Introduction: This study identified the trajectories of organized youth sports over 9 years in youths aged 9–18 years and examined whether the trajectories predicted physical activity, sedentary behavior, and obesity in midlife.

Methods: Self-reported organized youth sports trajectories were identified for participants between 1980 and 1989 (N=3,474). Accelerometer-derived physical activity was quantified for participants (n=1,349) in 2018–2020. Sociodemographic, physical activity, and TV viewing data were collected through questionnaires either at baselines or follow-up. Adult BMI was calculated to clarify obesity. Associations of organized youth sports trajectories with adult physical activity, sedentary behavior, and obesity were evaluated using mixture models, which were stratified by sex and conducted in 2022.

Results: Three organized youth sports trajectories were identified for boys and girls (sustained high-sports participation, 12.0%/7.5%; sustained moderate-sports participation, 14.0%/13.3%; and low-sports/nonparticipation, 74.0%/79.2%). Boys sustaining both moderate- and high-sports participation had higher levels of adult self-reported physical activity (β=0.59, p=0.007; β=0.69, p<0.001) than low-sports/nonparticipating boys. Girls sustaining both moderate- and high-sports participation accumulated more total physical activity (β=113.4, p=0.009; β=144.3, p=0.002), moderate-to-vigorous physical activity (β=7.86, p=0.016; β=14.01, p<0.001), step counts (β=1,020, p=0.003; β=1,045, p=0.005), and self-reported physical activity (β=0.79, p<0.001; β=0.63, p=0.003) in midlife than their low-sports/nonparticipating counterparts. Girls sustaining moderate-sports participation accumulated more light-intensity physical activity (β=19.79, p=0.012) and less sedentary time (β=27.65, p=0.009) than sustaining high-sports participation had lower obesity prevalence (OR=0.41, p=0.009) 40 years later than low-sports/nonparticipating girls.

Conclusions: Sustained participation in organized youth sports is independently predictive of physical activity patterns, sedentary time, and obesity in midlife, especially in girls, thus contributing to the development of a healthy and active lifestyle across the life course.

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INTRODUCTION

Participation in organized youth sports (OYS) is important for children and adolescents to meet the recommended levels of physical activity (PA), which is ≥60 minutes of moderate-to-vigorous PA (MVPA) per day. A recent systematic review has shown that intensive participation in OYS predicts higher PA levels in adulthood, particularly among those involved in OYS at least for 3 years. Sustained OYS participation has also been found to predict later health outcomes in terms of reduced obesity and metabolic syndrome, better cardiometabolic health, and healthy habits. Most evidence regarding the associations of participation in OYS with adult PA and health outcomes is based on the assessment of OYS between 2 time points.

In epidemiologic research, trajectory modeling has been applied to identify homogeneous subgroups within a given population rather than to assume the existence of subgroups at 2 different intervals. A recent systematic review was conducted to identify distinct trajectories of PA and related factors during the life course. In this review, only 3 of the 27 studies reported the impact of group-based OYS on health profiles in young adulthood such as less smoking, decreased TV viewing, lower BMI and better physical health, and cardiometabolic and mental health profiles. However, some studies found no clear patterns of association between OYS and obesity in cross-sectional designs and long-term prospective studies. These mixed results could be due to contextual differences between studies or the lack of repeated longitudinal data in the analysis.

Despite the increased interest in the trajectories of OYS as it relates to obesity and TV viewing in young adulthood, there is a lack of cohort studies of this kind that have assessed such associations in midlife using a longitudinal design. Of various sedentary behaviors (SBs), watching TV remains the most prevalent in Finland despite the proliferation of other electronic devices. Understanding the associations of OYS trajectories in youth with PA, SB, and obesity in midlife is important for assessing the significance of OYS behavior for physical health, especially from a preventive point of view, because adherence to a healthy lifestyle is a central target for prevention efforts. Thus, this study identified OYS trajectories and examined their associations with accelerometer-derived and self-reported PA, SB (i.e., sedentary time and TV viewing), and obesity in midlife, considering the baseline and follow-up characteristics of participants in the Young Finns Study (YFS). Because a few studies previously found that OYS trajectories were associated with adult health profiles in a relatively short period, this study specifically analyzed the associations of OYS trajectories with 3 distinct adult health outcomes over a longer period. It was hypothesized that children and adolescents who participated in OYS over 9 years would have higher levels of PA and lower levels of SB and obesity in midlife than low-sports/nonparticipants.

METHODS

Study Population

Data were obtained from the YFS of children and adolescents aged 3–18 years with 6 age cohorts in 1980. From 1980 to 1992, 3,596 participants have been remeasured triennially and then followed up in 4- to 9-year intervals from 1992 to 2011 and in 2018–2020. Participants were randomly selected from the 5 Finnish university cities with medical schools (Helsinki, Kuopio, Oulu, Tampere, and Turku) and their surrounding rural communities. For this study, participants (N=3,474) who had at least 1 nonmissing measure of OYS over time were included in trajectory analyses. Adult participants (n=1,349) who wore an accelerometer were included in regression analyses. The study was evaluated by the local ethics committees, and written informed consent was obtained from all participants in accordance with the Helsinki Declaration.

Measures

Self-reported OYS was assessed in youth aged 9–18 years in 1980, 1983, and 1986 as well as in those aged 12–18 years in 1989. The youngest children aged 9 years were instructed to ask for the assistance of their parents if needed. Between 1980 and 1989, 3 of the questions were used to measure OYS. The first question was "How many times per week do you usually engage in training sessions of a sport club?" The response alternatives were recoded into 4 scales: 1=not at all, 2=less than once a week, 3=once a week, and 4=many hours and times per week. The second question was "How heavily do you breathe and sweat when you engage in physical activity and sport?" The responses to the question were 1=not at all, 2=moderately, and 3=a lot. The third question asked, "Do you participate in sport competitions in (a) sports clubs, (b) at the regional level, and (c) at the national level?" These were simple yes–no (1,2) responses for each item, which were combined into a sports competition scale from 1 to 4. All questions were then summed to create an OYS index ranging from 3 to 11, with higher scores indicating higher levels of sports participation. Details of the reliability and validity of the PA index, including OYS have been reported elsewhere.

PA in adulthood was measured with a self-administered questionnaire in 2018 and consisted of the intensity of PA, frequency of vigorous PA, hours spent on vigorous PA, average duration of a PA session, and participation in organized PA, all with acceptable-to-good internal consistency (Cronbach’s α=0.73). The items were based on the average number of hours/times per week. Each item was coded from 1=low to 3=high and summed to generate a PA index ranging from 5 to 15. The PA index has been found to
be reliable and valid to measure PA across the lifespan.\textsuperscript{19,21} Simultaneously, the participants were asked to report how much time on average they spent daily on TV viewing. The daily TV viewing was measured in minutes separately for weekdays and weekend days, and those self-reports were calculated by \((5 \times \text{weekday} + 2 \times \text{weekend})/7\) as a mean daily TV viewing.\textsuperscript{27}

PA and sedentary time in adulthood were also objectively measured using a triaxial accelerometer (ActiGraph GT3X+ and wGT3X+, FL, USA) in 2018–2020. Briefly, participants were instructed to wear the accelerometer for 7 consecutive days and nights but to remove it for bathing and water activities. Data were collected at a 60 Hz sample rate using normal filter and later averaged to 60-second epochs. Individual-level data from at least \(\geq 10\) hours for \(\geq 4\) days during awake time were required for inclusion in the analysis. A total of 60 minutes of consecutive zero counts were defined as nonwearing time and excluded from data. The accelerometer measures have been recently described in detail elsewhere.\textsuperscript{20} For this study, the outcome variables included average vector magnitude counts per minute (cpm) as an index of total PA, steps/day, time spent on sedentary, light-intensity PA, and MVPA. Cut-points \(\leq 150\) cpm for vertical axis were defined as sedentary time, whereas cut-points >2,690 cpm for vector magnitude were defined as MVPA.\textsuperscript{23,24}

The participants’ height and weight were measured at the baseline and follow-up study visits, and BMI was calculated as weight (kg)/height (m\(^2\)). Adult BMI was categorized as follows: normal weight (<25 kg/m\(^2\)), overweight (\(\geq 25\) and <30), and obese (\(\geq 30\)).

Statistical Analyses

Descriptive characteristics are expressed as mean (SD) for continuous variables and as percentages for categorical variables. Sex differences in all variables were analyzed using independent \(t\)-tests or chi-square tests. Latent profile analysis (LPA) with 2–6 classes was fitted on boys’ and girls’ OYS on the basis of the data in the first 4 phases, which were synchronized using at least 1 OYS observation at successive ages 9–18 years. The flexibility of the LPA approach enables the classification of incompletely observed indicators. Classification of OYS was conducted by adjusting for baseline age; BMI; residential place; having siblings; and parental PA, education, and occupation.\textsuperscript{25} Several measures of model fit, including information theoretic criteria (Akaike’s Information Criterion, Bayesian Information Criterion, Sample-size adjusted Bayesian Information Criterion), likelihood-ratio \(-\)based tests (Vuong-Lo-Mendell-Rubin [VLMR], Lo-Mendell-Rubin [LMR], bootstrapped likelihood-ratio test), entropy values, and average posterior probabilities describing the classification uncertainty, were calculated and evaluated to determine the optimal number of classes. To select the most parsimonious adequate model, the lowest values of information criteria, specifically adjusted Bayesian Information Criterion, were favored within the range of class sizes suggested by likelihood-ratio tests.\textsuperscript{26} In addition, class sizes with \(<5\%\) of the total sample were not accepted. In the posthoc analysis, linear regressions were used for all outcome variables representing unstandardized \(\beta\)-coefficients (95% CI). Logistic regressions were used to estimate OR (95% CI) for obesity (category). Both unadjusted and adjusted models were estimated, adjusting for adult participants’ age, having children, and own education and income. Models for accelerometer-derived PA were additionally adjusted for wear time. All analyses were conducted in R environment\textsuperscript{27} and Mplus, Version 7.0,\textsuperscript{28} by R software package MplusAutomation\textsuperscript{29} in 2022. Missing data were assumed to be missing at random and were considered missing as a function of observed covariates and observed outcomes.\textsuperscript{28} Full information maximum likelihood estimation with robust SEs was used to handle the missing at random assumption to reduce potential bias in the parameter estimates and statistical power to detect statistically significant effects.

RESULTS

Of the 3,474 participants (48.8% males), 10.7% completed all the 4 OYS assessments, 26.6% completed 3, 35.8% completed 2, and 26.9% completed 1. In youth, boys were younger \((p=0.004)\) and had higher OYS at all study phases \((all\ p<0.001)\) than girls (Table 1). In adulthood, males engaged more in total PA \((p=0.005)\) and MVPA \((p<0.001)\), had higher income \((p<0.001)\), spent more time watching TV \((p=0.006)\), had higher BMI \((p=0.048)\), had lower levels of light-intensity PA \((p<0.001)\), and were less educated \((p<0.001)\) than females. Fathers had higher PA \((p<0.001)\) and manual work \((p<0.001)\) and lower educational attainment \((p=0.007)\) than mothers. No other sex differences were observed.

The 3-class model of boys’ and girls’ OYS was the most appropriate model according to the goodness-of-fit criteria (Table 2). VLMR and LMR were significant \((all\ p<0.0001)\), and the highest entropy values were displayed \((\geq 83\%)\) in both sexes. Three trajectory groups were identified for boys and girls: sustained high-sports participation \((12.0%/7.5\%)\) subjects generally participated in high-intensity training several hours and times a week and competitions at regional and/or national levels; sustained moderate-sports participation \((14.0%/13.3\%)\) subjects typically participated in moderate-intensity training at least once a week and competitions at local sport-club level; and low-sports/nonparticipation \((74.0%/79.2\%)\) subjects were either nonparticipants (those not participating in sports at all for the study period), occasional participants (those participating in sports less than once a week), or dropouts/decreasers (those quitting organized sports after the first 2 phases). Boys and girls had age-related increases in the levels of OYS in high- and moderate-sports participation classes from childhood to adolescence (Figure 1A and B).

Sustained moderate- and high-sports participation were associated with higher levels of adult self-reported PA than low-sports/nonparticipation in boys \((\beta=0.59,\ p=0.007;\ \beta=0.69,\ p<0.001)\) and girls \((\beta=0.79,\ p<0.001;\ \beta=0.63,\ p=0.003)\) (Table 3). Girls sustaining both
<table>
<thead>
<tr>
<th>Variables</th>
<th>All (N=3,474)</th>
<th>Males (n=1,697)</th>
<th>Females (n=1,777)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth age, years&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.6 (3.2)</td>
<td>13.5 (3.2)</td>
<td>13.7 (3.2)</td>
<td>0.004</td>
</tr>
<tr>
<td>Adult age, years</td>
<td>48.6 (4.9)</td>
<td>48.5 (4.9)</td>
<td>48.6 (4.9)</td>
<td>0.382</td>
</tr>
<tr>
<td>Youth BMI, kg/m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>17.9 (3.1)</td>
<td>17.9 (3.1)</td>
<td>17.9 (3.1)</td>
<td>0.915</td>
</tr>
<tr>
<td>Having siblings, %</td>
<td>85.1</td>
<td>84.6</td>
<td>85.6</td>
<td>0.420</td>
</tr>
<tr>
<td>Organized youth sports, index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>5.1 (1.5)</td>
<td>5.3 (1.6)</td>
<td>4.9 (1.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1983</td>
<td>5.2 (1.9)</td>
<td>5.5 (2.1)</td>
<td>4.9 (1.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1986</td>
<td>5.2 (1.9)</td>
<td>5.5 (2.1)</td>
<td>4.9 (1.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1989</td>
<td>5.1 (1.9)</td>
<td>5.4 (2.1)</td>
<td>4.9 (1.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Place of residence, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>52.8</td>
<td>52.1</td>
<td>53.5</td>
<td>0.441</td>
</tr>
<tr>
<td>Rural</td>
<td>47.2</td>
<td>47.9</td>
<td>46.5</td>
<td></td>
</tr>
<tr>
<td>Adult PA index</td>
<td>9.0 (1.9)</td>
<td>9.0 (1.9)</td>
<td>9.0 (1.9)</td>
<td>0.663</td>
</tr>
<tr>
<td>Adult TV viewing, minutes/day</td>
<td>119.8 (70.6)</td>
<td>124.7 (72.5)</td>
<td>115.8 (68.7)</td>
<td>0.006</td>
</tr>
<tr>
<td>Adult BMI, kg/m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>27.5 (5.3)</td>
<td>27.7 (4.7)</td>
<td>27.3 (5.8)</td>
<td>0.048</td>
</tr>
<tr>
<td>Adult education, year, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;13)</td>
<td>28.4</td>
<td>37</td>
<td>21.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>High (&gt;13)</td>
<td>71.6</td>
<td>63</td>
<td>78.8</td>
<td></td>
</tr>
<tr>
<td>Adult income, annual, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;€25,000</td>
<td>17.5</td>
<td>14.4</td>
<td>20.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>€25,000–€45,000</td>
<td>43.6</td>
<td>33.5</td>
<td>51.8</td>
<td></td>
</tr>
<tr>
<td>&gt;€45,000</td>
<td>38.9</td>
<td>52.1</td>
<td>28.2</td>
<td></td>
</tr>
<tr>
<td>Having children, %</td>
<td>48.3</td>
<td>49.8</td>
<td>47.1</td>
<td>0.262</td>
</tr>
<tr>
<td>Adult accelerometer PA</td>
<td>n=1,349</td>
<td>n=544</td>
<td>n=805</td>
<td></td>
</tr>
<tr>
<td>Total PA, cpm</td>
<td>1,034.5 (395.2)</td>
<td>1,072.1 (431.8)</td>
<td>1,009.0 (366.4)</td>
<td>0.005</td>
</tr>
<tr>
<td>MVPA, minutes/day</td>
<td>54.9 (32.0)</td>
<td>63.0 (36.0)</td>
<td>49.4 (27.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Light-intensity PA, minutes/day</td>
<td>265.1 (72.8)</td>
<td>257.3 (73.4)</td>
<td>270.3 (72.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>Sedentary time, minutes/day</td>
<td>699.3 (96.0)</td>
<td>699.6 (103.1)</td>
<td>699.2 (91.0)</td>
<td>0.939</td>
</tr>
<tr>
<td>Total steps, step/day</td>
<td>8,527 (2,957)</td>
<td>8,520 (3,033)</td>
<td>8,532 (2,907)</td>
<td>0.943</td>
</tr>
<tr>
<td>Wear time, minutes/day</td>
<td>1,019 (76)</td>
<td>1,020 (82)</td>
<td>1,019 (72)</td>
<td>0.821</td>
</tr>
<tr>
<td>Parental variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A little</td>
<td>27.0</td>
<td>23.2</td>
<td>30.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Occasionally</td>
<td>54.5</td>
<td>55.9</td>
<td>53.2</td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>18.5</td>
<td>20.9</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Education, year, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;9)</td>
<td>55.0</td>
<td>57.9</td>
<td>52.3</td>
<td>0.007</td>
</tr>
<tr>
<td>Moderate (10−12)</td>
<td>24.9</td>
<td>22.1</td>
<td>27.4</td>
<td></td>
</tr>
<tr>
<td>High (&gt;12)</td>
<td>20.1</td>
<td>20.0</td>
<td>20.3</td>
<td></td>
</tr>
<tr>
<td>Occupation, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td>36.3</td>
<td>40.3</td>
<td>32.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lower non-manual</td>
<td>29.7</td>
<td>19.6</td>
<td>38.7</td>
<td></td>
</tr>
<tr>
<td>Upper non-manual</td>
<td>34.0</td>
<td>40.1</td>
<td>28.6</td>
<td></td>
</tr>
</tbody>
</table>

Note: Boldface indicates statistical significance (p<0.05).
The p-value is determined from Student’s t-test or chi-square test.
<sup>a</sup>Average age at the youth study occasions.
<sup>b</sup>Fathers.
<sup>c</sup>Mothers.
cpm, count per minute; MVPA, moderate-to-vigorous intensity physical activity; PA, physical activity.
moderate- and high-sports participation accumulated more daily MVPA ($\beta$=7.86, $p$=0.016; $\beta$=14.01, $p$<0.001), step counts ($\beta$=1,020, $p$=0.003; $\beta$=1,045, $p$=0.005), and total PA ($\beta$=113.4, $p$=0.009; $\beta$=144.3, $p$=0.002) 40 years later than their low-sports/nonparticipation counterparts. Girls who maintained high-sports participation also had 59% lower odds of obesity than those who maintained low-sports/nonparticipation (OR=0.41, $p$=0.009), and those who maintained moderate-sports participation had higher light-intensity PA ($\beta$=19.79, $p$=0.012) and lower sedentary time ($\beta$= -27.65, $p$=0.002) in midlife. These associations were independent of covariates. High- or moderate-sports participating girls had less TV viewing time or lower overweight rates in midlife than low-sports/nonparticipating girls, but this disappeared after multivariable adjustments.

**DISCUSSION**

This study is the first to examine the association of distinct trajectories of OYS with accelerometer-derived and self-reported PA, SB, and obesity in midlife. Three OYS trajectory classes (sustained high-sports participation, sustained moderate-sports participation, and low-sports/nonparticipation) were identified for boys and girls.
Table 3. Regression Coefficients of Organized Sports Trajectories in Youth on Physical Activity, Sedentary Behavior, and Obesity in Midlife

<table>
<thead>
<tr>
<th>Outcome measures in midlife</th>
<th>Unadjusted model&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Adjusted model&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td></td>
<td>Sustained high-sports</td>
<td>Sustained moderate-sports</td>
</tr>
<tr>
<td></td>
<td>participation in youth</td>
<td>participation in youth</td>
</tr>
<tr>
<td></td>
<td>(n=226 boys/131 girls)</td>
<td>(n=166 boys/182 girls)</td>
</tr>
<tr>
<td>Total PA (cpm)</td>
<td>60.51 (−49.47, 170.5)</td>
<td>57.78 (178.3)</td>
</tr>
<tr>
<td>MVPA (min/day)</td>
<td>3.69 (−5.36, 12.75)</td>
<td>3.16 (−10.49, 16.82)</td>
</tr>
<tr>
<td>Light-intensity PA (min/day)</td>
<td>−1.28 (−18.97, 16.41)</td>
<td>1.04 (0.72, 1.52)</td>
</tr>
<tr>
<td>Sedentary time (min/day)</td>
<td>−2.42 (−25.29, 20.46)</td>
<td>0.94 (0.61, 1.44)</td>
</tr>
<tr>
<td>Total steps (step/day)</td>
<td>508.1 (−257.5, 1274)</td>
<td>1.28 (−18.97, 16.41)</td>
</tr>
<tr>
<td>Self-reported PA (score)</td>
<td>0.91 (0.56, 1.27)</td>
<td>0.76 (0.35, 1.17)</td>
</tr>
<tr>
<td>TV viewing (min/day)</td>
<td>3.16 (−10.49, 16.82)</td>
<td>1.04 (0.72, 1.52)</td>
</tr>
<tr>
<td>Overweight&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.04 (0.72, 1.52)</td>
<td>0.76 (0.35, 1.17)</td>
</tr>
<tr>
<td>Obese&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.94 (0.61, 1.44)</td>
<td>0.76 (0.35, 1.17)</td>
</tr>
</tbody>
</table>

Note: Boldface indicates statistical significance (p<0.05).
<sup>a</sup>Sports nonparticipation (n=1,193 boys/1,361 girls) serves as the reference group for each.
<sup>b</sup>Adjusted for participants’ adult age, having children, own education and income, and accelerometer wear time (special for the device).
<sup>c</sup>ORs from regression models with normal weight probands (BMI<25 kg/m²) coded as a reference level (0) and overweight (≥25 and <30) or obese (≥30) probands coded as 1 in corresponding models.

cpm, count per minute; min, minute; MVPA, moderate-to-vigorous intensity physical activity; PA, physical activity.
 girls. This study found that OYS trajectory classes over
9 years were differentially associated with PA, SB, and
obesity prospectively. However, no associations were
found between OYS trajectories and adult TV viewing in
either sex.

The results indicated that the proportion of boys and
girls sustaining both moderate- and high-sports partici-
aption over 9 years was 26.0% and 20.8%, respectively,
which was lower than that of boys (55.2%) and girls
(47.5%) in previous research.12 Changes in OYS over
time were also found in previous research10–12 but not
in this study. There are several methodologic aspects
that may explain this seemingly inconsistent finding.
The first is that this study used 3 items to create an index
for OYS, especially sports competitions, which may
affect the form of the OYS trajectories. The results, com-
bined with previous studies,10–12 may provide additional
information on OYS trajectories for future investiga-
tions. This study confirms previous findings that inten-
sive training and competitive sports in youth tend to
increase with age, although the number of participants
decreases gradually over time.30 Second, the LPA
approach was used to divide participants into homoge-
nous classes; classification was based on the level of the
index on 4 occasions. Most of these participants engaged
in OYS on some occasions or even all occasions, but
their indices still tended to be low. In this case, the most
probable class in the 3-class solution could be the low-
sports/nonparticipation. Further research is needed to
determine the best method for integrating data from
multiple OYS for trajectory evaluation. Finally, this
study identified OYS trajectories over relatively longer
periods than for previous tracking3–5 and trajectory
research. This may emphasize the importance of paying
attention to the analytical approach used in this study
when analyzing trajectories of sport-specific participa-
tion over a longer time.

The findings are not in line with previous studies in
which the dropout class was identified (e.g., those who
initially participated in OYS and then chose to withdraw
from the sport during follow-up periods).11,12 Although
the 4-class model of OYS displayed a dropout trajectory
for both sexes, it was dismissed because of its nonsignifi-
cance in both VLMR and LMR. This led to the selection
of the 3-class solution for OYS, which may attenuate
some relevant relationships between classification and
outcomes because the actual dropouts were grouped
into the low-sports/nonparticipation class. It is therefore
possible that dropout from OYS is commonly seen as
the result of a long-term process of low-intensity PA or
disengagement. Given its importance, future studies
should consider the multivariate statistical methods to
model and evaluate the assessment of single sport
participation in youth by highlighting the interaction of
frequency, intensity, and length of time across subgroups
during the transition to young adulthood.

The results supported the hypothesis that sustained
moderate- and high-sports participation classes were
associated with higher levels of adult self-reported PA
than low-sports/nonparticipation class in both sexes.
Girls sustaining moderate- and high-sports participation
accumulated more total PA, MVPA, step counts, and
light-intensity PA after 40 years than their low-sports/
nonparticipating counterparts. These results are consist-
tent with findings of previous research that found high-
intensity exercise and competitions in youth to be asso-
ciated with higher levels of PA in adulthood.3 However,
not all studies support this point. Some studies revealed
that consistent sports participation was not significantly
associated with the maintenance of MVPA in young
adulthood11 and found no significant association for
females.12 The differing findings may partially be
explained by different samples, the assessments of sports
participation, length of follow-up time, and different sta-
tistical methods. Another possible explanation could be
that girls sustaining OYS participation may have favored
accelerometer to improve the accuracy of daily PA in
midlife.

This study did not observe any association of OYS tra-
jectories with adult TV viewing, in contrast to previous
research, which has found that the consistently active
trajectory is associated with low TV viewing over time.11
However, the study found that girls sustaining moder-
ate-sports participation accumulated less sedentary time
in midlife than their low-sports/nonparticipation coun-
terparts. One explanation for this may be that TV view-
ing is a marker of sedentary activity that may not
adequately reflect the total sedentary time in adults.31,32
This suggests that sustained moderate-sports participa-
tion in youth, particularly in girls, should be considered
a basis for total sedentary time prevention later in life.

This prospective study found an inverse association
between sustained high-sports participation and BMI in
females but not in males. It is plausible that athletic
activity increases muscle mass, and athletes with inten-
sive training and competitions may have increased rela-
tive weight because of increased muscle mass,
particularly in male athletes. This is because BMI did
not distinguish between fat mass and fat-free mass in
youth athletes. For example, Etchcison et al.33 reported
that 13.31% of the 33,896 student athletes (aged 11–19
years) were classified as obese, whereas only 5.95% were
classified as obese using skinfold measures. More
research is needed to provide an adjustment method for
BMI34 and additional insight into body composition
assessment in athletes.35
Limitations
This study had several limitations. First, the study assessed trajectories of the index of frequency, intensity, and competition levels of sports participation, but sports specialization was not included in the study owing to incomplete data. Further YFS examinations, including the type of sports and years of training, would enable us to explore the metabolic equivalent task, which is utilized to quantify sports activities at different competitive levels. Second, although the assessments of PA were not comparable between the accelerometer-derived and self-reported methods, the data have shown a modest positive association between the 2 assessments in adults. Third, the study included only TV viewing during leisure-time but did not capture domain-specific (i.e., occupational, transport-related, and domestic) sitting time and other leisure sitting activities. Future studies should take into account a wide range of SBs assessed by accelerometry and self-report. Fourth, the study opted to use classification thresholds for MVPA (>2,690 cpm) and sedentary time (≤150 cpm). These cut-points might influence the amount of MVPA and sedentary time, which could potentially affect the outcomes of the LPA approach. Finally, the trajectory models did not address the change of OYS in both sexes over a 9-year follow-up, which might misclassify the participants who dropped out of sport or decreased sports activities with those who were actually part of the nonparticipation. The dropout/decreasing experiences may either enhance or undermine the influence of compliance with PA, SB, and obesity on adults’ health.

CONCLUSIONS
This study identified multiple patterns of OYS from childhood to adolescence over 9 years in both sexes. Sustained moderate- and high-sports participation may contribute to the development of a healthy, physically active lifestyle from childhood to adulthood, particularly in girls. The implication of this finding is that parents, teachers, trainers, health professionals, and policymakers should strive to not only enhance children’s athletic experience but also optimize environmental variables toward increasing children’s sports participation. More evidence is needed regarding children’s involvement in different sports contexts.

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