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Specific Types of Family Support and Adolescent Non-school Physical Activity Levels

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Abstract

In a sample of 291 adolescents (mean age 13 yr), seven psychosocial factors, including family support, were examined in relation to accelerometry-derived physical activity (PA) measured after school and during the weekend. Gender-specific stepwise linear regression analyses determined which combinations of factors explained the variance in non-school moderate to vigorous PA and non-school total PA after adjusting for % BF, age, and maturity ($p \leq 0.05$). Being praised by a family member and % BF explained 13% of the variance in female non-school MVPA, while being praised and maturity explained 13% of the variance in non-school total PA. Having a family member watch him participate, % BF, and age explained 11.5% of the variance in male non-school MVPA, while having a family member participate with him explained 6.4% of the variance in non-school total PA. Despite adolescents' growing independence, family support continues to influence PA levels.

Keywords

adolescence; adiposity; psychosocial

Adolescent physical activity (PA) is a complex behavior that has been shown to be influenced by multiple environmental, sociocultural, psychological, and biological factors. A recent review of environmental correlates found support from significant others, mother's education level, family income, school attendance, and low neighborhood crime incidence to be positively associated with adolescent PA levels (12). A systematic review of studies published between January 1999 and January 2005 found that attitude, self-efficacy, goal orientation/motivation, physical education/school sports participation, family influences, and

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friend support were positively correlated with adolescent PA levels (35). In a Midwestern sample of adolescent males and females, family support was the most significant and consistent factor associated with MVPA (38). The relationship between MVPA and family support was significant when MVPA was measured both subjectively (i.e., Physical Activity Questionnaire for Adolescents, PAQ-A) and objectively (i.e., Actigraph 7164 accelerometer). In a different study examining social support for PA in Midwestern rural middle school students, PA was assessed in three ways: total minutes of physical activity; number of days per week with at least one hour of MVPA; and self-defined physical activity (28). Regardless of the way PA was assessed, adolescents identified family members and the form of support they receive from family as important factors related to their PA involvement (28). A meta-analysis of parent socialization on child and adolescent PA revealed that children have a relative risk of being inactive that is 1.4 times greater if parents do not engage in socialization behaviors (e.g., encouragement, modeling, instrumental support) than when parents do engage in such behaviors (27). Furthermore, the odds of being an active child or adolescent were two times greater when parents were supportive rather than unsupportive.

Despite the fact that adolescents spend a large portion of their day at school, research suggests that adolescents accumulate greater activity levels outside the school environment (6, 17, 21, 36). Today, many adolescents travel to school by car or bus, spend less time in physical education class and recess, and often lack suitable places for outdoor activity (3, 19). A study examining PA levels of school-aged children in both the school and out-of-school environments showed that more steps were taken outside of the school environment (52.4%) than during the school day (47.6%). Furthermore, when compared to the least active group, the most active children obtained a significantly higher proportion of their daily step counts outside the school day (6). Similarly, research has found that adolescents' sport and exercise participation tend to peak in the early evening hours (10).

Although, research indicates that family support, among other factors, is positively associated with PA levels in the adolescent population (9, 28, 38, 39), the specific types of family support promoting adolescent PA are not well defined. The purpose of this paper was to examine the association of family support among other psychosocial factors thought to be associated with adolescent non-school PA. In addition, we uniquely examined five types of family support (i.e., encouragement, praise, transportation, PA participation with the adolescent, and watching the adolescent participate in PA) and adolescent non-school PA levels. The non-school time period was selected because it is a period of the day when adolescents are likely to have more autonomy in choosing to be active or not. Given recent evidence that levels of adiposity are predictive of adolescents' PA levels (16), a secondary study purpose was to examine if adiposity impacts the relationship of family support and non-school PA levels.

Method

Participants

The current study uses a subsample of 291 adolescents participating in the Iowa Bone Development Study (IBDS) who completed a questionnaire of the predisposing, reinforcing and enabling factors influencing physical activity. The IBDS is a longitudinal study of 471 participants aimed at understanding bone health from childhood to young adulthood. Study participants were recruited between 1998 and 2001 from a large birth cohort of Midwestern children (n = 890) that were participating in the Iowa Fluoride Study. Participants in this current study were almost all (96%) white; nearly two-thirds of the participants' parents had some level of college education and a family income (at recruitment) of $20,000 per year or greater (15).

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Procedures

All procedures were approved by the University of Iowa Committee for the Protection of Human Subjects. Assent was obtained from participants and informed consent was obtained from each participant's guardian(s). Participants wore an activity monitor at the hip via a clip or elastic belt up to five consecutive days (Wednesday through Sunday). Participants also completed a daily log of their monitor wear and questionnaires at their regularly scheduled clinic visit as part of the IBDS, which also included a DXA exam to measure body composition and anthropometry to estimate somatic maturity.

Instruments

Physical Activity Measures—This study used the Actigraph LLC (Model 7164) to measure non-school moderate and vigorous physical activity (MVPA) and non-school total activity (TA). There is general agreement that the Actigraph provides a valid and reliable measure of adolescent physical activity (10). Minute-by-minute movement counts were recorded. Non-school total activity was constructed as the sum of movement counts after 3 PM on weekdays and all day on weekends divided by the minutes of wear time (after 3 PM on weekdays and all day on weekends). Non-school daily minutes spent in MVPA were derived using the cut-point threshold of 3000 accelerometer movement counts per minute (ct·min^{-1}). This cut point was first proposed by Treuth for the Trial of Activity for Adolescent Girls (TAAG) study (34). In laboratory- and field-based studies, this cut point has been associated with MVPA at normal walking speeds in children and adolescents (13, 34). Percent of the non-school day spent in MVPA was derived by dividing the number of counts above the MVPA threshold by the non-school worn time.

Choices Questionnaire Guided by the Youth Physical Activity Promotion (YPAP) Model—A unique 26-item Choices Questionnaire was developed for use in this study to measure the predisposing, reinforcing and enabling factors suggested by the Youth Physical Activity Promotion Model (YPAP; 37). Although not in this format or within a single study, all questions included in this instrument have been used to measure these factors in previous studies (2, 7, 8, 20, 23, 26, 33). Prior to data collection, a pilot study conducted with 52 adolescents examined the internal consistency of these questions and provided further support for this questionnaire. Four questions from a previously developed measure (33) assessed self-efficacy to overcome barriers to physical activity, yielding a Cronbach's alpha of 0.76 in our pilot study. Enjoyment of physical activity was measured using seven negatively-worded questions from the Physical Activity Enjoyment Scale (PACES), which was adapted for adolescents and reported elsewhere (8, 24). Cronbach's alpha was 0.89 for these questions. The family and friend support questions were initially developed and used as part of the Amherst Study (26). Cronbach's alpha for these scales was 0.80 and 0.85, respectively. Questions about the perceived school climate scale were adapted from a scale used in the TAAG study. Cronbach's alpha for this scale was 0.85. Questions about the perceived access and safety of the participants' home and neighborhood environments were adopted from well-known scales and have previously been used with adolescents (23). Cronbach's alpha of these scales was 0.47 and 0.61, respectively.

Co-variates—At the clinical examination, the Hologic QDR 4500A Dual Energy X-ray Absorptiometry (DXA) (Delphi upgrade) with software version 12.3 and fan-beam mode was used to measure body composition. Quality control DXA scans were performed daily using the Hologic phantom. Fat mass (kg) was derived from the DXA scan images. Percent body fat (% BF) was calculated as fat mass (kg) divided by body weight (kg). Also at the clinical visit, research nurses trained in anthropometry measured the participants' height, weight, and sitting height. Standing and sitting height were used to calculate maturity offset (+ year from peak height velocity) by means of predictive equations established by Mirwald

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and colleagues (22). The equations were developed in white Canadian children and adolescents and they have been cross-validated in another Canadian sample and a Flemish sample (22).

Statistical Analysis

Gender-specific analyses were conducted using SAS version 9.2 (32). Descriptive analyses, including frequency distributions and estimation of summary descriptive measures, were conducted. Based on these analyses, enjoyment of physical activity, the perceived school climate, and the perceived access and safety scores were positively skewed and thus, dichotomized before investigating them as possible predictors of regression models (the enjoyment of physical activity scores as < 4.8 vs. ≥ 4.8, perceived school climate as < 4.5 vs. ≥ 4.5, and perceived access and safety scores as < 5 vs. ≥ 5). Boys and girls were compared using t-tests and non-parametric Kruskal-Wallis tests when appropriate (i.e., for skewed scales mentioned above). Non-school MVPA and total non-school PA had high value outliers. Thus, Spearman rank correlations coefficients were examined among the study variables. This method of correlation analysis was selected as it did not make any assumptions about the distribution from which the sample was drawn and was less likely to inflate the relationships. Stepwise linear regression analyses were conducted to determine which combinations of the study variables (i.e., psychosocial factors and possible co-variates) explained the variance in the two dependent variables: non-school MVPA or non-school total PA. Analysis of residuals was performed to confirm model assumptions. The same regression analyses were repeated for the set of five questions that formed the family support index. Maturity offset, age, and % BF were considered as possible co-variates and were retained in the final regression models when significant. % BF was dichotomized into obese (high % BF; ≥ 25% for males and ≥ 32% for females) and not obese (low %BF; < 25% for males and < 32% for females) according to national norms for separate sets of models. To examine if % BF modified the association between adolescent PA and family support, regression models were built to account for the possible interaction effect. Post hoc power analysis using the *G*Power 3.1 Program* (11) showed that after including statistically significant predictors, our sample sizes would be adequate to test for % BF and family support (or significant family support items) interaction effect that increases coefficient of determination (R^2) by 1%; power > 90% for $\alpha \leq 0.05$ and > 80% for $\alpha \leq 0.025$ (reduced α to adjust for multiple models). For all regression models, the p-value was set at ≤ 0.05.

Results

Descriptive Analysis

The characteristics of the 291 participants (144 females, 147 males) are provided in Table 1. The age of female adolescent participants ranged from 12.5 to 14.4 years, with a mean age of 13.0 years (*SD* = .27). For females, % BF ranged from 15.2 to 46.0 with a mean % BF of 26.0 (*SD* = 7.33). The age of male adolescent participants ranged from 12.5 to 14.4 years, with a mean age of 13.0 years (*SD* = .26). For males, % BF ranged from 8.3 to 45.7, with a mean % BF of 22.0 (*SD* = 9.06). Both males and females were more active during non-school time than during school time (see Table 1). The males spent a greater percentage of time in non-school MVPA and non-school total PA (see Table 1) than females. The characteristics for the five specific types of family support are also provided in Table 1.

Bi-variate Associations Among Study Variables

The bi-variate spearman rank correlation coefficients showed that both female non-school MVPA and non-school total PA were significantly and positively associated with family support, self-efficacy, enjoyment, and perceived access. Additionally, perceived safety was

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significantly and positively associated with non-school MVPA. Family support demonstrated the strongest association for females non-school MVPA: r = 0.35 and non-school total PA: r = 0.40 (see Table 2). In males, Spearman rank correlation coefficients were significant and positive between non-school MVPA and non-school total PA and family support, friend support, and self-efficacy. Additionally, perceived access was significantly and positively associated with non-school MVPA. Similar to females, family support demonstrated the strongest association for males (non-school MVPA: r = 0.30; non-school total PA: r = 0.27; see Table 2).

Female % BF was significantly and negatively associated with self-efficacy, enjoyment, and school climate (r = −0.27, −0.20, −0.18, respectively), while male % BF was significantly and negatively associated with family support, self-efficacy, and enjoyment (r = −0.24, −0.28, −0.38, respectively; see Table 2).

Regression Analysis for Non-school Physical Activity

Maturity, age, and % BF were included as possible co-variates in regression analysis, but retained in final models only when significant ($p \leq .05$). For females, maturity and/or % BF remained as significant co-variates, while age and/or % BF remained significant co-variates for adolescent males.

A regression model testing the seven psychosocial variables and female non-school MVPA indicated family support was the only psychosocial variable that predicted non-school MVPA (see Table 3, Model 1), explaining 8.1% of the variance. % BF explained an additional 5.3% of the variance.

For males' non-school MVPA, family support was also the only psychosocial variable that entered the regression model, explaining 5.5% of the variance (see Table 3, Model 1). % BF and centered age were significant co-variates in this model. Collectively, % BF, centered age, and family support explained a total of 11.5% of the variance in male non-school MVPA (see Table 3, Model 1). For both males and females, results were similar for non-school total PA (see Table 3, Model 2).

Regression models were also built to examine the impact of the five specific types of support offered by family members (i.e., encouragement, praise, transportation, participating with the adolescent, and watching the adolescent). 'Being praised' by a family member explained 7% of the variance in adolescent female non-school MVPA (see Table 4, Model 1). % BF explained an additional 5.9% the variance. Having a family member 'watch' him participate combined with % BF and centered age explained 11.5% of the variance in adolescent male non- school MVPA (see Table 4, Model 1). Again, results were similar for non-school total PA for males and females. The interaction of adiposity and family support was not significant.

Discussion

Given the health consequences of inactivity and the large proportion of inactive adolescents, there is a need for increased understanding of the factors that promote physical activity within the adolescent population. While previous research has investigated the amount of support family members provide during adolescents' total PA and total MVPA, this study specifically examines levels of PA during the hours after school and on the weekends, time periods in which adolescents are more likely to have choice in their participation of activities and therefore a period of time when behavioral interventions are likely to be effective and necessary. Although many of the psychosocial variables examined in our study were significantly associated with PA outcomes in our bi-variate analysis, family support

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stood out as the most important variable for both males and females in multivariate analysis. It was, in fact, the only significant psychosocial variable in the multivariate analysis.

While growth and developmental research suggests that extra-familial relationships influence adolescents' behaviors and need for independence to a greater extent than familial relationships (4, 5, 29), the results of this study suggest that support from family members is associated with adolescents' PA levels following the school day and on the weekends. For females, being told they were doing well in PA or sport (i.e., praise) explained the most variance in their levels of non-school PA. For males, having a family member watch his physical activity or sport performance explained the most variance in levels of non-school MVPA, while having a family member participate in a physical activity or sport with him accounted for the most variance in their non-school total PA.

Given the heightened awareness of adolescent obesity rates, its associations with negative health outcomes, and the possibility that obesity may be a determinant of physical inactivity, adiposity was also considered in our analysis. % BF was an important predictor of non-school PA. More specifically, lower social support and higher adiposity were independently associated with PA outcomes. However, models do not show evidence of significant interaction effect, thus we did not find that adiposity modifies the PA and social support association.

Epidemiological studies of PA have consistently demonstrated that PA declines as children and adolescents age (25, 31). Furthermore, research suggests that, regardless of age or biological growth, males are more active than females (14, 30). Since adolescent females mature an average of about two years earlier than males (18), making comparisons based on chronological age could be problematic. Therefore, in addition to age, we adjusted our regression models for maturity. The results of the present study suggest that maturity mattered more than age for adolescent females' but age was more important than maturity for males. Thus, less physically mature females and younger males, perceiving social support from family members, engaged in more PA than their older or more physically mature adolescent counterparts. Even though family support was found to be present regardless of maturity status or age, these results suggest that families would be most effective in helping their child maintain or increase physical activity levels during early adolescence.

Limitations of this study include inadequate representation of minorities and children from low SES households, due to the use of a Midwest, mostly rural, convenience sample. While a cross-sectional study design was useful in examining the associations among specific types of family support and adolescent physical activity, this design cannot be used infer causation.

Examining the specific type of family support contributing to adolescents' levels of physical activity provides insight to understanding what supportive behavior(s) family members can provide in an effort to promote physical activity among adolescent girls and boys. Parents can verbally praise their daughter's physical activity participation. For example, "I am proud of how hard you worked at soccer practice today. I can tell you are listening to your coach. Good job, keep it up!" Since boys reported that parental involvement was important to their own PA participation, parents can take their son to an activity space where they can practice the fundamentals of the sport/physical activity together.

In summary, our work suggests that the public health sector should continue to emphasize that family support is important for physical activity through the adolescent years. Family-based interventions should be developed and carried out through the adolescent years as adolescent females and males develop and maintain physical activity-related behaviors,

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attitudes, and beliefs within the family environment. Messages should be designed to encourage specific types of support that family members can provide to promote adolescent physical activity levels. Finally, dialogue within the public health sector should begin to address the implications of promoting specific types of family support regarding adolescent PA levels. Future research should explore the possible gendered discourse surrounding family support. Future studies should also examine who specifically provides a certain type of support to their daughter and/or son. While this study found that verbal praise was important for females' PA, it is possible that it was the only type of support available from family members; therefore, assuming that verbal praise is the best mode to support adolescent girls may be premature. Perhaps, if family members are encouraged to provide other types of support (e.g., involvement, watching, transporting) to their daughter/sister/granddaughter, etc., these factors may become relevant to females' PA participation, which in turn can help improve the PA levels of adolescent females, which is on the agenda of many public health endeavors.

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Table 1

Descriptive Statistics for Study Sample

	Female	N =144				Male	N = 147				
	Mean	**SD**	**Median**	**Min**	**Max**	**Mean**	**SD**	**Median**	**Min**	**Max**	**p**
Age (yr)	13.0	0.27	13.0	12.5	14.4	13.0	0.26	13.0	12.5	14.4	0.71[1]
Maturity offset (yr)	1.3	0.56	1.3	−0.2	2.5	−0.3	0.78	−0.4	−2.2	1.7	<0.0001[1]
% BF	25.9	7.33	24.3	15.2	45.9	22.0	9.06	19.8	8.3	45.7	<0.0001[1]
In-school MVPA (min)	12.7	10.62	10.3	0.00	57.7	20.7	15.94	17.3	0.00	90.7	<0.0001[1]
In-school total PA(ct/min)	192.0	91.46	180.8	28.3	574.6	238.1	109.50	218.5	67.2	694.6	<0.0001[1]
Non-school MVPA (min)	28.9	27.30	20.9	0.5	199.6	50.3	35.15	43.2	0.5	254.7	<0.0001[1]
Non-school total PA(ct/min)	518.1	246.09	483.1	157.9	2100.5	662.2	261.28	618.5	221.3	1926.9	<0.0001[1]
Family support	2.9	0.89	3.0	1.0	5.0	3.2	0.88	3.2	1.0	5.0	0.017[1]
Family do	2.4	1.17	3.0	1.0	5.0	2.8	1.21	3.0	1.0	5.0	0.0063[1]
Family encourage	3.2	1.19	3.0	1.0	5.0	3.6	1.19	4.0	1.0	5.0	0.0134[1]
Family praise	3.0	1.16	3.0	1.0	5.0	3.3	1.23	3.0	1.0	5.0	0.0137[1]
Family transport	3.3	1.36	4.0	1.0	5.0	3.3	1.37	3.0	1.0	5.0	0.8757[1]
Family watch	2.6	1.24	3.0	1.0	5.0	2.8	1.22	3.0	1.0	5.0	0.2054[1]
Friend support	3.2	0.97	3.0	1.0	5.0	3.2	0.95	3.3	1.0	5.0	0.1225[1]
Self-efficacy	3.9	0.83	4.0	1.0	5.0	3.9	0.74	4.0	1.0	5.0	0.0863[1]
Enjoyment	4.7	0.58	4.7	1.0	5.0	4.7	0.54	4.9	1.0	5.0	0.0124[2] 0.0005[2]
School climate	3.9	1.01	5.0	1.0	5.0	3.9	1.10	4.0	1.0	5.0	0.0083[2] 0.0073[2]
Perceived access	4.5	0.89	4.5	1.0	5.0	4.5	0.75	5.0	1.0	5.0	0.0265[2] 0.0241[2]
Perceived safety	4.6	0.82	5.0	1.0	5.0	4.6	0.78	5.0	1.0	5.0	0.5648[2] 0.5621[2]

Note. % BF = percentage of body fat. Non-school MVPA = mean daily moderate-to-vigorous physical activity after 3PM on weekdays and mean daily weekend physical activity (all day). Non-school total PA = mean daily total physical activity after 3 PM on weekdays and mean daily weekend physical activity (all day). Index response categories = (1) disagree a lot; (2) disagree a little; (3) neither agree or disagree; (4) agree a little; (5) agree a lot.

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Table 2

Spearman Correlation Coefficients among Study Variables and Adolescent Non-school Physical Activity

Female (N =144)							
	Self-efficacy	**Enjoyment**	**Family support**	**Friend support**	**School climate**	**Perceived access**	**Perceived safety**
Enjoyment	0.33**						
Family support	0.43**	0.24**					
Friend support	0.34**	0.25**	0.52**				
School climate	0.20*	0.16	0.21*	0.13			
Perceived access	0.30**	0.12	0.17*	0.01	0.01		
Perceived safety	0.20*	0.16	0.06	0.13	0.04	0.27**	
% BF	−0.27**	−0.20*	−0.13	−0.14	−0.18*	−0.10	−0.07
Non-school MVPA	0.22**	0.18*	0.35**	0.12	0.09	0.17*	0.20*
Non-school total PA	0.25**	0.19*	0.40**	0.08	0.10	0.19*	0.13
Male (N =147)							
	Self-efficacy	Enjoyment	Family support	Friend support	School climate	Perceived access	Perceived safety
Enjoyment	0.46**						
Family support	0.23**	0.19*					
Friend support	0.22**	0.12	0.61*				
School climate	0.07	0.14	0.10	0.13			
Perceived access	0.19*	0.14	0.14	0.17*	0.14		
Perceived safety	0.20*	0.13	0.14	0.17*	0.00	0.26**	
% BF	−0.28**	−0.38**	−0.24**	−0.15	−0.07	−0.07	−0.03
Non-school MVPA	0.20*	0.07	0.30**	0.20*	0.05	0.20*	0.09
Non-school total PA	0.18*	0.06	0.27**	0.22**	−0.06	0.14*	0.11

Note.

* $p < .05$,

** $p < .01$

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Table 3

Stepwise Regression with Non-school Physical Activity as Dependent Variable and Co-variates

	Dependent	Variable	B	SE	p	Partial R^2	Total R^2
Female							
Model 1	Non-school MVPA	% BF	−0.86	0.29	0.004	0.053	0.134
		Family support	7.93	2.41	0.001	0.081	
Model 2	Non-school Total	Maturity offset	−96.37	34.98	0.006	0.048	0.116
		Family support	68.33	21.89	0.002	0.069	
Male							
Model 1	Non-school MVPA	% BF	−0.74	0.32	0.02	0.029	0.115
		Centered age	−23.35	10.59	0.03	0.030	
		Family support	7.25	3.25	0.03	0.055	
Model 2	Non-school Total	% BF	−4.53	2.37	0.06	0.023	0.103
		Centered age	−161.68	79.22	0.04	0.023	
		Family support	57.79	24.29	0.019	0.058	

Note. % BF = percentage of body fat. In all models only significant co-variates at $p \leq 0.05$ were retained. Female Models considered % BF, maturation offset, Family support x % BF. Male Models considered % BF, centered age, Family support x % BF.

Table 4

Stepwise Regression with Non-school Physical Activity as Dependent Variable and Specific Family Index Items

	Dependent	Variable	B	SE	p	Partial R^2	Total R^2
Female							
Model 1	Non-school MVPA	% BF	-0.90	0.29	0.002	0.059	0.129
		Family praise	5.80	1.85	0.002	0.070	
Model 2	Non-school Total	Maturity offset	−89.94	34.84	0.011	0.041	0.130
		Family praise	58.31	16.71	0.0006	0.089	
Male							
Model 1	Non-school MVPA	% BF	−0.72	0.32	0.025	0.028	0.115
		Centered age	−23.95	10.67	0.026	0.032	
		Family watch	5.61	2.36	0.019	0.055	
Model 2	Non-school Total	Family do	44.48	17.84	0.014	0.064	0.064

Note. **Family praise**= In the last 7 days, how often has a member of your household *told* you that you are doing well in a physical activity or sport?; **Family watch** = …*watched* you participate in a physical activity or sport?; **Family do** = … *done* a physical activity or played sports with you?

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