A Detailed Examination of the Longitudinal Associations Between Individual and Team Sports and Alcohol Use

Anne-Sophie Denault[a], Université Laval

François Poulin[b], Université du Québec à Montréal

[a]Département des fondements et pratiques en éducation, Université Laval, 2320, rue des Bibliothèques, Québec, QC, Canada, G1V 0A6. E-mail: anne-sophie.denault@fse.ulaval.ca

[b]Département de psychologie, Université du Québec à Montréal, 100, rue Sherbrooke Ouest, Montréal, Québec, Canada, H2X 3P2. E-mail: poulin.francois@uqam.ca

Corresponding Author: Anne-Sophie Denault, PhD, Département des fondements et pratiques en éducation, Université Laval, 2320, rue des Bibliothèques, Québec, QC, Canada, G1V 0A6. Phone: 1-418-656-2131 # 6930. Fax: 1-418-656-2885. E-mail: anne-sophie.denault@fse.ulaval.ca

Funding: This work was supported by the Social Sciences and Humanities Research Council of Canada (grant number 435-2012-1171) and the Fonds de Recherche du Québec sur la Société et la Culture (grant number 2008-AC-118531).

Abstract

This study examined the longitudinal associations between participation in individual and team sports and indicators of alcohol use during the high school years and beyond. A total of 310 youths were surveyed over six waves of data collection (ages 12, 14 to 17, and 19). Participation in individual and team sports was measured through phone interviews, whereas frequency of alcohol use, frequency of intoxication, and problematic alcohol use were self-reported. Control variables included participation in other types of organized activities, sex, family income and structure, parental education and knowledge, problem behaviors, deviant peers, and peer status. The results of autoregressive latent trajectory models revealed reciprocal associations between time spent in individual sports and frequency of alcohol use and intoxication. The results also revealed that time spent in team sports predicted an increase in frequency of alcohol use in middle adolescence. Lastly, the only significant finding at age 19 suggested that the initial number of hours spent in individual sports predicted lower scores on alcohol intoxication. These findings suggest that team sports act as a risk factor for less severe forms of alcohol use in middle adolescence, whereas individual sports act as a protective factor against more severe forms of alcohol use during adolescence and beyond.

Keywords: sports, alcohol use, adolescence, young adulthood, growth curve.

A Detailed Examination of the Longitudinal Associations Between Individual and Team Sports and Alcohol Use

Alcohol use in early adulthood represents an important public health concern (Health Canada, 2014), since it peaks during this period and is associated with increased risks of problematic alcohol use later in life (Maggs & Schulenberg, 2005; Windle & Zucker, 2010). One counterintuitive factor linked to increases in alcohol use is participation in organized sports, as documented in at least three recent meta-analyses and systematic reviews (Dielh et al., 2012; Kwan, Bobko, Faulkner, Donnelly, & Cairney, 2014; Lisha & Sussman, 2010). On the one hand, sports participation can be considered a protective factor against alcohol use because it connects youths with prosocial peers and adults and helps them develop transferable life skills, thus promoting healthy youth development (Clark, Camiré, Wade, & Cairney, 2015; Peck, Vida, & Eccles, 2008; Veliz, Boyd, & McCabe, 2015). On the other hand, sports can be considered a risk factor for alcohol use on account of the drinking culture associated with sports (which can result in normative beliefs regarding alcohol use), the self-selection of sensation-seeking youths into sports, and the stress and pressures associated with competition (Dever et al., 2012; Dielh et al., 2012; Kwan et al., 2014).

Given the limitations of prior research, gaps remain in our understanding of the complex associations between organized sports and alcohol use during adolescence and early adulthood (Mays, Gatti, & Thompson, 2011). Very few studies have (a) distinguished between individual and team sports, (b) examined changing patterns of both sports participation and alcohol use over time, as well as their reciprocal associations, and (c) distinguished between normative and problematic alcohol use (Dever et al., 2012; Kwan et al., 2014; Mays, DePadilla, Thompson, Kushner & Windle, 2010; Mays et al., 2011). These limitations were addressed in this study.

Examining these complex associations is important for developing selective interventions targeting sports participants (Mays et al., 2010).

Individual and Team Sports

Different types of organized sports may foster different peer cultures that either facilitate or deter alcohol use (Veliz et al., 2015). One way of classifying organized sports is to distinguish between individual sports (e.g., swimming, speed skating, gymnastics) and team sports (e.g., football, basketball, ice hockey). Among multiple potential mechanisms linking organized sports to alcohol use, the question of peers is central given their importance in the developmental trajectories of alcohol use (Lynne-Landsman, Bradshaw, & Ialongo, 2010; Schulenberg, Patrick, Maslowsky, & Maggs, 2014). While peers are omnipresent in both individual and team sports, the peer dynamics could be different in these two types of sports. In individual sports, youths set personal goals, and might even be in competition with other group members to achieve them. Given the individualistic nature of these sports, youths may stay focused on their individual performance and thus be less prone to the influence of other group members when it comes to drinking. In team sports, youths have to work together and collaborate to reach shared goals. Thus, youths in team sports might form stronger bonds with their teammates and be more inclined to influence one another's behavior. Peer norming effects with regard to alcohol use might thus be stronger in team sports than in individual sports (Marsh & Kleitman, 2003; Wetherhill & Fromme, 2007). Results from previous studies are consistent with this reasoning: youths involved in both types of sports report higher levels of perceived peer drinking than those only involved in individual sports (Mays et al., 2009) and youths involved in team sports report a greater increase in alcohol intoxication than those involved in individual sports (Wichstrom &Wichstrom, 2009).

Longitudinal Approach

Taking a longitudinal approach and controlling for other types of organized activities is essential in order to isolate the unique contribution of sports. Indeed, youths usually participate in more than one activity at the same time and other organized activities, such as youth clubs, have been shown to be negatively related to alcohol use (Denault, Poulin, & Pedersen, 2009). Reciprocal effects are also likely to come into play between sports and alcohol use (Lisha & Sussman, 2010), and might be different in individual and team sports. For instance, alcohol use might have a negative impact on individual performance and thus predict a decrease in participation in individual sports over time (Wichstrom & Wichstrom, 2009). In contrast, team sports create opportunities to celebrate victories (or commiserate over defeats), and drinking may be a socially acceptable way of doing so within that specific peer culture (Kwan et al., 2014). Team sports might thus predict an increase in alcohol use over time. Using latent growth curve (LGC) analyses, Wichstrom and Wichstrom (2009) found that involvement in sports predicted an increase in alcohol intoxication, but not the reverse. As reported above, this was especially true for team sports. While innovative, their study did not examine reciprocal effects over time, and questions thus remain regarding which behavior drives the other.

Indicators of Alcohol Use

Drinking can be viewed as a socially acceptable and normative behavior during adolescence. From a prevention/intervention perspective, it is thus important to consider different levels of severity. Results from previous studies suggest that sports participation is associated with both normative alcohol use (e.g., any use, frequent use; Dever et al., 2012; Wetherhill & Fromme, 2007) and problematic alcohol use (e.g., heavy drinking, intoxication; Mays et al., 2010; Veliz et al., 2015; Wichstrom & Wichstrom, 2009). In this study, we investigated whether these associations remain after controlling for other types of organized activities and important covariates associated with both types of sports (e.g., family income and structure, parental

education; Denault & Poulin, 2009; Pedersen, 2005) and alcohol use. As for alcohol use, in addition to socio-demographic variables, to be consistent with ecological models of substance use, we also included variables at the family (monitoring), social (deviant peers and peer status), and individual (sex, problems behaviors, prior alcohol use) levels (Lynne-Landsman et al., 2010; Schulenberg et al., 2014).

Study Objectives

The goals of this study were (a) to examine the longitudinal and reciprocal associations between organized individual/team sports and alcohol use (frequency of use and intoxication) from ages 14 to 17, using autoregressive latent trajectory models (ALT; Bollem & Curran, 2004), and (b) to investigate the predictive associations between individual/team sports from ages 14 to 17 and frequency of alcohol use, intoxication, and problematic alcohol use at age 19, using latent growth curves and regressions. Based on prior research findings and given the peer dynamics likely to occur in team sports, we expected that team sports would predict increases in alcohol use over time. We also expected alcohol use to predict a decrease in individual sports participation over time, given its potential detrimental effects on performance and the individualistic nature of this type of sports.

Methods

Participants and Study Design

The data came from a longitudinal study beginning in 2001 involving 390 students in Grade 6 (58% girls, M_{age} = 12.38). Students in the sample were drawn from eight elementary schools in four separate districts representing different socio-economic backgrounds in a city of 350,000 in the province of Quebec, Canada. Six waves of data collection were used: T1 = age 12, T2 to T5 = ages 14 to 17, T6 = age 19. In the province where the data were collected, the high school years are comprised of Grades 7 to 11 (ages 13 to 17). Students were mostly Caucasian

(90%) and French-speaking and came from families that were, for the majority, intact (68%) and had an average annual income before taxes of over CAN$50,000. Of the 390 youths in the study, data on participation in organized activities from ages 14 to 17 were available for 72% to 77% of respondents, depending on the age. Only youths with data for at least two time points out of four were included in the analyses (Jones, Nagin, & Roeder, 2001; $n = 310$; on average, 8.0% of the data were missing across the 32 variables used in this study). With regard to socio-demographic factors and covariates at age 12, youths who met the criterion for inclusion were only more likely to be girls, $\chi^2(N = 390) = 7.34, p = .007)$.

Procedure

Control variables were measured at age 12 using self-report questionnaires, peer nominations, and teacher-rated questionnaires. Participation in organized sports was measured from ages 14 to 17, retrospectively each year in June through a structured telephone interview. Indicators of alcohol use were self-reported at all ages. Ethical approval for this research was obtained from the University's ethics review board.

Measures

Descriptive information for all variables is provided in Table 1.

Hours spent in individual and team sports (ages 14 to 17). Time spent in organized sports over a 10-month period was measured annually using the free recall procedure. From ages 14 to 17, 29.8%, 21.4%, 19.5%, and 12.8% of youths participated in individual sports. The percentages for team sports were 31.6%, 24.9%, 21.5%, and 17.6%, respectively. The most frequent individual sports were swimming, skiing, badminton, and karate, whereas the most frequent team sports were ice hockey, soccer, football, and volleyball. For each sport, the number of hours per week was multiplied by the number of weeks of participation over the 10-month

period (max. 40 weeks). For example, a youth who played football eight hours a week from September to November (12 weeks) would have a total of 96 hours of participation. The number of hours were summed up separately for all individual sports and all team sports reported by the youths. Extreme values (z values equal to or higher than 2.5; Tabachnik & Fidell, 2013) were screened out and replaced using winsorization to improve the distribution of the variables.

Alcohol use (ages 14 to 17, age 19). At each measurement time, youths responded to two items on their alcohol use: (a) "In the last month, how many drinks did you have?" (frequency of alcohol use) and (b) "In the last month, how many times did you drink alcohol in order to get drunk?" (frequency of intoxication). The items were rated on a 13-point scale, ranging from 0 to 13 (*41 drinks/times or more*).

Problematic alcohol use (age 19). The sum of the values for nine items rated on a yes/no scale was used to assess problems associated with alcohol use (e.g., passed out from drinking; alpha = .66). The items were taken from the *Structured Clinical Interview for DSM-IV* (SCID; First, Spitzer, Gibbon, & Williams, 1997) and the *Alcohol Use Disorders Identification Test* (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993).

Covariates. Hours spent in other types of organized activities (ages 14 to 17; e.g., performance and fine arts, youth clubs, volunteering) were calculated in the same way as hours spent in sports. Sex was coded "0" for girls (n = 190; 61%) and "1" for boys (n = 120). All the other variables were measured at age 12. Family structure was coded "0" for non-intact families (n = 82; 27%) and "1" for intact families (i.e., youths living with both biological parents*;* n = 226). Family income before taxes was the indicator used to assess the family's economic situation (1, *less than $5,000* to 13, $*60,000 or more*). The number of years of education completed by the mother and father were averaged to create a parental education score (r = .47). To assess parental monitoring, youths completed the general knowledge scale developed by Kerr

and Stattin (2000), comprising nine items rated on a five-point Likert scale ranging from 1 (*never*) to 5 (*always*; "Do your parents know what you do during your free time?"; alpha = .86). Problem behaviors (8 items; 1 = *never true* to 5 = *almost always true*; "This student gets into fights"; alpha = .95) and affiliation with deviant peers (3 items; same anchor; "This student hangs out with kids who smoke cigarettes"; alpha = .76) were assessed through teacher ratings. Youths also reported on the frequency of their alcohol use (item described earlier; at age 12, this item was dichotomized: 0 = no, n = 248, and 1 = at least one, n = 59; three missing data). Lastly, two socio-metric questions were used to measure peer status: "Who do you Like to hang out with the Least?" (LL); "Who do you Like to hang out with the Most?" (LM). The number of nominations received was counted and standardized within each classroom. The peer status variable was created by subtracting the LL score from the LM score (Coie & Dodge, 1983).

Analytical Strategy

First, the LGCs of hours spent in organized individual/team sports and frequency of alcohol use/intoxication from ages 14 to 17 were identified in four separate univariate models. Only hours spent in the other type of sports and in other types of activities were included as covariates when estimating the LGCs of hours spent in individual/team sports. No covariates were included when estimating the LGCs of frequency of alcohol use and intoxication. Second, we conducted ALT models to simultaneously examine (a) the predictive associations between the LGCs of sports participation and alcohol use (the slopes were regressed on the intercepts) and (b) the reciprocal associations between individual/team sports participation and alcohol use (see Figure 1). Combining LGC and cross-lagged models allowed us to simultaneously consider the associations between developmental growth curves and time-specific measures. The LGC part of the model tested whether changes in sports participation over the high school years were correlated with changes in youth alcohol use during the same period. The cross-lagged part of the

model tested whether there were bidirectional associations between sports participation and alcohol use, after controlling for the stable components of growth over time. Four ALT models were tested: (a) individual sports and frequency of alcohol use, (b) individual sports and intoxication, (c) team sports and alcohol use, and (d) team sports and intoxication. For these analyses, the family, social, and individual covariates assessed at age 12 were included in the models, as well as the controls for the number of hours spent in sports. Third, frequency of alcohol use, frequency of intoxication, and problematic alcohol use at age 19 were regressed on the LGCs of individual/team sports participation separately (intercept and slope; two models tested). The same covariates as those included in the ALT models were included in these analyses. Models were tested using Mplus version 7.4 (Muthén & Muthén, 2012) with robust maximum likelihood estimation, to obtain unbiased standard errors for the parameter estimates. As per the usual practice with this statistical package, missing data were handled using the full information maximum likelihood procedure.

Results

Univariate LGC Analyses

Linear and quadratic models were tested for the four variables of interest from ages 14 to 17. Differences in chi-squares were compared to identify the best-fitting model for each curve using the Satorra-Bentler correction. Models that provide a good fit to the data usually have nonsignificant chi-square values ($p > .05$), comparative fit indexes (CFI) greater than .95, and root mean square errors of approximation (RMSEAs) of less than .06 (Hu & Bentler, 1999). Results appear in Table 2. As can be seen from this table, for participation in individual sports, frequency of alcohol use, and frequency of intoxication, the linear model provided the best fit to the data. For participation in team sports, the quadratic model provided the best fit. For this

model, the variance around the quadratic slope had to be fixed to zero to facilitate model estimation. As can be seen in Table 2, the results for individual sports revealed a linear decrease over time, whereas the results for team sports revealed a steeper decrease by the end of high school. The results for both indicators of alcohol use revealed a linear increase over time. Significant variances were observed around the intercept and slope parameters of the four LGCs.

ALT Models

The main results for the ALT models are presented in Table 3 (for more information on the other parameters, see supplemental Tables S1 to S4). These models provided good fit to the data: (a) individual sports and frequency of alcohol use, $\chi^2(95) = 127.81$, $p = .014$, CFI = .962, RMSEA = .03 (.02, .05), (b) individual sports and intoxication, $\chi^2(107) = 156.16$, $p = .001$, CFI = .94, RMSEA = .04 (.02, .05), (c) team sports and frequency of alcohol use, $\chi^2(114) = 146.13$, $p = .023$, CFI= .972, RMSEA = .03 (.01, .04), and (d) team sports and intoxication, $\chi^2(105) = 165.85$, $p = .000$, CFI = .945, RMSEA = .04 (.03, .06).

For individual sports, beyond the control variables, the results revealed three significant predictive links with respect to frequency of alcohol use. First, frequency of alcohol use at age 15 predicted a decrease in hours spent in individual sports at age 16 (R^2 for individual sports at age 16 = 41%). Second, reciprocal effects were found between frequency of alcohol use and individual sports between ages 16 and 17: whereas alcohol use at age 16 predicted a decrease in hours spent in individual sports at age 17 (R^2 for individual sports at age 17 = 59%), hours spent in individual sports at age 16 predicted a decrease in alcohol use at age 17 (R^2 for frequency of alcohol use at age 17 = 60%). With respect to intoxication, the results revealed that frequency of intoxication at age 14 predicted a decrease in hours spent in individual sports at age 15 (R^2 for

individual sports at age 15 = 62%) and that hours spent in individual sports at age 15 predicted a decrease in frequency of intoxication at age 16 (R^2 for intoxication at age 16 = 67%).

As for team sports, the results revealed that the number of hours spent in team sports at age 15 predicted an increase in the frequency of alcohol use at age 16 (R^2 for alcohol use at age 16 = 60%). There were no significant associations with respect to intoxication.

Alcohol-Related Variables in Early Adulthood

Beyond the control variables, the only significant link in the two tested models indicated that the initial number of hours spent in individual sports predicted a lower frequency of intoxication at age 19 (beta = -.11, *SE* = .05, z = -2.04, p = .042, 95% CI = -.22, -.01; $\chi^2[112]$ = 146.60, p = .014, CFI = .937, RMSEA = .03 [.01, .04]; R^2 for frequency of intoxication at age 19 = 6%).

Discussion

Examining the role of organized sports in alcohol use during the adolescent and early adulthood years constitutes an important contribution to the literature given the public health concern represented by the risks associated with alcohol use during this period (Health Canada, 2014). Are sports good or bad for youths' health? The answer is complex. Overall, our findings revealed that team sports were risky for alcohol use during mid-adolescence, whereas individual sports were protective across the high school years. Moreover, whereas participation in team sports during adolescence was no longer associated with alcohol use two years after high school, the initial levels of participation in individual sports predicted lower scores on frequency of intoxication at age 19. Neither team nor individual sports were associated with problematic alcohol use in early adulthood.

Only one predictive association was found with respect to team sports and this association was observed during the mid-adolescence years, but not over the longer term. However, the results for team sports highlight the potential dynamic interplay between team sports and peer status and norms during the adolescent years. Being on a team usually gives youths higher social status at school (Sussman, Pokhrel, Ashmore, & Brown, 2007). Youths may tend to hang out with teammates after practices and games; if the norms in the team encourage alcohol use, then drinking alcohol and partying may become part of the team's culture. Moreover, this pattern appears to be especially important during the mid-adolescent years, when peer influence is at its peak (Steinberg & Monahan, 2007). As suggested by Vest and Simpkins (2013), these peer mechanisms should be tested in future research. Results from their study revealed that sports participation could be protective or risky for adolescents' alcohol use depending on the alcohol use of their sports friends and teammates. Moderators of this association should also be investigated, such as competitive versus non-competitive (Veliz et al., 2015) and high-status versus low-status team sports (e.g., football *vs*. rugby). On the other hand, the results also showed that involvement in team sports during the adolescent years did not represent a risk for intoxication during the high school years and beyond or for problematic alcohol use in early adulthood. This association thus appears to be embedded in a more normative, peer culture phenomenon during adolescence.

More associations were found with respect to individual sports during the adolescent years. Reciprocal effects were found between individual sports and both frequency of alcohol use and intoxication. Hours spent in individual sports predicted a decrease in alcohol use across the years from age 14 to 17 and alcohol use predicted a decrease in hours spent in individual sports across this same period. The latter results highlight the potential deleterious effects of alcohol use on individual performance. Individual sports also played a protective role against alcohol

intoxication at age 19. As noted by Wichstrom and Wichstrom (2009), involvement in endurance sports, which include most individual sports (e.g., swimming, martial arts, cross-country running, speed skating), may lower the occurrence of alcohol intoxication because athletes seek to avoid the negative affects of intoxication on their physical capacity. Thus, youths in individual sports may be more likely to remain focused on their own performance and less likely to be influenced by the drinking habits of other group members. Future research should thus further investigate the individual norms associated with alcohol use in individual sports, as well as their association with athletes' desire to achieve high levels of performance.

Overall, our results are consistent with past research showing a positive association between sports and alcohol use. What our study adds is that this association (a) was only true for team sports and only during the mid-adolescence years, (b) held up after using a precise measure of sports participation and controlling for hours spent in individual sports and other types of organized activities, and (c) tended to disappear as the youths grew older. It also highlights the potential protective effect of individual sports during and after the high school years. Our findings thus provide a more nuanced picture of the association between sports and alcohol use. However, participation in organized sports and alcohol use were self-reported, which may have inflated the covariance between the variables. The sample was also rather small, which limits the generalizability of the findings. In addition, other important covariates, such as sensation-seeking, were not examined in this study. Yet, as underlined by researchers (e.g., Dever et al., 2012; Dielh et al., 2012; Kwan et al., 2014), this variable might have a role to play in the association between sports and alcohol use and should be examined in future studies. Finally, sex was included as a covariate in the analyses. However, other studies have identified sex as a moderator of the relationship between physical activity and alcohol use (Buscemi, Martens, Murphy, Yurasek, &

Smith, 2011; Lisha, Martens, & Leventhal, 2011). Further research is thus needed to examine sex as a moderator in the associations between team and individual sports and alcohol use.

In conclusion, our results give parents, school staff, and policy makers sensitive information that could contribute to prevention and intervention efforts. Such efforts should be focused on team sports, especially during the mid-adolescent years when the influence of peers and social status play an important role. As noted by Veliz et al. (2015), organized sports offer no guarantees when it comes to endorsing a healthy lifestyle during adolescence. Future research should thus take a closer look at the conditions that make team sports risky for alcohol use (Vest & Simpkins, 2013). The question remains open regarding if, when, how, and for whom alcohol use can overshadow all the other positive aspects associated with team sports during adolescence.

References

Buscemi, J., Martens, M. P., Murphy, J. G., Yurasek, A. M., & Smith, A. E. (2011). Moderators of the relationship between physical activity and alcohol consumption in college students. *Journal of American College Health, 59*, 403-509. http://dx.doi.org//10.1080/07448481.2010.518326

Clark, H. J., Camiré, M., Wade, T. J., & Cairney, J. (2015). Sports and its association with social and psychological factors known to predict substance use and abuse among youth: A scoping review of the literature. *International Review of Sport and Exercise Psychology*, *8*(1), 224-250. http://dx.doi.org/10.1080/1750984X.2015.1068829.

Coie, J. D., & Dodge, K. A. (1983). Continuities and changes in children's social status: A five-year longitudinal study. *Merrill Palmer Quarterly*, *29*(3), 261-282.

Denault, A.-S., & Poulin, F. (2009). Predictors of adolescent participation in organized activities: A five-year longitudinal study. *Journal of Research on Adolescence*, *19*(2), 287-311. http://dx.doi.org/10.1111/j.1532-7795.2009.00597.x.

Denault, A.-S., & Poulin, F. (2007). Sports as peer socialization contexts. *ISSBD Newsletter*, *3*, 5-7.

Denault, A.-S., Poulin, F., & Pedersen, S. (2009). Intensity of participation in organized youth activities during the high school years: Longitudinal associations with adjustment. *Applied Developmental Psychology*, *13*(2), 74-87. http://dx.doi.org/10.1080/ 10888690902801459.

Dever, B. V., Schulenberg, J. E., Dworkin, J. B., O'Malley, P. M., Kloska, D. D., & Bachman, J. G. (2012). Predicting risk-taking with and without substance use: The effects of parental monitoring, school bonding, and sports participation. *Prevention Science*, *13*, 605-615. http://dx.doi.org/10.1007/s.11121-012-0288-z.

Dielh, K., Thiel, A., Zipfel, S., Mayer, J., Litaker, D. G., & Schneider, S. (2012). How healthy is the behavior of young athletes? A systematic literature review and meta-analyses. *Journal of Sports Science and Medicine*, *11*, 201-220.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1997). *Structured clinical interview for DSM-IV Axis I disorders, Research Version, Non-patient edition (SCID-I/NP)*. New York, NY: American Psychiatric Press.

Health Canada. (2014). *Health concerns*. http://www.hc-sc.gc.ca/hc-ps/alc/index-eng.php.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1-55. http://dx.doi.org/10.1080/10705519909540118.

Jones, B. L., Nagin, D. S., & Roeder, K. A. (2001). SAS procedure based on mixture models for estimating developmental trajectories. *Sociological Methods Research*, *29*(3), 374-393. http://dx.doi.org/10.1177/0049124101029003005.

Kerr, M., & Stattin, H. (2000). What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring. *Developmental Psychology*, *36*(3), 366-380. http://dx.doi.org/10.1037/0012-1649.36.3.366.

Kwan, M., Bobko, S., Faulkner, G., Donnelly, P., & Cairney, J. (2014). Sport participation and alcohol and illicit drug use in adolescents and young adults: A systematic review of longitudinal studies. *Addictive Behaviors, 39*, 497-605. http://dx.doi.org/10.1016/j.addbeh.2013.11.006.

Lisha, N. E., Martens, M., & Leventhal, A. M. (2011). Age and gender as moderators of the relationship between physical activity and alcohol use. *Addictive Behaviors, 36*, 933-936. http://dx.doi.org/10.1016/jaddbeh.2011.04.003.

Lisha, N. E., & Sussman, S. (2010). Relationship of high school and college sports participation with alcohol, tobacco, and illicit drug use: A review. *Addictive Behaviors*, *35*, 399-407. http://dx.doi.org/10.1016/j.addbeh.2009.12.032.

Lynne-Landsman, S. D., Bradshaw, C. P., & Ialongo, N. S. (2010). Testing a developmental cascade model of adolescent substance use trajectories and young adult adjustment. *Development and Psychopathology*, *22*(4), 933-948. http://dx.doi.org/10.1017/S0954579410000556.

Maggs, J. L., & Schulenberg, J. E. (2005). Trajectories of alcohol use during the transition to adulthood. *Alcohol Research & Health, 28*(4), 195-201.

Marsh, H. W., & Kleitman, S. (2003) School athletic participation: Mostly gain with little pain. *Journal of Sport & Exercise Psychology*, *25*, 205-228.

Mays, D., DePadilla, L., Thompson, N. J., Kushner, H. I., & Windle, M. (2010). Sports participation and problem alcohol use: A multi-wave national sample of adolescents. *American College of Preventive Medicine*, *38*(5), 491-498. http://dx.doi.org/10.1016/j.amepre.2010.01.023.

Mays, D., Gatti, M. E., & Thompson, N. J. (2011). Sports participation and alcohol use among adolescents: The impact of measurement and other research design elements, *Current Drug Abuse Reviews*, *4*, 98-109. http://dx.doi.org/10.2174/ 1874473711104020098.

Mays, D., Thompson, N., Kushner, H. I., Mays II, D. F., Farmer, D., & Windle, M. (2009). Sports-specific factors, perceived peer drinking, and alcohol-related behaviors among adolescents participating in school-based sports in Southwest Georgia. *Addictive Behaviors*, *35*, 235-241. http://dx.doi.org/10.1016/j.addbeh.2009.10.018.

Muthén, L. K., & Muthén, B. (2012). *Mplus statistical software.* Los Angeles, CA: Muthén & Muthén.

Peck, S., Vida, M., & Eccles, J. (2008). Adolescent pathways to adulthood drinking: sport activity involvement is not necessarily risky or protective. *Addiction*, *103*(Suppl. 1), 69-83. http://dx.doi.org/10.1111/j.1360-0443.2008.02177.x.

Pedersen, S. (2005). Urban adolescent's out-of-school activity profiles: Associations with youth, family, and school transition characteristics. *Applied Developmental Science*, *9*(2), 107-124.

Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption: II. *Addiction*, *88*(6), 791-804. http://dx.doi.org/10.1111/j.1360-0443.1993.tb02093.x.

Schulenberg, J., Patrick, M. E., Maslowsky, J., & Maggs, J. L. (2014). The epidemiology and etiology of adolescent substance use in developmental perspective. In M. Lewis, & K. D. Rudolph (Eds.), *Handbook of Developmental Psychopathology* (pp. 601-620). New-York, NY : Springer Science & Buiness Media. http://dx.doi.org/10.1007/978-1-4614-9608-3_30.

Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology*, *43*(6), 1531-1543. http://dx.doi.org/10.1037/0012-1649.43.6.1531.

Sussman, S., Pokhrel, P., Ashmore, R. D., & Brown, B. B. (2007). Adolescent peer group identification and characteristics: A review of the literature. *Addictive Behaviors*, *32*, 1602-1627. http://dx.doi.org/10.1016/j.addbeh.2006.11.018.

Tabachnik, B. G., & Fidell, L. S. (2013). *Using multivariate statistics*. Boston : Pearson.

Veliz, P. T., Boyd, C. J., & McCabe, S. E. (2015). Competitve sport involvement and substance use among adolescents: A Nationwide Study. *Substance Use and Misuse*, *50*(2), 156-165. http://dx.doi.org/10.3109/10826084.2014.962049.

Vest, A. E., & Simpkins, S. D. (2013). When is sports participation risky or protective for alcohol use? The role of teammates, friendships, and popularity. In J. A. Fredricks & S. D. Simpkins (Eds.), Organized out-of-school activities: Settings for peer relationships. *New Directions for Child and Adolescent Development, 140*, 37-55.

Wetherhill, R. R., & Fromme, K. (2007). Alcohol use, sexual activity, and perceived risk in high school athletes and non-athletes. *Journal of Adolescence Health*, *41*, 294-301. http://dx.doi.org/10.1016/j.jadohealth.2007.04.019.

Wichstrom, T., & Wichstrom, L. (2009). Does sport during adolescence prevent later alcohol, tobacco and cannabis use? *Addiction*, *104*, 138-149. http://dx.doi.org/10.1111/ j.1360-0443.2008.02422.x.

Windle, M., & Zucker, R. A. (2010). Reducing underage and young adult drinking: how to address critical drinking problems during this developmental period. *Alcohol Research & Health*, *33*(Suppl. 1-2), 29-44.

Table 1

Descriptive Statistics for the Study Variables (n = 310)

Variables	N	Range	Mean	SD	S	K
Organized activities variables						
Hours in individual sports – Age 14	285	0-242.8	27.32	58.58	2.59	6.16
Hours in individual sports – Age 15	285	0-173.2	18.01	43.72	2.63	5.93
Hours in individual sports – Age 16	293	0-194.9	19.87	48.44	2.57	5.58
Hours in individual sports – Age 17	290	0-173.2	11.12	35.91	3.64	12.80
Hours in team sports – Age 14	285	0-303.1	37.27	72.61	2.13	3.84
Hours in team sports – Age 15	285	0-303.1	32.84	71.76	2.41	5.25
Hours in team sports – Age 16	293	0-303.1	32.30	74.52	2.40	4.79
Hours in team sports – Age 17	290	0-212.2	21.10	54.95	2.70	6.10
Hours in other activities – Age 14	285	0-303.1	41.24	73.67	2.16	4.13
Hours in other activities – Age 15	285	0-303.1	37.58	71.14	2.43	5.80
Hours in other activities – Age 16	293	0-303.1	34.66	67.70	2.33	5.03
Hours in other activities – Age 17	290	0-220.8	30.68	60.63	2.07	3.16
Alcohol variables						
Frequency – Age 14	270	0-11	1.87	2.58	1.99	3.87
Frequency – Age 15	286	0-13	2.72	3.33	1.32	0.78
Frequency – Age 16	286	0-13	3.82	3.95	0.83	-0.57
Frequency – Age 17	281	0-13	4.69	4.15	0.51	-1.06
Intoxication – Age 14	264	0-6	0.58	1.38	2.71	6.79
Intoxication – Age 15	287	0-10	1.29	2.50	2.36	4.84
Intoxication – Age 16	286	0-13	1.80	3.21	2.03	3.11
Intoxication – Age 17	282	0-13	2.09	3.37	1.79	2.06
Frequency – Age 19	282	0-13	7.23	4.41	-0.34	-1.37
Intoxication – Age 19	282	0-13	2.61	3.88	1.54	1.04
Problematic use of alcohol – Age 19	281	0-8	1.67	1.55	1.17	1.47
Control variables (age 12)						
Sex	310	0-1	-	-	-	-
Family structure	308	0-1	-	-	-	-
Family income	230	0-13	10.76	2.95	-1.19	0.47
Parental education	243	2-21	13.03	2.63	-0.06	1.33
Parental monitoring	306	1.3-5.0	4.02	0.82	-0.92	0.34
Frequency of alcohol use	307	0-1	-	-	-	-
Problem behaviors	302	1-4.6	1.61	0.80	1.53	1.87
Deviant peers	296	1-4.7	1.96	0.88	0.88	0.28
Peer status	303	-5.1-4.9	0.04	1.59	-0.65	0.77

Note. SD = Standard deviation, S = Skewness, K = Kurtosis.

Table 2

Unconditional Growth Curve Model Fit Comparisons and Results

Model	Fit	$\Delta\chi^2$	i	s	q	var i	var s	var q
Individual sports								
Linear	**$\chi^2(13) = 13.10$, $p = .44$, CFI = 1.00, RMSEA = .01 (.00, .06)**	**-**	**2.91**	**-0.57**	**-**	***	**	**-**
Quadratic	Error message involving IS7	-	-	-	-	-	-	-
Team sports								
Linear	$\chi^2(13) = 65.08$, $p = .00$, CFI = 0.91, RMSEA = .11 (.09, .14)	-	4.17	-0.61	-	***	**	-
Quadratic	Error message involving S	-	-	-	-	-	-	-
Quadratic@0	**$\chi^2(12) = 59.14$, $p = .00$, CFI = .92, RMSEA = .11 (.08, .14).**	**5.94**	**3.66**	**0.43, *ns***	**-0.32**	***	***ns***	**-**
Frequency								
Linear	**$\chi^2(5) = 7.25$, $p = .20$, CFI = .99, RMSEA = .04 (.00, .09)**	**-**	**1.80**	**1.02**	**-**	***	***	**-**
Quadratic	Error message involving Q	-	-	-	-	-	-	-
Quadratic @0	$\chi^2(4) = 6.99$, p = .14, CFI= .99, RMSEA = .05 (.00, .11)	0.26, *ns*	1.81	0.93	0.04, *ns*	***	***	-
Intoxication								
Linear; alc5b with alc6b	**$\chi^2(4) = 13.49$, $p = .01$, CFI = .93, RMSEA = .09 (.04, .14)**	**-**	**0.57**	**0.58**	**-**	***	***	**-**
Quadratic	Error message involving Q	-	-	-	-	-	-	-
Quadratic@0	$\chi^2(4) = 10.09$, $p = .02$, CFI = .95, RMSEA = .09 (.03, .15)	3.40, *ns*	0.56	0.83	-.09, *ns*	***	***	-

Note. In bold = selected model, i = intercept, s = linear slope, q = quadratic slope, Var = variance, *ns* = nonsignificant.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3

Main Associations in the Autoregressive Latent Trajectory Models

Model	Beta	SE	z	*p*	95% CI
1. Individual sports and frequency of alcohol use					
Intercept spt → Slope alc	.21	.148	1.45	.148	-.08, .50
Intercept alc → Slope spt	.22	.173	1.29	.199	-.12, .51
Spt T4 → Alc T5	-.08	.048	-1.64	.102	-.17, .02
Spt T5 → Alc T6	-.09	.056	-1.63	.104	-.20, .02
Spt T6 → Alc T7	-.17*	.073	-2.32	.020	-.31, -.03
Alc T4 → Spt T5	-.07	.053	-1.42	.156	-.18, .03
Alc T5 → Spt T6	-.12*	.052	-2.22	.026	-.22, -.01
Alc T6 → Spt T7	-.30*	.117	-2.55	.011	-.53, -.07
2. Individual sports and intoxication					
Intercept spt → Slope alc	-.01	.138	-.06	.951	-.28, .26
Intercept alc → Slope spt	.13	.181	.72	.472	-.22, .48
Spt T4 → Alc T5	-.07	.042	-1.68	.092	-.15, .01
Spt T5 → Alc T6	-.12*	.061	-1.97	.048	-.24, -.00
Spt T6 → Alc T7	-.13	.106	-.19	.233	-.33, .08
Alc T4 → Spt T5	-.15**	.045	-3.23	.001	-.23, -.06
Alc T5 → Spt T6	-.12	.071	-1.65	.098	-.26, .02
Alc T6 → Spt T7	-.28	.166	-.166	.096	-.60, .05
3. Team sports and frequency of alcohol use					
Intercept spt → Slope alc	-.23	.276	-.82	.413	-.77, .32
Intercept alc → Slope spt	-.10	.183	-.55	.583	-.46, .26
Spt T4 → Alc T5	.08	.095	.92	.357	-.09, .24
Spt T5 → Alc T6	.29*	.115	2.49	.013	.06, .51
Spt T6 → Alc T7	.34	.192	1.78	.075	-.04, .72
Alc T4 → Spt T5	.03	.042	.79	.425	-.05, .12
Alc T5 → Spt T6	.04	.053	.80	.422	-.06, .15
Alc T6 → Spt T7	.22	.153	1.42	.155	-.08, .52
4. Team sports and intoxication					
Intercept spt → Slope alc	-.11	.448	-.25	.801	-.99, .76
Intercept alc → Slope spt	-.07	.240	-.28	.778	-.54, .40
Spt T4 → Alc T5	.12	.105	1.17	.244	-.08, .33
Spt T5 → Alc T6	.17	.203	.84	.403	-.23, .57
Spt T6 → Alc T7	.19	.291	.66	.509	-.38, .76
Alc T4 → Spt T5	.03	.039	.78	.436	-.05, .11
Alc T5 → Spt T6	.05	.081	.60	.550	-.11, .21
Alc T6 → Spt T7	.22	.22	.98	.330	-.22, .65

* $p < .05$, ** $p < .01$.

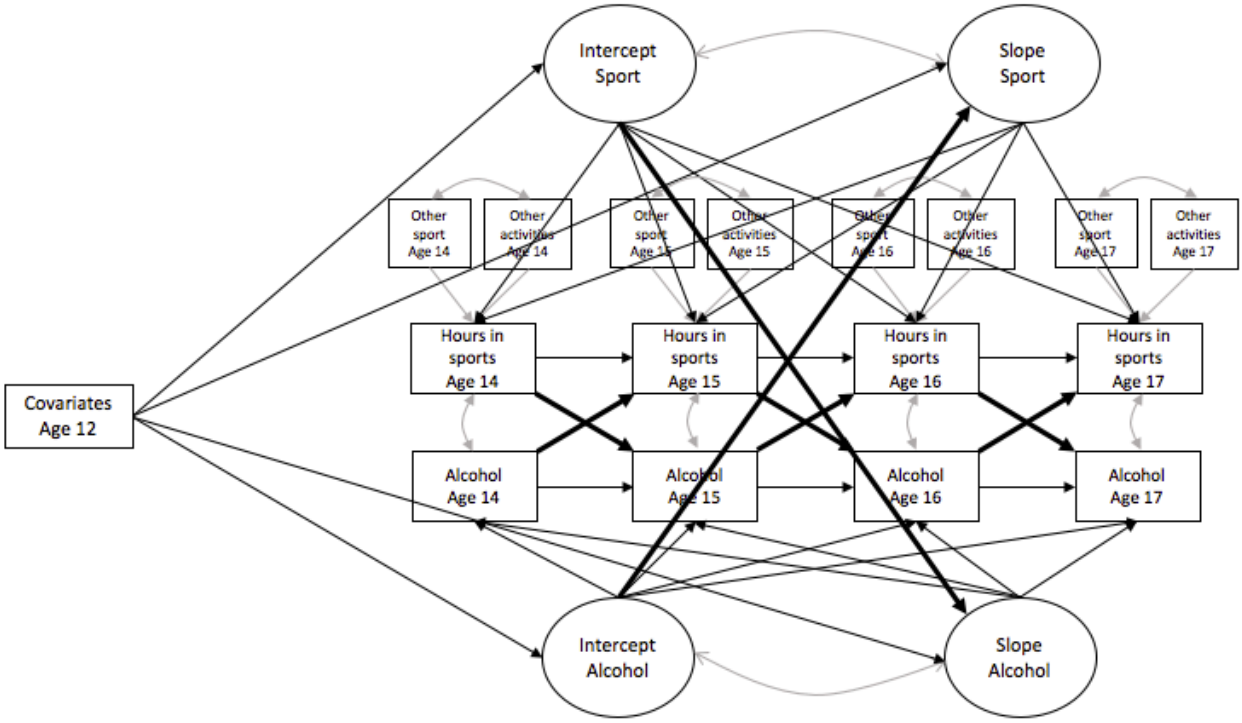

Figure 1. Example of an autoregressive latent trajectory model testing the predictive associations between the LGCs of hours spent in sports and alcohol use from ages 14 to 17, as well as their reciprocal associations. This model controls for hours spent in the other type of sports and other organized activities, and age 12 covariates.