). However, the fact that baseline physical activity did not predict activity within the multivariable model for S4 girls suggests that situational factors are highly relevant to the decisions young people make about physical activity and may be more important than past behavior for older girls.

This study is subject to a number of limitations. The low response rate among the final longitudinal sample may lead to attrition bias. However, with the exception of family affluence and physical self-worth, further analyses indicated that the longitudinal sample did not differ significantly from those lost to follow-up by gender, physical activity or other key variables. Furthermore, the response rate is comparable with other longitudinal studies over a similar time period (2,21,28). Findings are likely to be context-specific and further examination of these relationships in different countries and among different cultural groups would strengthen the evidence base. While the longitudinal nature of the study enables identification of predictors of physical activity, it is likely that relationships are bidirectional. Future research will explore this further. Finally, given the life stage during which data were collected, maturational status is a potentially important issue and may influence both self-perceptions and physical activity behavior. Validated measures of pubertal status appropriate for use with both boys and girls should be included in any future research.

In conclusion, results from this study demonstrate the importance of positive physical self-perceptions in relation to physical activity behavior among adolescent boys and girls. There is strong evidence that girls hold more negative self-perceptions than boys and these differences are apparent as early as 11 years. If we are to prepare adolescent girls successfully for lifelong participation in physical activity, physical activity programs must focus on promoting their physical competencies

and confidence. Changes in the relative influence of different aspects of self-concept over time also highlight the importance of developmental approaches to program design. Future research should aim to identify those physical activities which may be most likely to foster positive self-perceptions during the adolescent years.

## References

1. Bandura, A. *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall, 1986.
2. Barnett, L.M., P.J. Morgan, E. van Beurden, and J.R. Beard. Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment. *Int. J. Behav. Nutr. Phys. Act.* 5:40, 2008.
3. Biddle, S.J.H. Cognitive theories of motivation and the physical self. In: *The Physical Self: From Motivation to Wellbeing*, K.R. Fox (Ed.). Champagne, IL: Human Kinetics, 1997, pp. 59–82.
4. Biro, F.M., R.H. Striegel-Moore, D.L. Franko, J. Padgett, and J.A. Bean. Self-esteem in adolescent females. *J. Adolesc. Health.* 39:501–507, 2006.
5. Conrad, K.M., B.R. Flay, and D. Hill. Why children start smoking cigarettes: predictors of onset. *Brit. J. Adolesc.* 87:1711–1724, 1992.
6. Coopersmith, S. *The antecedents of self-esteem*. San Francisco: Freeman, 1967.
7. Corbin, C.B. Physical activity for everyone: what every physical educator should know about promoting lifelong physical activity. *J Teach Phys Educ.* 21:128–144, 2002.
8. Crocker, P., D. Bailey, R. Faulkner, K.C. Kowalski, and R. McGrath. Measuring general levels of physical activity: preliminary evidence for the physical activity questionnaire for older children. *Med. Sci. Sports Exerc.* 29:1344–1349, 1997.
9. Crocker, P.R., R.C. Eklund, and K.C. Kowalski. Children's physical activity and physical self-perceptions. *J. Soc. Sci.* 18(6):383–394, 2000.
10. Crocker, P., C. Sabiston, K. Kowalski, M. McDonough, and N. Kowalski. Longitudinal assessment of the relationship between physical self-concept and health-related behaviour and emotion in adolescent girls. *J. Appl. Sport Psychol.* 18:185–200, 2006.
11. Currie, C., S. Nic Gabhainn, E. Godeau, et al. *Inequalities in young people's health. HBSC international report from the 2005/2006 survey*. Copenhagen: WHO, 2008.
12. Currie, C., M. Molcho, W. Boyce, B. Holstein, T. Torsheim, and M. Richter. Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Soc. Sci. Med.* 66:1429–1436, 2008.
13. Ekeland, E.F. Heian, K.B. Hagen, J. Abbott, & L.V. Nordheim. Exercise to improve self-esteem in children and young people. *Cochrane Database Syst. Rev.* (Issue 1):CD003683, 2004. .
14. Fox, K.R. The physical self and processes in self-esteem development. In: *The Physical Self: From Motivation to Well-Being*, K. Fox (Ed.). Champaign, IL: Human Kinetics, 1997, pp. 111–139.
15. Fox, K.R. The self-esteem complex and youth fitness. *Quest.* 40:230–246, 1988.
16. Garcia, A.W., N.J. Pender, C.L. Antonakos, and D.L. Ronis. Changes in physical activity beliefs and behaviours of boys and girls across the transition to junior high school. *J. Adolesc. Health.* 22:394–402, 1998.
17. Garrett, R. Negotiating a physical identity: girls, bodies and physical education. *Sport Educ. Soc.* 9(2):223–237, 2004.
18. Gilson, N.D., C.B. Cooke, and C.A. Mahoney. Adolescent physical self-perceptions, sport/exercise and lifestyle physical activity. *Health Educ.* 105(6):437–450, 2005.
19. Harter, S. Effectance motivation reconsidered: toward a developmental model. *Hum. Dev.* 21:34–64, 1978.

20. Harter, S. *The Construction of the Self: A Developmental Perspective*. New York: Guilford, 1999.
21. Kelder, S.H., C.L. Perry, K-I. Klepp, and L.L. Lytle. Longitudinal tracking of adolescent smoking, physical activity and food choice behaviours. *Am. J. Public Health*. 84(7):1121–1126, 1994.
22. Knowles, A-M., A.G. Niven, S.G. Fawcner, and J.M. Henretty. A longitudinal examination of the influence of maturation on physical self-perceptions and the relationship with physical activity in early adolescent girls. *J. Adolesc.* 32:555–566, 2009.
23. Kowalski, K., P. Crocker, and R. Faulkner. Validation of the physical activity questionnaire for older children. *Pediatr. Exerc. Sci.* 9:174–186, 1997.
24. McGee, R., and S. Williams. Does low self-esteem predict health compromising behaviours among adolescents? *J. Adolesc.* 23:569–582, 2000.
25. Marsh, H.W. *Self-Description Questionnaire 1 (SDQ1) Manual*. Sydney: University of Western Australia, 1990.
26. Neumark-Sztainer, D., M. Story, P.J. Hannan, T. Sharp, and J. Rex. Factors associated with changes in physical activity. A cohort study of inactive adolescent girls. *Arch. Pediatr. Adolesc. Med.* 157:803–810, 2003.
27. Ormston, R. Physical Activity. In: *The Scottish Health Survey 2009*, Vol. 1, Chapter 6, C. Bromley, L. Given, and R. Ormston (Eds.). Edinburgh: Main Report. The Scottish Government, 2010.
28. Pfeiffer, K.A., M. Dowda, R.K. Dishman, et al. Sport participation and physical activity in adolescent females across a four-year period. *J. Adolesc. Health*. 39:523–529, 2006.
29. Rosenberg, M. *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press, 1965.
30. Sallis, J.F., J.J. Prochaska, and W.C. Taylor. A review of correlates of physical activity of children and adolescents. *Med. Sci. Sports Exerc.* 32:963–975, 2000.
31. Scottish Executive. *Let's make Scotland more active – A Strategy for Physical Activity*. Edinburgh: The Stationary Office, 2003.
32. Shavelson, R.J., J.J. Hubner, and G.C. Stanton. Self-concept: validation of construct interpretations. *Rev. Educ. Res.* 46(3):407–411, 1976.
33. Spence, J.C., K.R. McGannon, and P. Poon. The effect of exercise on global self-esteem: A quantitative review. *J Sport Exer Psychol.* 27:311–334, 2005.
34. Telama, R. Tracking of Physical Activity from Childhood to Adulthood: A Review. *Obesity Facts*. 2(3):187–195, 2009.
35. Weiss, M.R. Psychological skill development in children and adolescents. *T Sport Psychol.* 5:335–354, 1991.
36. Welk, G.J., K. Wood, and G. Morss. Parental influences on physical activity in children: an exploration of potential mechanisms. *Pediatr. Exerc. Sci.* 15:19–33, 2003.
37. West, P., and H. Sweeting. “Lost souls” and “rebels”: a challenge to the assumption that low self-esteem and unhealthy lifestyles are related. *Health Educ.* 5:161–167, 1997.
38. West, P., H. Sweeting, and A. Leyland. School effects on pupils’ health behaviours: evidence in support of the health promoting school. *Res. Pap. Educ.* 19(3):261–291, 2004.
39. Whitehead, J.R. A study of children’s physical self-perceptions using an adapted physical self-perception profile questionnaire. *Pediatr. Exerc. Sci.* 7:132–151, 1995.
40. Wichstrom, L. Harter’s Self-Perception Profile for Adolescents: reliability, validity and evaluation of the question format. *J. Pers. Assess.* 65:100–116, 1995.

## Acknowledgments

The PASS study was funded by NHS Health Scotland and the Health Improvement Division of the Scottish Government. We are grateful to all schools who participated in the study and in particular to the Head Teachers, staff and pupils who took part in the research. We would also like to thank Dorothy Currie and Kate Levin for valuable statistical advice.