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Journal

Annals of Medicine, 57(1)

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Publication Date

2025-12-01

DOI

10.1080/07853890.2024.2447905

Peer reviewed

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ANNALS OF MEDICINE
2025, VOL. 57, NO. 1, 2447905
https://doi.org/10.1080/07853890.2024.2447905

RESEARCH ARTICLE

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Childhood predictors of high school sport participation and effects of participation on young adult activity and mental health

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ABSTRACT

Introduction: In the United States, sport is a common form of youth physical activity (PA) with demonstrated health benefits. However, limited longitudinal dataexists on the psychosocial determinants and consequences of youth sport participation. This study examined grade 6 (11–12-year-old) predictors of high school organized sport participation and effects of high school sport participation on age 26 behavior, mental health and wellbeing.

Methods: Structural equation models tested relationships using the National Institute for Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD). Half of the sample was male, and played organized sports at ages 15 and 18. Eighty percent of the sample was white.

Results: Grade 6 predictors of playing high school sport were: child enjoys PA, parent enjoys PA, parent feels physical education (PE) is important, and vigorous PA minutes/week. Playing sports at ages 15 and 18 was associated with better wellbeing, lower depression, increased sport and fitness activity participation. Enjoyment of PA was directly associated with fitness activities at age 26, more than a decade later. High school sport participation at both age 15 and 18 further mediated relationships between enjoyment with wellbeing and depression at age 26.

Discussion: Sport participation is a common accessible means of PA, and participating in sports in high school is associated with better mental health and PA outcomes at age 26. Fostering enjoyment of PA during childhood helps shape PA in early adulthood and adult mental health benefits derived from high school sport participation.

ARTICLE HISTORY
Received 15 January 2024
Revised 25 November 2024
Accepted 11 December 2024

KEYWORDS
Children; physical activity; wellbeing; social health; enjoyment; Child Behavior Checklist

Introduction

Behavioral health is of particular concern for young adults (ages 18–26). Approximately two-thirds of disabilities in this age group are associated with mental illness, as this is the typical age of onset for psychiatric and substance abuse disorders [1]. Compared to those aged 25–34, young adults are more likely to experience serious psychological distress and to think about, plan, and attempt suicide [2]; compared to adolescents who attempt suicide at similar rates, young adults are more likely to complete such attempts [1,3]. The Affordable Care Act (ACA) provides extended coverage for young adults, resulting in gains in healthcare coverage for this population [4]. However, this has not led to significant improvements in well-being for young adults, leading the Institute of Medicine and National Research Council to release a report titled Investing in the Health and Well-Being of Young Adults [1,5]. This report concluded that early adulthood is a crucial developmental period with long-lasting implications for future employment; career paths; economic security; and physical, psychological, and emotional well-being [1,5].

The benefits of physical activity (PA) participation include improved levels of inflammation, triglycerides, insulin sensitivity, HDL-C, endothelial function, adiposity, cardiovascular fitness, musculoskeletal health, mental adaptations, improved brain structure and function, cognition, and self-concept [6–10]. Meaningful PA,

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beyond minutes of exercise intensity, experienced with positive stimuli—such as enjoyment and feelings of connectedness—may also contribute to social adaptations such as increased productivity, social inclusion, and other mental and emotional wellbeing outcomes [11]. The desire for a more physically active population is apparent with the advent of federal PA guidelines and mass marketing PA promotion campaigns such as NFL Play60 and Let's Move! In the United States, organized youth sports are a primary means (along with physical education (PE) and dance) for youth to develop physical literacy [12], an important construct defined as the confidence, competence, knowledge, and motivation to be physically active throughout one's life [13]. Enjoyment of PA, an important construct for motivation, during childhood has been shown to predict future PA measures in a large US longitudinal dataset, compared to minutes of MVPA in PE which did not [14]. Previous research has also elucidated factors associated with a parent's attitudes toward PA on their child's participation in sports—such as emotional support, reinforcement, parental role modeling, the presence of PA equipment in the home, and financial support. These relationships were mediated by the child's enjoyment of the activity and the child's perceived behavioral control [15]. Meanwhile parents' value toward PE classes have been shown to be lower than their value toward sport as the parent can be more involved in sport and their child has more choice and develop a deeper understanding of the activity [16].

Unlike the obligatory participation approach utilized in most PE classes, sports require voluntary participation during leisure time. Understanding the longitudinal determinants of youth sport participation can inform efforts to increase and sustain it. To this end, a secondary analysis of the Michigan Study of Adolescent Life Transitions analyzed more than 600 respondents aged 12, 17, and 25 to determine whether sport participation during childhood predicted sport and physical fitness activities during early adulthood [17]. Sex and sport participation in adolescence significantly predicted sport participation in early adulthood. Alternatively, another study modeled the associations between childhood and early adolescence fitness and high school participation. Models showed performance on specific events predicted high school sport participation with some sex differences [18]. Meanwhile, youth with high levels of sports participation (≥4 h a week) are eight times more likely to participate in sports as young adults than youth reporting no time in competitive athletic or sports activities [17]. Other supported sport participation predictors include variables of parent factors, sex, race/ethnicity, and child behavior difficulty. One study showed that parental participation in interdependent activities—those that require one to function as part of a group or team—predicted their children's participation in these same types of activities [19].

The long-term psychosocial and health behavior consequences of youth sport participation are similarly of interest to parents, educators, and policymakers. The benefits of sport and PA participation is even more important for children with psychosocial and behavioral needs such as those with ADHD. A recent study found a sample of children who endorse ADHD in a large Midwestern city to have negligible sport participation rates compared to those in matched local and national groups [20]. Meanwhile, low sport participation has been shown to be associated with withdrawn and depressed symptoms21] and mental difficulties [22] in school-age children measured using the Child Behavior Checklist (CBCL). Given these findings it is important to understand sport participation's role in helping children who are struggling with emotion and/or behavior gain either minutes of health-promoting activity or psychosocial benefits from the activity.

PA guidelines state that children should be moderately to vigorously active for at least 60 min per day, and adults should accrue a combination of 150–300 min of moderate or 75–150 min of vigorous activity per week. Evidence for the benefits of this activity intensity include reduced anxiety and depressive symptoms, and improved cardiorespiratory and muscular fitness [9]. Sport participation is a major outlet for children to participate in health-promoting PA, though recent data shows that throughout the COVID-19 pandemic, between 2019 and 2022, regular team sport participation for youth 6–17 years of age has diminished by 6% [23].

The purpose of the current study is to build on the literature regarding longitudinal psychosocial antecedents and consequences of sport participation by testing previously untested predictors over a longer duration (dependent variables (DV)s at age 26). This study was guided by the following research questions: (1) What grade 3 (school ages 8–9) to grade 6 (school ages 11–12) factors (i.e. child enjoys PA, parent enjoys PA, parents feel PE is important, child device-assessed minutes of vigorous PA, child behavior problems, and previous sports experience) are associated with sports participation during ages 15 and 18? (2) What are the direct and indirect effects of grade 3 to grade 6 factors on young adults' behavioral, psychological, emotional, and social health? (3) What are the direct effects of

sport participation patterns at ages 15 and 18 on mental health and PA outcomes at age 26?

Methods

Ethical review and approval were waived by the University of Illinois Chicago institutional review board for this study due to secondary data analysis indicating no new data collected on human subjects – Protocol Number 2020-0788.

Participants

Further details on recruitment methods have been documented in previous publications [24]. Briefly, mothers were recruited during hospital visits at 10 locations in the United States during the years 1991–1994: Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Hickory, NC; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Seattle, WA; and Madison, WI. Inclusion criteria for mothers were: aged 18 or older, spoke English as her primary language, her family did not plan to move during the next three years, the baby was not from a multiple birth or released for adoption, mother and child lived within one hour of the research site, the neighborhood was not too dangerous to visit as verified by the police, and mothers agreed to be telephoned in two weeks. Control measures were collected during the 1-month interview (Phase 1). The next time-point for this study was grade 6 (Phase 3, years 2000–2004). This included enjoyment of PA, parental support, and standardized inattention scores. Phase 4 (years 2005–2007) of the study included the first variable of sports participation behavior pattern, age 15, and Phase 5 (years 2008–2010) included the second variable, age 18. Finally, Phase 6 (years 2016–2018) of the study included all young adults (age 26) as DVs. Figure 1 shows a flowchart of the time points and measures used in this study.

Measures

Figure 1 shows a flow diagram for the phases in which the measures were collected for this study. Table 1 summarizes the information and timeline of data collection for the variables.

Independent variables (IV)s

Parent interview of child PA: During phase 3 of the SECCYD (sixth grade), mothers or other parents/guardians were asked to complete a questionnaire about their children's PA divided into four sections: parent support for child PA; parent beliefs about PA, child PA skill level, and parental support for PA; parent report of child participation in PA; and parental self-report of personal PA participation (modeling). One question asked about the child's enjoyment of PA. The remaining questions of interest for this study were related to parental enjoyment and the belief that PE is important. Answers were given on a 5-point scale (1-Strongly disagree, 2-Disagree, 3-Somewhat disagree, 4-Agree, 5-Strongly agree) and were asked as follows:

- *Child Enjoys PA*: 'My child enjoys participating in PA/sports'.
- *Parent Enjoys PA*: 'I myself enjoy participating in PA/sports'.
- Parent Feels PE is Important: 'It is important that my child have quality PE at school nearly every day'.

Physical Activity Monitor (PAM), Vigorous PA: A PAM was used to measure PA over a seven-day period during a typical school week. This device was obtained from the Ambulatory Monitoring Applications Division of Computer Science and Applications (CSA), Inc. The CSA is a single-channel accelerometer that records data with multiple accelerations (changes in the rate of movement of a body). The reliability of this measure was evaluated in 30 children ages 7–15 who wore the CSA for 12 h per day for 6 days. The stability of the measure increased from 1 d ($R = 0.42–0.47$) to 6 days ($R = 0.81–0.84$). Acceptable validity was evidenced after four days ($R = 0.75–0.78$, CI = 0.60–0.88) [25].

Child Behavior Checklist (CBCL): During Phase 1, parents reported measures for their children using the CBCL. The CBCL is widely used to assess social competence and problem behavior in children 4–18 years old. The measure has been standardized for samples of

Figure 1. Flow diagram of phases and measures in this study.

Table 1. Variable measurement time points, source, and validity.

Variable	Timeline	Measurement source	Validity/reliability if applicable
Independent variables			
Device-assessed PA	Grade 5	Accelerometer	R > 0.7
Child Enjoys PA	Grade 6	Parent	
Parent Enjoys PA	Grade 6		
Parent feels PE is Important	Grade 6		
Child Behavior Checklist	Grade 6		R ≥ 0.8
Mediator variables			
Sport Participation	Ages 15 and 18	Participant	
Dependent variables			
Depression	Age 26	Participant	$\alpha > 0.8$
Mental Health	Age 26		$\alpha = 0.34 - 0.8$
Adult Sport Participation	Age 26		
Adult Fitness Participation	Age 26		
Control variables			
Demographics	1-month	Parent	
Wellness	Grade 5	Parent	$\alpha > 0.7$
Sport Participation	Grade 6	Participant	

Timeline refers to age or school time period of the child participant. Participant refers to child participant in the study and Parent refers to the primary caregiver parent of the study participant. R = correlation coefficient, α = Cronbach's alpha.

children in both the United States and abroad. A series of behaviors was rated on a 3-point scale from 0 (not true of the child) to 2 (very true of the child). Items measure the broad constructs of internalizing and externalizing behaviors and the narrower constructs of social problems, aggression, attention problems, and depression [26]. Reliability for the CBCL for 6- to 18-year-olds is reported from 0.8 to 0.94 [27]. For this study, a parent report was used at grade 6. Standardized raw scores of the total problems were utilized, with higher scores indicating greater social difficulty.

Out of School Context and Structured Activities: Developed during phase 3 of the SECCYD and assessed during phases 3 and 4, surveys called 'Things I Do After School or on Weekends' were answered by the participating children in grades 6, and ages 15 and 18. Questions pertained to activities participated in during the previous year, including organized sports, music, dance, drama, or art; academic clubs; non-academic clubs or groups; volunteer or community service work; and religious service classes or groups. Data were collected for at least one time point between phases 4 and 5 for 997 children. Those who had data from phase 4 but not 5 totaled 227, while those who had data from phase 5 but not 4 totaled 248. Data were only counted in this measure for participation at both time points for $N = 748$.

Dependent variables (DV)s – Phase 6, age 26

Center for Epidemiologic Studies Depression Scale (CES-D): The CES-D measures the major facets of depression, including depressed mood, feelings of worthlessness, feelings of helplessness, psychomotor retardation, loss of appetite, and sleep disturbance [28,29]. Overall depression, used in this analysis, is scored using the mean of all the items measuring somatic/depressed affect, positive affect, and interpersonal/depressed affect on a 4-point scale (1-Rarely or none of the time (Less than 1 day), 2-Some or a little of the time (1–2 days), 3-Occasionally or a moderate amount of time (3–4 days), 4-Most or all of the time (5–7 days). Example items include: Somatic/Depressed affect—I was bothered by things that usually don't bother me, Positive affect—I felt I was just as good as other people, and Interpersonal/Depressed affect: I thought my life had been a failure. Previous reliability testing showed Cronbach's alpha for the scale to be at 0.80 or above across all tested subgroups, which were age, sex, race, and various levels of education [29].

Mental Health Continuum Short Form: Created to assess emotional, psychological, and social wellbeing, long and short forms of this measure are widely used [30,31]. Using a 5-point scale (1-Never, 3-Once or twice a month, 3-About once a week, 4-About 2 or 3 times a week, and 5-Almost every day), participants responded to the prompt. Example questions include: 'In the last month, how often do you feel happy?', and 'In the last month, how often did you feel that you had something important to contribute to society?' Previous reliability testing of the measure showed moderate to high reliability for measures of emotional well-being ($\alpha = 0.60–0.80$), moderate reliability for psychological well-being ($\alpha = 0.43–0.72$), and low to moderate for social well-being ($\alpha = 0.34–0.73$) [31].

Time Use: This series of questions is used to assess the frequency of participation in a range of activities with a seven-point Likert scale (1-Never, 2-Less than once a month, 3-At least once a month, 4-Once a week, 5-Several times a week, 6-Almost every day, 7-Every day). The questions were adapted from the Panel Study of Income Dynamics [32] and the Michigan Study of Adolescent Life Transitions (MSALT) [33].

> During the last 12 months, about how often did you participate on an athletic or sports team?
>
> During the last 12 months, how often did you exercise or do any fitness activity?

Control variables

To account for factors affecting sports participation, the analysis controlled for demographics, including gender, race, and ethnicity, as well as baseline indicators of wellness and sport participation. Sex was indicated by the parent as male or female. Race was

reported by the parent based on offered selections, and ethnicity was dichotomized as whether the respondent described their child as Hispanic (yes or no).

Grade 6 Sport Participation: As mentioned above, this measure was developed during phase 3 of the SECCYD surveys and is called 'Things I Do After School or on Weekends'. Grade 6 sports participation data was incorporated as a baseline control variable in the model.

Wellness: During grade 5, Phase 3, study children completed the 'My Health Questionnaire', which was adapted from the Starfield Child Health and Illness Profile (CHIP-AE) protocol [34]. This measure uses four Likert-scale questions with values between 1 and 4, pertaining to well-being. The sum of their variables indicates their well-being scores, which range from 4 to 12. This instrument has shown reliability with Cronbach's alpha coefficients above 0.7 [35].

Analysis plan

This analysis utilized applied a structural equation modeling approach to assess relationships among variables. All analyses were completed using Mplus software version 8.6 [36]. Missing data were handled using full information maximum likelihood (FIML) with robust standard errors based on observed data (not estimated parameters), wherein estimations were modeled using all available information from the complete data in the analysis. Robust standard errors are correct for the non-normality of predictor variables [37]. Data were considered missing at random and were likely due to non-participation in the overall longitudinal study instead of other non-random factors. The full information maximum likelihood (FIML) estimation was based on data from 1,364 participants.

First, mutually exclusive dummy variables were created to determine sport behavior patterns in high school. Participants were categorized into four groups based on their sports participation patterns: consistently participated at both ages, participated only at age 15, never participated, or participated only at age 18. The fourth group comprised a small proportion (3.8%) of the sample and was not included in the analysis. The reference group, not included in the model, was those who played at age 15 but not at age 18, as this allows for the direct comparison of those who played sports at one time point to those who participated at both. Within Mplus, a multilevel complex analysis was specified by clustering on the site of data collection, which fits previously reported recommendations [38]. Direct relationships were evaluated between all independent variables and two specified dummy variables. This method allows us to see the probability of being in the two groups tested (played sports at both time points, and neither time point) relative to the other mutually exclusive possibilities. Direct associations were also tested between sports participation variables and age 26 DVs. Control variables were tested as covariates in the model in the same way as DVs, with direct effects on outcomes and covariance with the other IVs.

Results

Descriptive statistics

Table 2 shows the descriptive statistics of all variables used in the model. Most children in this sample enjoyed PA. At recruitment, 11% of mothers had not completed high school, 14% of mothers were single parents, 12.9% Black, 1.6% Asian or Pacific Islander, 0.4% American Indian, Eskimo, or Aleutian, and 4.7% 'Other' race, 6.1% were Hispanic, and 21% had income levels less than twice the poverty level. The majority of parents felt that PE was important and enjoyed the PA themselves, although to a lesser degree. Only two children in the sample of 695 who completed device-assessed PA measures did not perform vigorous PA in Grade 3. The lowest 20% of children in grade 3 performed 3.7 min of vigorous PA in a week, and the highest 20% performed 14.5 min per week, with a maximum performance of 52.9 min. The mean score for the CBCL was 50, which is considered to be not detrimental to social difficulty. For sports participation variables, individuals who played sports at both ages 15 and 18 comprised 51% of the sample, and those who did not play at either time point comprised 18% of the sample. The reference category, individuals who played sports at age 15 but not at age 18, composed 27% of the sample, and only 4% of participants were in the remaining category – did not play sports at age 15 but did play sports at age 18. The sample had comparable numbers of females and males, with slightly more females. It was mostly white and non-Hispanic.

Model fit indices

The model fit was assessed using standard indices. These included the comparative fit index (CFI), with values greater than 0.9 considered a good fit [39]. The value of this model was 0.916. Second, the root mean square error of approximation (RMSEA) was used with a strong fit indicated by scores less than 0.08 [39]. The value of this model is 0.062. Finally, standard root

Table 2. Descriptive statistics of all variables, $n = 1364$.

Variable	N	Missing	Mean	SE	Range
Grade 6 independent variables ($N = 1075$)					
Child enjoys PA	900	175	4.47	0.856	1–5
Parent Enjoys PA	900	175	3.92	1.09	1–5
Parent Feels PE is Important	898	177	4.27	0.689	1–5
PAM: Vigorous	695	380	10.03	66.534	0–52.857
Child Behavior Checklist	1022	53	44.778	114.384	23–77
Ages 15 and 18 sport participation patterns ($N = 779$)					
Age 15 Sport Participation	748	31	Yes = 582 (78%)		0–1
Age 18 Sport Participation			Yes = 407 (54%)		0–1
Sport Participation at Age 15 & 18			379 (51%)		0–1
No Sport Participation at Age 15 or 18			138 (18%)		0–1
Age 26 dependent variables ($N = 814$)					
Depression	808	6	2.74	0.595	1–3.9
Time Use: Organized Athletic			2	2.142	1–7
Time Use: Fitness Activities			4.29	2.213	1–7
Wellbeing	Latent variable				
Emotional	810	4	4.28	0.869	1–5
Social	807	7	2.98	0.995	1–5
Psychological	808	6	4.07	0.821	1.2–5
Control variables					
Child sex	1364	–	Male = 709, 52%		0–1
Child Race (White/ non-white)	1364	–	White = 1097, 80%		0–1
Ethnicity (Hispanic? yes/no)	1364	–	Yes = 83, 6%		0–1
Grade 6 Sport Participation	1012	63	Yes = 685, 67.7%		0–1
Grade 5 Wellness	1010	65	9.86	0.057	4–12

Missing values are based on total participation during phase of data collection. High school sport participation missing values based on complete data for both participants subtracted from total participation in phase 4 (age 18). Data for this analysis is considered not missing at random.

mean squared residual (SRMR) values less than 0.08 are also considered a good fit [40]. The SRMR value of this model was 0.034. All of these fit indices indicate that this model is well within the bounds for appropriateness, and thus, we are able to interpret the findings with strong confidence.

Model estimates

Figure 2 shows the model effects without control variables and Table 3 shows all model estimates, including the control variables. IVs included: child enjoys PA, parent enjoys PA, parent feels PE is important, device-assessed minutes of vigorous PA, and child behavior (CBCL total problems). All except one of the five grade 6 IVs and minutes of vigorous PA were significantly associated with maintaining sports throughout high school. The remaining four grade 6 IVs had small significant associations with high school sports participation (i.e. children enjoyed PA, parents enjoyed PA, parents felt that PE was important, and CBCL). Only one grade 6 IV was significantly associated with never playing sports in high school; children with higher levels of enjoyment of PA ($\beta = -0.228$, $p < 0.001$) were less likely, compared to those who played at one time point, to never participate in sports in high school. Grade 6 IVs were also directly related to the age of the 26 DVs. Specifically, PA enjoyment in grade 6 positively predicted age 26 fitness activity participation, and behavioral difficulties (CBCL) in grade 6 were negatively associated with age 26 well-being and fitness activity participation and positively associated with depression symptoms. Lastly, grade 6 vigorous PA was associated with better well-being scores and more time playing organized sports at age 26 years.

High school sport participation patterns were consistently related to age 26 outcomes in this sample. Playing sports at both high school time points (ages 15 and 18) was significantly associated with all four age 26 DVs (i.e. well-being, depression, organized athletics, and fitness activities). Those who did not participate in high school sports at either time point were less likely to participate in organized athletics at age 26 than those who participated at age 15 but not 18.

Several control variables were associated with high school sports participation and age 26 outcomes. Being biologically female at birth, compared to males, was associated with not playing sports in high school and not participating in fitness activities at age 26, but also having better wellness scores at age 26. However, sex was not associated with playing sports at grade 6 ($\Phi = 0.075$, $p = 0.075$). Children identified as White had a small association with never playing sports in high school, yet White students were more likely to participate in fitness activities at age 26, and evidenced better wellness and depression scores at age 26. Similar to sex identification, students identified as white or non-white were not associated with playing sports in grade 6 ($\Phi = 0.075$, $p = 0.084$). Baseline wellness scores were associated with less depression and more time participating in organized athletic and fitness activities at age 26. Grade 5 wellness was positively associated with playing sports playing sports in grade 6 ($\Phi = 0.106$, $p < 0.001$). Finally, grade 6 sports participation was associated with playing sports in high school and at age 26 years.

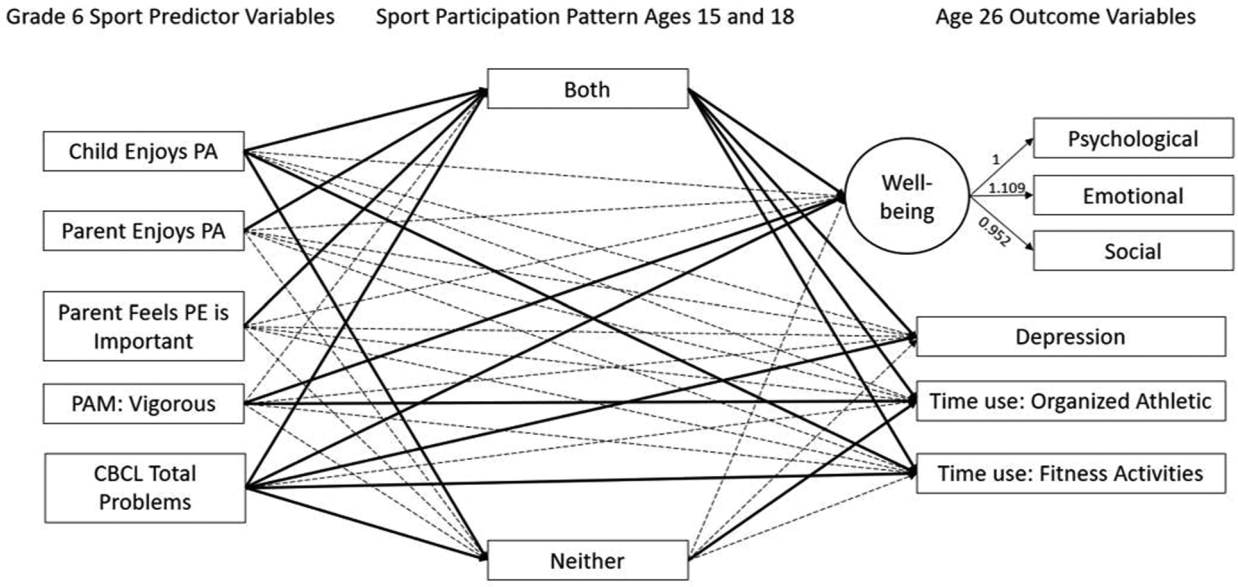

Figure 2. Path model of all tested associations. Solid line indicates significant associations. Dotted line indicates non-significant associations. Significant indirect paths: Child enjoys PA → Both → Depression (β = -0.021, $p = 0.001$). Child enjoys PA → Both → Well-being ($\beta = 0.02$, $p = 0.036$). Child enjoys PA → Both → Time use: Fitness Activities ($\beta = 0.028$, $p = 0.004$). Child enjoys PA → Both → Time use: Organized Athletic ($\beta = 0.038$, $p < 0.001$).

Table 3. All standardized estimates in the model.

	Direct associations β (p-value)					
Variable	High school sports – both	High school sports – never	Wellness Age 26	Depression Age 26	Organized athletics Age 26	Fitness activities Age 26
Child Enjoys PA	**0.195 (<0.001)**	**−0.228 (<0.001)**	0.021 (0.414)	−0.049 (0.094)	0.019 (0.455)	**0.073 (0.018)**
Parent Enjoys PA	**0.091 (0.005)**	−0.072 (0.083)	−0.053 (0.225)	0.019 (0.504)	−0.038 (0.207)	0.038 (0.170)
Parent Feels PE Important	**−0.066 (0.012)**	0.048 (0.280)	0.037 (0.398)	−0.038 (0.216)	0.006 (0.840)	0.031 (0.240)
PAM: Vigorous	0.079 (0.174)	−0.074 (0.112)	**0.149 (0.010)**	−0.056 (0.186)	**0.160 (<0.001)**	−0.008 (0.862)
CBCL Total Problems	**−0.074 (0.041)**	0.038 (0.460)	**−0.065 (0.011)**	**0.146 (<0.001)**	−0.033 (0.225)	**−0.100 (0.005)**
Child Female	**−0.092 (0.039)**	**0.051 (0.019)**	**0.161 (<0.001)**	−0.003 (0.912)	**−0.117 (<0.001)**	**−0.111 (0.011)**
Child Hispanic	−0.038 (0.323)	0.020 (0.546)	−0.042 (0.401)	0.083 (0.061)	−0.018 (0.437)	0.035 (0.176)
Child White	0.050 (0.259)	**0.090 (0.002)**	**0.108 (0.030)**	**−0.087 (0.039)**	0.011 (0.742)	**0.146 (<0.001)**
Grade 6 Sport Participation	**0.168 (<0.001)**	**−0.222 (<0.001)**	−0.018 (0.608)	−0.009 (0.729)	**0.123 (<0.001)**	0.052 (0.153)
Grade 5 Wellness	0.008 (0.733)	0.028 (0.501)	0.071 (0.055)	**−0.090 (0.015)**	**0.105 (0.002)**	**0.055 (0.037)**
High School Sport – Both			**0.104 (0.035)**	**−0.109 (0.003)**	**0.195 (<0.001)**	**0.142 (0.002)**
High School Sport – Never			−0.027 (0.564)	−0.043 (0.367)	**−0.064 (0.020)**	−0.076 (0.158)

Significant findings in bold.

Discussion

Sport participation in the United States declines steeply with age. This is abundantly clear in both previously collected data [41] and the observation of proportionally who is participating in the activities after high school [42]. This is likely due to the demand for competition for bodies without injury and with excess power, skills, and other virtues expressed in activities that tend to diminish with age. Regardless of the reason, sport does not supply society with lifelong PA. At best, it provides people with excellent PA in youth and early adulthood, and the physical literacy skills necessary to transition to other forms of PA with age. The descriptive statistics in this study show that only half of the sample (50.7%) maintained sport participation through both high school time points (ages 15 and 18). At the age of 26, the mean participation rate for organized athletics was between never and less than once per month.

Our model showed that those who participated in sport throughout high school were more likely to have positive mental health and lead to active lifestyle age 26 than those who discontinued during high school and those who did not participate at all. It should also

be noted, however, that those who did not participate in high school sports were not more likely to have worse mental health or fewer days of fitness activity participation compared with those who played sports at age 15 and not 18, and fitness activity participation at age 26 was explained by enjoyment of PA in grade 6 independent of any high school experience. While the mechanism of health outcomes from sport participation are likely due to the physical activity it provides [9], it is plausible and likely that those who did not participate in sport found other means of PA or psychosocially beneficial activities leading to the variable nature of the finding. Furthermore, mostly mothers were respondents to the questions regarding PA enjoyment of themselves, their children, and the importance of PE. It is possible measurements may have been different if primarily fathers or other caregivers provided this information about their children, as parent gender differences in perception has been shown to influence children's perceptions of their own physical competency [43]. Childrens' perceived physical competence is an important mediator of motor skill proficiency and PA participation and fitness [44].

According to our model, individuals who participated in sports in high school were distinct from those who did not, in that they reported higher scores of enjoyment of PA in grade 6, their parents reported higher PA enjoyment in grade 6, and their parents felt PE was unimportant in grade 6. Enjoyment of PA at grade 6 stood out as a predictor variable, as it was directly related to participation in fitness activities at age 26. Furthermore, mediation of the relationship between grade 6 PA enjoyment and age 26 DVs occurred through participation in high school sports. Specifically, our findings show partial mediation between early enjoyment of PA and participation in fitness activities at age 26 and full mediation between the other DVs. This indicates that sport participation in the United States is a crucial expression of PA for children to gain the direct psychosocial benefits of PA later in life. Previous research on feelings about PA and sport align with these findings. One prospective study found that enjoyment of sports at ages 11–15 to was protective against sport dropout one year later [45]; and many qualitative studies have found enjoyment to be associated with a desire to participate in sports [46,47]. Furthermore, the partial mediation relationship of PA enjoyment to fitness activities again shows that sports participation is not the sole factor for whether children will be active adults. There is variation in the sample of those who enjoyed PA, did not play sports, and then participated in fitness activities as adults, providing further evidence that enjoyment of PA should be supported in both groups of children who play and do not play sports in order to promote lifelong PA for health benefits.

The literature has shown that sport participation is influenced by those with authority over a child's life and experiences. Newman et al. [48] found, using hierarchical linear regression, that there were both independent and interactive effects of staff and parent/caregiver support on skill and learning outcomes. Another research group analyzed Australian sport participants and found involvement in sports to be associated with children's intrinsic motivation for participation in structured leisure activities and self-efficacy in children aged 12–17; as well as active and passive parental support [49]. The current study adds to this evidence by demonstrating that a parent's enjoyment of PA is related to the child participating in and maintaining sports throughout high school. This relationship is likely learned and inherited by the child from the parent through association, and implicit and explicit messaging throughout their lives. Interestingly, however, parents with high levels of belief that PE is important had children who were less likely to play sports at both the time points. This association was small and perhaps driven by parents reporting low levels of PE importance because their children were already or were soon to be participating in sports.

Previous research on children's attitudes toward PE and sports participation has been conducted in Norway. Measures of PE attitude, sports participation, and PA were collected from ages 13 to 16. PE attitude and sports participation were all significantly correlated for both boys and girls, as was sports participation and PA. PE and PA are significantly correlated at some time points, but not all [50]. Cultural differences exist in the US and Norway regarding PE; however, children were not asked about PE attitudes in this study. A strong possible explanation for our findings regarding PE value is that parents devalue PE in the US or at least value PE to a smaller degree than sports. If parents have children already in sports by grade 6 or intend to push them into participating in high school, they may feel that PE would be redundant for their child, as their child would be provided with all movement skill learning *via* their sport(s).

Findings from our model also showed that social and/or behavioral difficulties in grade 6, measured by the CBCL, predicted not maintaining sport participation through high school. This is expected, as in the current US school competitive sport model, winning against opponents increasingly becomes the primary goal of events. Winning is more difficult when players defy coaches, miss assignments, conflict with

teammates, or struggle with emotional regulation. This was evident in a previous study that assessed behavioral difficulties using the Strengths and Difficulties Questionnaire (SDQ) at age 8 and sports participation at age 10. Children exhibiting total difficulties (internalizing and externalizing combined) and internalizing problems (social and emotional difficulties) were found to be likelier to dropout from sports, yet those exhibiting externalizing difficulties (behavior conduct and attention) were not more likely to dropout [51]. Vella et al. argue that this phenomenon may be due to bullying behavior in sport, as it tends to more adversely affect children who struggle with internalizing difficulties. A likely explanation for the externalizing finding is that sports are places where those with externalizing difficulties are disallowed from exhibiting these behaviors given the contexts in which they are participating (e.g. American football is typically facilitated as a pseudo-military activity). Our findings add further supporting evidence that the total problems from the CBCL in primary school, both internalizing and externalizing, contribute to sports nonparticipation in high school.

Many cross-sectional studies have explored social, psychological, and psychosocial health outcomes of team sports participation (e.g. camaraderie, communicative skills, social capital, coping, decreased depressive symptoms, self-control, and sense of purpose) [52]. We now have longitudinal evidence for positive associations between sports participation at both ages 15 and 18, with decreased depressive symptoms and better well-being scores at age 26.

Regarding the influence of control variables on relationships, previous cross-sectional research has shown that sex is a discriminating factor in sport participation [53]. Worldwide, participation in sport is lower for females, although participation rose from 294,015 girls participating in high school sports in 1972 to 3,655,367 in 2007 [54]. During the 2018–2019 school year, girls were reported to make up approximately 43% of high school athletes according to data from the National Federation of State High School Associations [55]. Gender roles, as well as what society values within those roles, are important factors as individual sports are often classified as either masculine, feminine, or neutral [56,57]; Similar findings have been found internationally [56,58,59] and across age groups from kindergarten [57] to college [59]. The internalization of societal roles is believed to impact individual behavior [60]. Despite the literature, sex was not a significant covariate for sport participation in our sample in grade 6. This suggests that, until that point, sport participation rates are similar. However, males were more active than females at the ages of 15, 18, and 26. The findings suggest that focusing on adolescence is important for reducing sex disparities in sport and fitness participation [61]. More research is warranted to understand how differences in children's sex and gender affect beneficial outcomes of sport participation and expression of PA behaviors from childhood to adulthood.

Limitations

The SECCYD data included participants from regions around the United States with strong longitudinal retention rates. However, these data are not nationally representative, and thus, the interpretation of findings may not be generalizable based on demographic regional dispersion. This sample is largely White (80%), while demographics in the United States show that those of the White race are closer to 60%. Thus. Findings from this study should be replicated in other diverse communities for more generalizable associations.

Furthermore, these are non-experimental data, and as such, significant associations are not full proof of causation. There remains the possibility of confounding variables responsible for the observed relationships, meaning that unmeasured factors may have influenced the relationships. However, our model controlled for multiple important potential moderators, including Grade 6 well-being and previous sport participation. These data should still be viewed as an initial step for determining the factors to be tested *via* an experimental design.

It is also important to note that IVs from parent reports of child PA in grade 6 showed skewness toward high ratings on the measures. However, full information maximum likelihood estimation relaxes the need for normal distributions among predictor variables partially because of the utilization of robust standard errors.

Conclusion

High school sport participation is influenced by childhood experiences and parental practices, and influences on age 26 mental health and PA. Our data suggest that children who enjoy PA are more likely to seek opportunities to participate in high school sports. Sport participation in high school, in turn, is associated with better psychological and behavioral health outcomes and mediates relationships between multiple childhood exposures and outcomes at age 26. Therefore, we should consider establishing the next

generation of American adults for healthy active lives when they are still children. Where we can include more children in sports through adolescence, it is possible that we will yield strong physical and mental health benefits many years later.

Authors contributions

Analysis and interpretation of the data, Jared D. Ramer, Robert J. Duncan, and David L. DuBois; original drafting of the paper, Jared D. Ramer; revising critically for intellectual content, Jared D. Ramer, David L. DuBois, Robert J. Duncan, Andres S. Bustamante, Deborah L. Vandell, David X. Marquez, Eduardo E. Bustamante; final approval of version for publication, Jared D. Ramer, David L. DuBois, Robert J. Duncan, Andres S. Bustamante, Deborah L. Vandell, David X. Marquez, Eduardo E. Bustamante. All authors agree to be accountable for all aspects of the work.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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Data availability statement

The data supporting the findings of this study can be obtained by contacting the Inter-university Consortium for Political and Social Research (ICPSR) and completing an application. https://www.icpsr.umich.edu/web/ICPSR/series/00233, reference number 21941.

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