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Childhood and contemporaneous correlates of adolescent leisure-time physical inactivity: a longitudinal study

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Abstract

Purpose—Although concurrent influences on adolescent physical activity are well documented, longitudinal studies offer additional insights about early life antecedents of participation. The aim of this study was to examine associations between childhood and contemporaneous factors and patterns of physical activity participation during adolescence.

Methods—Physical activity participation at ages 15 and 18 was assessed among members of the Dunedin Multidisciplinary Health and Development Study cohort using the interview-based Minnesota Leisure Time Physical Activity Questionnaire. Logistic regression was used to examine associations between childhood factors (socioeconomic status, family 'active-recreation' orientation, home activities, motor ability, intelligence and psychiatric disorder), contemporaneous factors (parental health, BMI, predicted VO_{2max}, general health, television viewing, smoking and alcohol use) and 'Persistent Inactivity', 'Declining Participation' or 'Persistent Activity' during adolescence.

Results—In multivariate models, Persistent Inactivity during adolescence was associated with lower childhood family active-recreation orientation, and poorer cardiorespiratory fitness and general health during adolescence. Declining participation was more likely among those who reported fewer activities at home during childhood. Persistent Activity was associated with better cardiorespiratory fitness and watched less television during adolescence.

Conclusions—This study found that childhood and contemporaneous factors were associated with Persistent Inactivity, Persistent Activity and Declining Participation during adolescence. The findings highlight several factors from the family and home environment of potential importance in early intervention programs to support adolescent participation in physical activity.

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Introduction

The health benefits of physical activity participation are now well established, [1] with a broad range of concurrent determinants of adolescent physical activity identified, spanning intrapersonal factors, behavioral attributes/skills, social/cultural factors and the physical environment [2]. Life course epidemiology suggests that, in addition to these concurrent determinants, early life factors may also influence later outcomes [3]. Longitudinal studies offer unique insights into antecedents of adolescent physical activity participation and potential opportunities for early intervention.

The focus here is on four potential domains of influence, family environment, physical health/ability, mental health/ability, and health risk behavior. Family factors may influence physical activity participation through a variety of environmental, cultural and genetic factors [4,5]. Evidence suggests antecedents of adolescent physical activity include higher SES [4,6] and parental modeling/support for participation [6,7]. In contrast studies have not reported associations between opportunities to be active at home and later physical activity [7,8]. Physical health and ability are another potentially important domain, with evidence that better self-report general health [9,10], physical fitness [9], adiposity [11] and motor ability [12] are antecedents of adolescent physical activity, though findings are mixed for the latter two factors [6,10,13]. An individual's mental health status and intellectual ability can potentially play a role in facilitating or limiting their capacity to enjoy and maintain participation in physical activity, though evidence for as an antecedent of adolescent activity is mixed [14–16] [10]. The final domain is health risk behavior, which is of interest because there is evidence that risk behaviors, including physical inactivity, may cluster or co-occur during adolescence [17]. There is inconsistent evidence about risk behaviors being antecedents of adolescent physical activity, with some studies reporting significant associations for less television viewing [6] and being a non-smoker [10] while others reported no associations [6,7]. Alcohol use has also been examined but no associations found with later physical activity [10].

Another important aspect of longitudinal research is that it allows examination of patterns of participation during adolescence, rather than participation at one point in time [18]. Studies examining *persistently low* participation in physical activity during late childhood/adolescence [6,10,19] found antecedents included SES, less parental support, poor perceived health, high BMI, smoking, perceptions of low physical competence and type of school attended (vocational or academically oriented). A study which examined a group with *declining* participation, in addition to a *persistently low* group [6], found several influences that were specific to the *declining* group, including associations with ethnicity, television viewing, and low self-efficacy.

Based on previous findings reviewed here, it was hypothesized that childhood (socioeconomic status, family active-recreation orientation, home activities, motor ability, intelligence and psychiatric disorder) and contemporaneous (parental health, BMI, VO_{2max}, general health, television viewing, smoking and alcohol use) factors would be associated with patterns of physical activity participation from ages 15–18 years.

Methods

Subjects

The Dunedin Multidisciplinary Health and Development Study is an ongoing longitudinal study of health and behavior among a cohort born in Dunedin, New Zealand between April 1972 and March 1973 [20]. Following collection of perinatal data, a cohort of 1037 Study members were first followed up at age 3 years (91% of those still resident in the greater Dunedin metropolitan area). The current study includes data from birth and subsequent assessments at

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ages 3 (n=1037, 48% female), 5 (n=991, 48% female), 7 (n=954, 48% female), 9 (n=955, 48% female), 11 (n=925, 48% female), 13 (n=850, 49% female), 15 (n=976, 49% female) and 18 years (n=993, 49% female). Families of Study members represent the full range of socioeconomic status (SES) in the New Zealand population [20]. Furthermore, Study members appeared to be very similar to other New Zealand age matched peers across several health-related measures, including physical activity [21]. This study focuses on those with complete physical activity data at both assessments (n = 770). In comparisons (involving all independent variables) for those with complete and incomplete data, those with complete data had higher family SES, family active recreation orientation, motor scores, IQ scores and were less likely to smoke than those with incomplete data. All research procedures were approved by the Otago Ethics Committee and written informed consent was obtained prior to participation in the study at each age.

Procedures

At each assessment, Study members were invited to spend a day at the Dunedin Research Unit. Study members were assessed as close to their birthday as possible (i.e. usually within one or two months) and attempts were made to obtain at least partial data from those who were unable to attend the Dunedin Research Unit.

Measurements

Physical activity participation—Participation at ages 15 and 18 was assessed using the interview-based Minnesota Leisure Time Physical Activity Questionnaire (MLTPAQ) [22], modified to capture sporting and recreational activities carried out in New Zealand [23] [9]. Estimates of energy expenditure from this measure among adolescents have been shown to be correlated (r = 0.49) with energy expenditure from the doubly labeled water technique [24]. This study focuses on those with complete physical activity data at both assessments (n = 770). At each age physical activity participation was dichotomized to reflect attainment of recommended levels of participation for adolescents (one hour per day, seven days a week, of moderate to vigorous intensity) [1].

The present study examines three patterns of participation: the Persistent Inactivity group who did not meet the recommendations at either 15 and 18 years (females: n = 192, 24.9%; males: n = 117, 15.2%), the Persistent Activity group who met the recommendations at both ages 15 and 18 years (females: n = 45, 5.8%; males: n = 122, 15.8%) and those who met the recommendations at age 15 but not 18 years (Declining Participation: females: n = 119, 15.4%; males: n = 128, 16.6%). A fourth grouping was possible which included those who met the recommendations at age 18 but not at 15 years (Increasing Participation), however, given the limited number of Study members in this group (females: n = 16, 2.1%; males: n = 31, 4.0%), this study focused on the other three patterns of participation as outcome measures, with the Increasing Participation group included in the comparison groups only.

Childhood measures—The *SES* of families of study members was described using a six-point scale which assessed parents self-reported occupational status, based on the educational levels and income associated with that occupation in data from the New Zealand Census [25].

An average based on the higher SES of either parent at each assessment from birth to age 15 was calculated to reflect the cumulative influence of SES during childhood and early adolescence [26], with higher scores indicating lower SES. The *Family Active-Recreation Orientation* subscale of the Moos Family Environment Scale was used to measure family participation in social and recreational activities [27]. This subscale consists of 9 questions that include specific items about family participation in sport and recreational activities, for

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example, ‘Nobody in our family is active in sports, Little league, bowling etc’, ‘Family members are not very involved in recreational activities outside work or school’, ‘We often go to movies, sports events, camping etc.’ For analysis, the Active-Recreation Orientation scale scores from ages 7 and 9 were combined and standardized. Finally, a *Home activities* measure was created to reflect opportunities for activity within the childhood home at ages 3, 5, 7 and 9. Parents were asked if Study members had been swimming/paddling in a pool, climbing trees or fences, playing on swings or bars, riding a trike/bike, or playing ball games (with the latter two activities measured at ages 3 and 5 only) at home during the previous 6 months. The number of activities was summed across ages and scores standardized.

Intelligence was measured using the Wechsler Intelligence Scale for Children-Revised at ages 7, 9, 11 and 13 [28]. An average of scores across ages 7, 9, 11 and 13 years was calculated and standardized to give the final *IQ* measure. Those with an IQ less than 70 (n = 10) were excluded from the analysis.

Mental health during late childhood/early adolescence was also examined using the Diagnostic Interview Schedule for Children at ages 11, 13 and 15 years [29]. All psychiatric disorders were combined to create a single variable *Any psychiatric disorder* which included diagnoses of Anxiety, Depression, Attention deficit and hyperactivity, and Conduct/oppositional disorders diagnosed during the 12 months prior to the age 11, 13 and 15 assessments (any psychiatric disorder: females: n = 137, 36.8%; males: n = 155, 38.9%, in the analytic sample).

Childhood motor ability was assessed using the Basic Motor Ability Test ages 7 and 9 [30]. This test is comprised of nine subtests, which assess both gross motor (subtests: standing long jump, agility run, target throwing, chair push-ups, face down to standing) and fine motor (subtests: tapping board, static balance, bead stringing and hamstring stretch) ability. Scores for each of the subscales were standardized and an average of the standardized scores across the two ages calculated.

Contemporaneous measures (age 15)—At age 15, mothers of study members were asked to give a self-report rating of their own health and a proxy report rating of the Study member’s father health as being either very good, good, fair or poor. As there were few instances of fair or poor health, the health status of both parents was combined and dichotomized to create a *Parental health* measure. This measure identified when neither parent had very good health (females: n = 87, 26.1%; males: n = 90, 25.3%) versus those where at least one parent was reported to have very good health (females: n = 247, 74.0%; males: n = 266, 74.7%), with higher scores indicating poorer parental health.

Each Study member’s health status was also measured at age 15. Predicted maximal oxygen uptake (VO_{2max}) was included as an indicator of physical fitness. This score (measurement and correction details described elsewhere [31]) was standardized for the purposes of analysis. *General health* was measured by self-reports of general/overall health on a four point scale (range 1 poor – 4 very good). As few Study members reported poorer health status, responses to this question were dichotomized to give a measure of ‘very good’ health (females: n = 216, 58.2%; males: n = 226, 57.4%) compared to all other responses (‘good’, ‘not too good’ and ‘poor’). *BMI* scores (measurement described elsewhere [32]) were divided into normal weight versus overweight/obese (females: n = 49, 13.3%; males: n = 34, 8.6%) using established cut-off points for age 15 [33].

At age 15 Study members were asked how many hours they usually spent watching television on weekdays and at the weekend [34]. These measures were combined to give an estimate of weekly time spent *Television viewing* and standardized, with higher scores indicating greater time spent watching television. Measures of tobacco smoking and alcohol use at age 15 were

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categorized to give a *Tobacco smoking* measure that identified Study members who 'usually smoke one or more times a week' (females: n = 84, 22.7%; males: n = 57, 14.4%)[35], and an *Alcohol use* measure that identified whether Study members reported having experienced being drunk at least once by age 15 (females: n = 128, 34.8%; males: n = 130, 32.8%).[36]

Statistical analyses

Intercorrelation between independent variables was estimated using Spearman correlation coefficients. Univariate and multivariate logistic regression was used to examine associations between childhood and adolescent measures and patterns of participation between ages 15 and 18 years. Data were divided into strata that compared those patterns of participation that, from a public health perspective, were least desirable with the more desirable, using a continuation ratio model [37]. First, those with Persistent Inactivity were compared to those reporting Persistent Activity, Declining Participation and Increasing Participation. Second, the Declining participation group was compared with those reporting Persistent Activity and Increasing Participation. Third, the most desirable group (again from a public health perspective), those reporting Persistent Activity, was compared to all less desirable patterns (i.e. those reporting Persistent Inactivity, Declining Participation and Increasing Participation). Sex was included in all models to account for differences between males and females in proportions reporting each pattern of participation. Additionally, we tested for sex interaction effects in the univariate associations and none were found. All analyses were conducted in Intercooled Stata 8.0 (STATA Corporation, Texas, 2003).

Results

Descriptive statistics for continuous independent variables are shown in Table 1 and spearman correlation coefficients for all independent variables in Table 2.

Results from the univariate analyses for the three groups are shown in Table 3. In terms of childhood risk factors, those with lower family SES, lower Moos Family Active-Recreation Orientation scale scores and who participated in fewer activities at home during childhood were more likely to be in the Persistent Inactivity group during adolescence. The likelihood of being in the Persistent Inactivity groups was higher among those with poorer general and parental health, lower cardiorespiratory fitness and higher rates of television watching at age 15. Participation in fewer activities at home during childhood was also associated with Declining Participation. No contemporaneous factors were associated with this pattern of participation.

Those with higher family SES, higher scores on the Moos Family Active-Recreation Orientation scale, participation in more activities at home during childhood and better childhood motor ability were more likely to show later Persistent Activity than those with less supportive family environments. Subsequent analyses also suggest that the gross motor components (Odds ratio: 1.41, 95% Confidence Interval: 1.12–1.79) of the overall motor score were more strongly related to later Persistent Activity gross than the fine motor scores (Odds ratio: 1.12, 95% Confidence Interval: 0.89–1.41). Additionally, those with better parental and general health, better cardiorespiratory fitness and lower rates of television watching at age 15 were more likely to display Persistent Activity during adolescence.

Multivariate logistic regressions were carried out separately for the three patterns of activity and included those variables where $p<0.20$ in the univariate analyses [38]. As shown in Table 4, after controlling for all other factors in the model, those with lower scores on the Moos Family Active-Recreation Orientation scale during childhood, and poorer contemporaneous cardiorespiratory fitness and general health were more likely to be in the Persistent Inactivity group. In the multivariate model for Declining Participation, one childhood factor remained

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marginally significant (p = 0.05), with those reporting fewer home activities during childhood being more likely to be in this group than those with greater opportunities to be active at home. In contrast, while no childhood factors were associated with Persistent Activity, there were significant associations with two contemporaneous factors in the multivariate models. Those with better cardiorespiratory fitness and watched less television were more likely to be in the Persistent Activity group (albeit at borderline significance in the latter case, p = 0.05).

Discussion

Three patterns of physical activity during adolescence were examined: Persistent Inactivity, Persistent Activity and Declining Participation. The childhood and contemporaneous (age 15) factors associated with these patterns in univariate and multivariate analyses are now discussed, beginning with the most 'at risk' group, those with Persistent Inactivity between ages 15 and 18 years.

Consistent with previous longitudinal studies [4,6], Persistent Inactivity was associated with lower family SES. A unique aspect of the current study is the inclusion of a measure of SES from birth to adolescence, as it is likely to be a better reflection of the cumulative experience of socioeconomic disadvantage over time than a single measurement [26]. Persistent Inactivity was also associated with lower family active-recreation orientation during childhood, even after other factors were controlled for. While this is consistent with other studies that have found associations between activity and parental modelling or support for participation [6,7], the current measure reflects a broader family dynamic where regular participation in social and recreational activities is part of the normal family environment. A third measure of family environment during childhood, activities at home, was also associated with later activity. Persistent Inactivity was associated with less participation in activities at home, such as climbing fences/trees, playing on swings, playing in paddling pools, riding bikes and playing ball games. This is in contrast to two previous longitudinal studies [7,8] where no associations were reported, and mixed evidence from cross-sectional studies [2]. Some of contrast observed here may reflect differences in the measures of home environment, with the current study examining opportunities at younger ages and over multiple assessments.

The association between family and home environments and Persistent Inactivity also continued with the contemporaneous measures examined. Persistent Inactivity was more likely among Study members whose parents had poorer health (as reported by the mother of Study members). Parental health has been a relatively unexplored influence on physical activity until now, but is potentially important in determining a parent's ability to either model or provide support for participation in physical activity. The observed association between television viewing and Persistent Inactivity was consistent with previous research [6]. Although television viewing has not been traditionally considered a 'family environment' measure, if it is assumed that the majority of television viewing occurs at home, family norms and rules regarding appropriate viewing times are likely to be an important influence on this behaviour. Finally, Persistent Inactivity was also associated with contemporaneous measures of health status. Consistent with findings from previous research [9,10], Study members with Persistent Inactivity were more likely to have poorer self-reported health and lower cardiorespiratory fitness.

The associations found for the other two patterns of physical activity participation (Declining participation and Persistent Activity) shared several commonalities with those for Persistent Inactivity. Declining Participation in physical activity was associated with participation in fewer activities at home during childhood. An additional finding, unique to the pattern of Declining Participation, was a significant association (albeit marginal) with activities at home, after controlling for other factors in the multivariate model.

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The univariate findings for the Persistent Activity group mirrored those described for the Persistent Inactivity group, with one exception. Persistent Activity was more likely among Study members with better childhood motor ability. This is consistent with some previous work examining the influence of childhood motor ability on physical activity during adolescence [12], though in contrast with other findings [13]. It is possible that having better motor skills, either through opportunities to practice or via genetic determined advantage, facilitates enjoyment and mastery of physically active tasks. The current study suggests that the gross motor components of the Basic Motor Ability Test may be of greater importance than fine motor components in determining later physical activity participation. It may be that skills related to 'large body' movement are of greater relevance for ongoing physical activity participation than fine motor abilities.

The current study did not find evidence for associations between patterns of physical activity and BMI, tobacco smoking, alcohol use, psychiatric disorder or IQ. This is consistent with previous research regarding alcohol use [10] and with the mixed evidence available for BMI [6,10], tobacco smoking [6,10] and psychiatric disorder [15,16]. In terms of IQ, this was the first study to exploring the potential of IQ as a possible underlying factor in reported associations between type of school attended (academic versus vocational) and patterns of physical activity participation [10]. Given the lack of association reported here, it suggests that there may be other aspects of academic achievement other than intellectual ability that are underpinning previously observed relationships with physical activity.

The life course epidemiology perspective examines the long-term effects of physical and social exposures that have been encountered during the life course [3,39]. In the current study several factors from early life were associated with multiple patterns of adolescent physical activity participation, with implications for policy and practice focusing on early intervention programs in the family and home environment. Factors from childhood associated with later adolescent physical activity included family SES, family active recreation orientation and home activities. Thus, future research might consider the potential of interventions targeting families with low SES, encouraging family-wide involvement in physical recreation, and assessing the provision of home-based opportunities for active outdoor play.

There are limitations in this study that should be borne in mind when interpreting the longitudinal findings. This study examined individuals who were adolescents during the late 1980s/early 1990's, and the context for physical activity is likely to have changed for contemporary adolescents. Another potential issue is the impact of data loss resulting from measurement at multiple ages. In the current study those with complete physical activity data at ages 15 and 18 had higher SES, family active recreation orientation, motor scores and were more likely to be non-smokers than those with incomplete data. As these factors tend to be associated with higher physical activity participation, the estimates of association with physical activity participation may be conservative. Data loss also occurred in the multivariate analysis due to missing values in the independent variables, however, no substantial alterations in the results were found when multivariate analyses were re-run with imputed missing values (analysis not shown). Finally, given the self-report nature of many of the measures (e.g. physical activity, general health) these findings need to be replicated using more extensive, objective measurement techniques.

Other suggestions for future research include further exploration of opportunities to be active within the home and neighbourhood environment. There have been significant advances in techniques for describing neighbourhood environments [40], yet few have been applied in long-term longitudinal studies. Also of interest is if the childhood and adolescence factors identified here continue to be associated with physical activity into adulthood.

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Strengths of this study included the ability to examine a) childhood and contemporaneous correlates of adolescent physical activity in the same individuals, b) patterns of participation over time as an outcome (rather than at one point in time), and c) the associations between a range of factors, some novel, and physical activity patterns during adolescence. While observational longitudinal studies do not provide definitive evidence of causal pathways, studies such as this can provide unique insights about associations after controlling for other factors and for hypothesis generation for further research. The findings highlight several factors from the family and home environment of potential importance in early intervention programs to support adolescent participation in physical activity.

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Table 1

Descriptive statistics for unstandardised continuous childhood and adolescent measures and physical activity

	Females					Males				
Variables	**n**	**Mean**	**Std dev**	**Min**	**Max**	**n**	**Mean**	**Std dev**	**Min**	**Max**
Childhood measures										
Socioeconomic status[a]	371	3.14	1.09	1.00	5.50	398	3.17	1.10	1.00	6.00
Family active-recreation orientation[b]	358	6.17	1.79	1.00	9.00	388	6.04	1.82	0.50	9.00
Home activities[c]	338	12.62	2.37	5.00	16.00	366	12.63	2.11	4.00	16.00
Childhood motor ability[d]	336	−0.07	0.96	−8.21	2.15	374	0.12	0.87	−4.42	2.39
IQ	362	107.25	12.83	70.00	140.50	395	108.69	13.14	74.75	136.50
Contemporaneous measures										
Predicted VO_2max	365	44.08	4.42	34.20	61.70	397	49.24	5.73	36.50	71.30
Television viewing (hours/week)	349	22.23	11.84	0.00	67.00	378	25.40	12.64	2.00	86.00
Physical activity[e]										
Age 15	401	7.56	5.90	0.00	36.02	431	11.28	8.18	0.00	41.27
Age 18	421	4.09	4.54	0.00	30.10	449	7.32	7.78	0.00	53.08

[a] SES score on scale of 1–6 with higher scores = lower SES

[b] Scores on scale from 0–9 with higher scores = higher family active-recreation orientation

[c] Score out of a total of 16 available activities

[d] Average of standardized motor scores from ages 7 and 9 years

[e] Average hours per week

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Table 2

Spearman correlation coefficients for all childhood and adolescent predictor variables

	Variables														
Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1 Persistent Inactivity	1.00														
2 Declining Participation	-	1.00													
3 Persistent Activity	-	-	1.00												
4 Socioeconomic status	0.08*	−0.05	−0.07	1.00											
5 Family Act. Rec. Orient.	−0.12*	0.04	0.11*	−0.26*	1.00										
6 Home activities	−0.07	−0.04	0.14*	−0.14*	0.20*	1.00									
7 Childhood motor ability	−0.06	−0.002	0.12*	−0.12*	0.13*	0.12*	1.00								
8 IQ	−0.01	−0.03	0.07*	−0.41*	0.17*	0.07*	0.32*	1.00							
9 Psychiatric disorder	0.01	−0.03	0.02	0.15*	−0.02	−0.02	−0.07*	−0.14*	1.00						
10 Parent health	0.09*	0.01	−0.09*	0.15*	−0.13*	0.05	−0.03	−0.03	0.05	1.00					
11 Body mass index	0.01	0.002	−0.05	0.12*	−0.04	−0.02	−0.11*	−0.06	0.11*	0.05	1.00				
12 Predicted VO_2max	−0.23*	0.05	0.22*	−0.05	0.08*	0.05	0.17*	0.10*	−0.01	0.06	−0.24*	1.00			
13 General health	0.11*	−0.02	−0.11*	0.10*	−0.04	−0.06	−0.08*	−0.07*	0.16*	0.09*	0.15*	−0.17*	1.00		
14 Television viewing	0.07	−0.01	−0.10*	0.29*	−0.15*	−0.07	−0.08*	−0.26*	0.06	0.18*	0.12*	−0.03	0.11*	1.00	
15 Tobacco smoking	0.04	0.03	−0.04	0.14*	0.06*	−0.02	−0.001	−0.13*	0.27*	−0.03	0.03	−0.07*	0.14*	−0.05	1.00
16 Alcohol use	−0.01	0.04	−0.04	0.06	0.13*	0.02	0.10*	−0.01	0.19*	−0.06	0.02	0.01	0.05	−0.02	0.41*

*Correlation is significant at the 0.05 level

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Table 3

Univariate associations between predictor variables and patterns of physical activity participation during adolescence

	Persistent Inactivity vs PA, DP, IP				Declining Participation vs PA, IP				Persistent Activity vs DP, IP, PI			
Variables	**n**	**OR**	**95% CI**	**p-value**	**n**	**OR**	**95% CI**	**p-value**	**n**	**OR**	**95% CI**	**p-value**
Childhood measures												
Socioeconomic status[a]	769	1.19	1.04–1.37	0.01	461	1.01	0.85–1.19	0.94	769	0.85	0.72–1.00	<0.05
Family Active Rec. Orient.[b]	746	0.74	0.63–0.87	<0.01	453	0.90	0.74–1.11	0.33	746	1.41	1.16–1.75	<0.01
Home activities[c]	704	0.85	0.73–1.00	<0.05	428	0.74	0.60–0.92	<0.01	704	1.49	1.20–1.84	<0.01
Childhood motor ability[d]	710	0.90	0.76–1.06	0.21	435	0.92	0.73–1.17	0.51	710	1.30	1.04–1.61	0.02
IQ[e]	757	1.01	0.87–1.18	0.89	458	0.92	0.74–1.11	0.37	757	1.16	0.97–1.39	0.11
Psychiatric disorder												
any disorder	770	1.07	0.79–1.45	0.67	461	0.88	0.60–1.29	0.51	770	1.07	0.72–1.53	0.72
no disorder		1.00				1.00				1.00		
Contemporaneous measures												
Parent health												
not very good	690	1.54	1.08–2.19	0.02	426	1.59	0.98–2.56	0.06	690	0.58	0.37–0.92	0.02
very good		1.00				1.00				1.00		
Body mass index												
overweight/obese	765	0.98	0.61–1.57	0.94	458	1.05	0.57–1.95	0.87	765	0.73	0.39–1.38	0.33
normal weight		1.00				1.00				1.00		
Predicted VO_2max[f]	762	0.67	0.56–0.81	<0.01	457	0.85	0.69–1.03	0.10	762	1.53	1.26–1.84	<0.01
General health												
not very good	765	1.63	1.20–2.21	<0.01	457	1.37	0.94–2.00	0.10	765	0.57	0.40–0.81	<0.01
very good		1.00				1.00				1.00		
Television viewing[g]	727	1.20	1.03–1.39	0.02	440	1.13	0.93–1.37	0.23	727	0.70	0.57–0.85	<0.01
Tobacco smoking												
smoker	766	1.11	0.76–1.62	0.59	458	1.47	0.88–2.47	0.14	766	0.87	0.53–1.41	0.56
non-smoker		1.00				1.00				1.00		
Alcohol use												
been drunk	764	0.94	0.69–1.30	0.73	458	1.23	0.82–1.83	0.32	764	0.83	0.57–1.21	0.34
never been drunk		1.00				1.00				1.00		

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Key

PI: Persistent Inactivity

PA: Persistent Activity

DP: Declining Participation

IP: Increasing Participation

CI: Confidence Interval

OR: Odds Ratio

All analyses controlled for sex

Table notes: Reference groups

[a] Higher SES

[b] Lower Family Active Recreation Orientation scores

[c] Fewer Home Activities

[d] Lower motor ability scores

[e] Higher IQ scores

[f] Lower Predicted VO_2max scores

[g] Greater time spent Television viewing

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Table 4

Multivariate associations between predictor variables and patterns of physical activity participation during adolescence

Variables	Persistent Inactivity vs PA, DP, IP (n = 591)			Declining Participation vs PA, IP (n = 389)			Persistent Activity vs DP, IP, PI (n = 569)		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Childhood measures									
Socioeconomic status [a]	1.01	0.85–1.21	0.87	-	-	-	1.06	0.85–1.33	0.60
Family Active Rec. Orient.[b]	0.78	0.64–0.95	0.01	-	-	-	1.20	0.94–1.53	0.15
Home activities[c]	0.94	0.78–1.14	0.54	0.80	0.63–1.00	0.05	1.24	0.98–1.57	0.08
Childhood motor ability[d]	-	-	-	-	-	-	1.17	0.90–1.52	0.24
IQ[e]	-	-	-	-	-	-	1.03	0.80–1.32	0.84
Contemporaneous measures									
Parent health									
not very good	1.46	0.97–2.18	0.07	1.43	0.87–2.36	0.16	0.60	0.35–1.02	0.06
very good	1.00			1.00			1.00		
VO_2max[f]	0.77	0.62–0.96	0.02	0.92	0.74–1.14	0.45	1.40	1.13–1.75	<0.01
General health									
not very good	1.50	1.04–2.16	0.03	1.26	0.82–1.93	0.29	0.72	0.47–1.11	0.13
very good	1.00			1.00			1.00		
Television viewing[g]	1.05	0.87–1.27	0.59	-	-	-	0.78	0.61–1.00	0.05
Tobacco smoking									
smoker	-	-	-	1.35	0.74–2.45	0.33	-	-	-
non-smoker	-	-	-	1.00			-	-	-

Key

PI: Persistent Inactivity

PA: Persistent Activity

DP: Declining Participation

IP: Increasing Participation

CI: Confidence Interval

OR: Odds Ratio n: number remaining in each multivariate model

All analyses controlled for sex

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Table notes: Reference groups

[a] Higher SES

[b] Lower Family Active Recreation Orientation scores

[c] Fewer Home Activities

[d] Lower motor ability scores

[e] Higher IQ scores

[f] Lower Predicted VO_2max scores

[g] Greater time spent Television viewing