Adolescent Athletic Participation and Nonmedical Adderall Use: An Exploratory Analysis of a Performance-Enhancing Drug

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ABSTRACT. Objective: A primary motive for adolescents and young adults to nonmedically use prescription stimulants is to help them study. Adolescents and young adults are using prescription stimulants, such as Adderall (amphetamine aspartate, amphetamine sulfate, dextroamphetamine saccharate, dextroamphetamine sulfate), as performance enhancers in certain social domains, including academics and sports. The purpose of this exploratory study was to examine the nonmedical use of Adderall (a commonly prescribed stimulant used nonmedically) among adolescents who participate in competitive sports. **Method:** The Monitoring the Future survey for 2010 and 2011, a representative sample of 8th- and 10th-grade students, surveyed involvement in competitive sports and nonmedical Adderall use among 21,137 adolescents. Past-year nonmedical use of Adderall served as the main outcome measure. Logistic regression analyses were run to examine whether sports participation in general and involvement in different types of competitive sports participation were associated with past-year nonmedical use of Adderall among males and females. **Results:** The odds of past-year nonmedical use of Adderall among males were higher for male respondents who participated in lacrosse (adjusted odds ratio [AOR] = 2.52, 95% CI [1.20, 5.29]) and wrestling (AOR = 1.74, 95% CI [1.01, 2.98]). However, no particular sport among females was found to be associated with past-year nonmedical use of Adderall. **Conclusions:** Certain extracurricular activities, such as high-contact sports, may influence male participants to misuse prescription stimulants as performance enhancers either on or off the playing field. (*J. Stud. Alcohol Drugs, 74,* 714–719, 2013)

THE NONMEDICAL USE OF PRESCRIPTION stimulants (i.e., taking medications without a doctor's orders) as a cognitive performance enhancer among adolescents and young adults has produced an upsurge of research and public debate over the past several years (Arria et al., 2008a, 2008b, 2013; Arria and DuPont, 2010; Rabiner et al., 2009; Teter et al., 2005, 2006). Currently, 1.2% of people ages 12–17 years and 3.1% of people ages 18–25 years have nonmedically used stimulants during the past year (Substance Abuse and Mental Health Services Administration, 2012). Among the various prescription stimulants being used nonmedically by adolescents and college students, Adderall (amphetamine aspartate, amphetamine sulfate, dextroamphetamine saccharate, dextroamphetamine sulfate) is the most common (Arria et al., 2008a; Johnston et al., 2012c; Teter et al., 2006). Interestingly, the popularity of nonmedically using prescription stimulants among adolescents and young adults is not only to simply get high but also to help them concentrate and study (Arria et al., 2008a; Garnier-Dykstra et al., 2012; Johnston et al., 2012a; Teter et al., 2006). For instance, 49% of high school seniors who nonmedically used stimulants during the past year indicated that they used these medications to help them study, whereas 36% indicated using stimulants nonmedically to feel good or get high (Johnston et al., 2012a).

Despite the groundswell of attention focusing on the nonmedical use of prescription stimulants for the purpose of enhancing cognitive performance within the academic realm, there has been a lack of research to examine if these "smart drugs" (i.e., Adderall) will be misused in other competitive domains where people seek an advantage over their peers—namely, sports. To date, primarily anecdotal evidence from the media has addressed how professional athletes nonmedically use Adderall to combat fatigue on the playing field, with some athletes being fined or suspended for using this banned performance-enhancing substance (Cohen, 2012; Moore and Corbett, 2012). Unfortunately, the extent of this problem surrounding the nonmedical use of Adderall among athletes at the professional and amateur levels is relatively unknown within the empirical literature on prescription stimulant misuse (Lakhan and Kirchgessner, 2012).

Accordingly, the major objective for this exploratory investigation was to examine the relationship between sports participation and nonmedical Adderall use among adolescents. It is hypothesized that sports participants who nonmedically use Adderall are engaging in what Hughes and Coakley (1991) refer to as positive deviance. In other words, given that some sports socialize participants to a set of normative behaviors that facilitate either counter-conformity or over-conformity (e.g., positive deviance—using performance-enhancing drugs to be the best), we ex-

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pect that male adolescents who participate in highly competitive and masculine sports (e.g., football) will be at a greater risk to engage in certain forms of positive deviance (i.e., nonmedical use of Adderall) because their identities hinge on competent performances in these sports (Connell, 1987, 1995; Hughes and Coakley, 1991; Messner, 1990a; Messner and Sabo, 1990). Using data from the Monitoring the Future (MTF) study, we explore this hypothesized relationship by examining the association between sports participation (i.e., sports participation in general, and involvement in different types of sports) and the odds of past-year nonmedical use of Adderall among adolescent males and females.

Method

Sample and procedure

The data analyzed here were collected as part of the MTF study of U.S. secondary school students, which is an annual cross-sectional survey (Johnston et al., 2012b). The MTF study surveys adolescents on a range of topics such as substance use, academic performance, and competitive sports participation. For the purposes of these analyses, MTF data collected from 8th- and 10th-grade students during 2010 and 2011 were merged, allowing us to capture a large sample of adolescents who have nonmedically used Adderall during the past year. Merging data for 2010 and 2011 resulted in a total unweighted sample size of 21,137 respondents. Respondents with any missing data among the variables used in the analyses were excluded, leaving a final unweighted sample size of 15,334 adolescents (7,293 females and 8,041 males). Although 27% of the total sample was excluded from the analysis, the final sample and total sample were relatively comparable across several key demographic characteristics such as gender (51% female in total sample vs. 52% female in final sample), grade level (49% 10th graders in total sample vs. 52% 10th graders in final sample), and race (56% non-Hispanic White, 12% non-Hispanic Black, 15% Hispanic, and 18% "missing" race in total sample vs. 61% non-Hispanic White, 10% non-Hispanic Black, 14% Hispanic, and 15% "missing" race in final sample). However, caution should be given when generalizing to the population because the final sample was skewed toward higher achieving students (i.e., the strongest predictor of missing at least one item among the variables used in the study was self-reported grades: $r = -.123$, $p < .001$).

Past-year nonmedical use of Adderall. The dependent measure used in the analyses, past-year nonmedical use of Adderall, was measured from the following question: "During the LAST 12 MONTHS, on how many occasions (if any) have you taken Adderall (without a doctor's orders)?" There were seven response categories that ranged from 1 (*0 occasions*) to 7 (*40 or more*). For the purposes of this study, the responses were collapsed into two groups: "did not nonmedically use Adderall during the past year" versus "did nonmedically use Adderall during the past year." Among the final sample used in the study, 3.7% of males and 3.1% of females indicated using Adderall nonmedically during the past year.

Athletic participation. The key independent variables used in the analyses focused on participation in competitive sports during the past year. The primary question provided to respondents was as follows: "In which competitive sports (if any) did you participate during the LAST 12 MONTHS? Include school, community, and other organized sports. (Mark all that apply.)" The competitive sports that respondents were able to select (but were not limited to) included baseball, basketball, cheerleading, crew, cross country, equestrian, field hockey, football, golf, gymnastics, ice hockey, lacrosse, soccer, swimming, tennis, track and field, volleyball, water polo, wrestling, and "other" sports (i.e., "other" sports was a response option that respondents could select in the MTF survey). For the analyses, each of the 20 different sports listed above was treated as a separate binary variable (e.g., baseball: 0 = *does not participate in baseball,* 1 = *does participate in baseball;* basketball: 0 = *does not participate in basketball,* 1 = *does participate in basketball;* etc.). Furthermore, two additional measures were constructed to examine the overall impact of competitive sports participation. First, a binary measure was constructed to capture participation in any competitive sports during the past year; if participants indicated participating in any of the 20 different sports, they were given a value of 1, whereas respondents who did not select any of the 20 different sports were assigned a value of 0. Second, a continuous measure was also constructed to measure the number of different competitive sports adolescents were involved with during the past year. According to the final sample, 84% of males and 78% of females indicated participating in at least one competitive sport during the past year, with the typical male athlete ($M = 2.58$) participating in three different sports and the typical female athlete ($M = 2.26$) participating in two different sports (Table 2 provides the percentage of males and females involved in the different types of competitive sports).

Control variables. Several variables from the MTF were used in the analysis as control variables and included the following measures: survey year (2011: 50.4%, and 2010: 49.6% [reference category]); region of the United States where the respondent lived (North Central: 25.8%; South: 34.5%; West: 20.1%; Northeast: 19.6% [reference category]); geographic location of respondent's residence at the time of the survey (lives in the country/on a farm: 18.4%; lives in the city: 81.6% [reference category]); whether the respondent lived in a two-parent household (lives in a single-parent household: 22%; lives in a two-parent household: 78% [reference category]); the highest level of education of the respondent's mother (college degree or higher: 49.9%; some college: 17.8%; high school degree only: 22.1%; less

than a high school degree: 10.2% [reference category]); gender of respondent (female: 52.4%; male: 47.6% [reference category]); race of respondent (non-Hispanic Black: 9.7%; Hispanic: 13.7%; "missing race": 15.4%; non-Hispanic White: 61.2% [reference category]); grade level of respondent (10th grade: 52.5%; 8th grade: 47.5% [reference category]); respondent's self-reported grades in school during the past year (possible values for this continuous measure range from D [0] to A [8]; $M = 5.4$, B average); whether the respondent had worked in a paid job during the school year (did work a paid job during the school year: 24.4%; did not work a paid job during the school year: 75.6% [reference category]); participated in the school newspaper or yearbook (participated: 16.4%; did not participate: 83.6% [reference category]); participated in music or other performing arts at school (participated: 41.5%; did not participate: 58.5% [reference category]), participated in other school clubs or activities (participated: 56%; did not participate: 44% [reference category]); and actively participates in sports, athletics, or exercising almost every day (actively participates almost every day: 55.3%; participates once a week at the most: 44.7% [reference category]).

Moreover, an additional control variable was included in the analyses to account for previous and current exposure to stimulant medications that were specifically prescribed to respondents to treat disorders such as attention-deficit/hyperactivity disorder (ADHD). Current and past medical use of prescription stimulants was measured with the fol-

TABLE 1. Adjusted odds ratios (AORs) for past-year nonmedical use of Adderall and athletic participation (global measure of participation and total number of sports)

	Male sample (n = 7,293)				Female sample (n = 8,041)			
	Model 1		Model 2		Model 3		Model 4	
Variable	AOR	[95% CI]	AOR	[95% CI]	AOR	[95% CI]	AOR	[95% CI]
Control variables								
2011	0.968	[0.676, 1.38]	0.969	[0.677, 1.39]	0.877	[0.603, 1.28]	0.872	[0.600, 1.27]
Region								
North Central	1.34	[0.783, 2.29]	1.35	[0.790, 2.31]	1.57	[0.858, 2.88]	1.61	[0.871, 2.96]
South	1.04	[0.598, 1.82]	1.05	[0.604, 1.84]	1.00	[0.534, 1.87]	1.03	[0.549, 1.95]
West	0.528	[0.262, 1.06]	0.531	[0.263, 1.07]	0.960	[0.486, 1.90]	0.964	[0.486, 1.91]
Lives in the country/farm	0.917	[0.586, 1.44]	0.916	[0.586, 1.43]	0.844	[0.505, 1.41]	0.835	[0.499, 1.40]
Single-parent family	1.62	[1.08, 2.43]	1.62	[1.08, 2.43]	1.60	[1.05, 2.44]	1.61	[1.06, 2.45]
Highest level of education of the respondent's mother								
Mother has high school degree only	1.05	[0.506, 2.20]	1.049	[0.503, 2.18]	0.693	[0.368, 1.30]	0.690	[0.367, 1.30]
Mother has some college	1.116	[0.528, 2.36]	1.121	[0.532, 2.36]	0.902	[0.474, 1.72]	0.880	[0.463, 1.67]
Mother has college degree or higher	1.095	[0.541, 2.22]	1.097	[0.543, 2.22]	0.693	[0.373, 1.28]	0.665	[0.360, 1.23]
10th grade	2.94	[1.92, 4.50]	2.95	[1.91, 4.57]	2.09	[1.39, 3.13]	2.26	[1.50, 3.39]
Race								
Non-Hispanic Black	0.280	[0.117, 0.672]	0.288	[0.120, 0.692]	0.243	[0.087, 0.684]	0.247	[0.088, 0.696]
Hispanic	0.640	[0.322, 1.27]	0.647	[0.326, 1.28]	0.559	[0.278, 1.12]	0.550	[0.275, 1.10]
"Missing" race	0.817	[0.468, 1.43]	0.819	[0.469, 1.43]	0.835	[0.474, 1.47]	0.826	[0.469, 1.46]
Medical use of Rx stimulants								
Medically used Rx stimulants in the past (not currently)	3.12	[1.84, 5.32]	3.11	[1.82, 5.30]	6.56	[3.92, 11.0]	6.51	[3.91, 10.9]
Medically uses Rx stimulants (currently)	2.64	[1.34, 5.17]	2.65	[1.35, 5.19]	4.03	[1.85, 8.78]	4.00	[1.85, 8.65]
Self-reported grades in school	0.767	[0.702, 0.838]	0.770	[0.705, 0.841]	0.809	[0.736, 0.889]	0.807	[0.735, 0.887]
Has a (paying) job	1.45	[0.99, 2.14]	1.47	[1.00, 2.16]	1.10	[0.701, 1.73]	1.07	[0.685, 1.68]
Activity involvement								
Involved in the school newspaper/ yearbook	1.76	[1.04, 2.99]	1.76	[1.03, 3.00]	1.27	[0.767. 2.11]	1.24	[0.750, 2.06]
Involved in music or performing arts at school	0.841	[0.560, 1.26]	0.833	[0.555, 1.25]	0.924	[0.629, 1.36]	0.898	[0.614, 1.31]
Involved in other school clubs or activities	0.833	[0.558, 1.24]	0.832	[0.559, 1.24]	0.548	[0.366, 0.821]	0.523	[0.350, 0.781]
Actively participates in sports almost every day	0.914	[0.617, 1.35]	0.943	[0.637, 1.40]	1.003	[0.643, 1.56]	0.872	[0.573, 1.33]
Main independent variables								
Participates in competitive sports (in at least 1 of the 20 sports)	1.30	[0.789, 2.14]	–	–	0.802	[0.502, 1.28]	–	–
Total number of competitive sports respondent is involved with	–	–	1.04	[0.936, 1.15]	–	–	1.07	[0.948, 1.21]
McFadden pseudo R^2	.117[a]		.117[a]		.142[a]		.143[a]	

Notes: CI = confidence interval; Rx = prescription; – = variables were not included in the model. [a]McFadden's pseudo R^2 was calculated without taking the complex survey design into consideration.

lowing item: "Have you ever taken any of these stimulant-type prescription drugs (i.e., Ritalin, Adderall, Concerta, Metadate, Dexedrine, Focalin, Cylert, and others) under a doctor's supervision for these conditions (i.e., attention deficit disorder, hyperactivity, or both [ADHD])?" Respondents could choose from three options that included "no"; "yes, in the past, but not now"; and "yes, I take them now." "Yes, I take them now" represented current medical use of prescription stimulants (3.2%) and "yes, in the past, but not now" represented previous medical use of prescription stimulants (4.7%), whereas respondents who had never been prescribed stimulants served as the reference category (92.1%).

Analytic procedure

Three sets of logistic regression models were used to model past-year nonmedical use of Adderall by competitive sports participation for males and females separately. The first set of models (Models 1 and 3) included a logistic regression analysis that examined whether respondents who participated in any competitive sport had higher odds of past-year nonmedical use of Adderall when compared with respondents who do not participate in any competitive sports. The second set of logistic regression models (Models 2 and 4) examined whether an increase in the number of different sports males and females participated in was associated with an increase in the odds of past-year nonmedical use of Adderall. Finally, the third set of models (Models 5 and 6) included each of the 20 different sports in the multivariate logistic regression analysis to examine whether respondents who participated in certain sports had higher odds of past-year nonmedical use of Adderall.

The multistage sampling design used for MTF resulted in clustering of the data, which may cause some overstatement of the statistical significance of results when conducting analyses that do not account for the complex sampling. Because MTF did not provide the information needed to account for the complex sampling design (e.g., primary sampling unit and Strata variables) in the public-use data files, West and McCabe's (2012) Stata program (Stata .ado file – deft2corr) was used to apply the appropriate adjustments to the variance estimates in the logistic regression models. Accordingly, the 95% confidence intervals (CIs) provided in the tables reflect the adjustments made to account for the complex sampling procedure in the MTF data.

Results

Models 1 and 3 in Table 1 included the global measure of competitive sports participation (i.e., participated in at least 1 of the 20 sports listed) and revealed no differences in past-year nonmedical use of Adderall between participants

TABLE 2. Percentage of respondents involved in each sport and the adjusted odds ratios (AORs) for past-year nonmedical use of Adderall, by different types of sports participation

	Male sample (n = 7,293)				Female sample (n = 8,041)			
	% involved in each sport		Model 5 AOR		% involved in each sport		Model 6 AOR	
Sport	n	%	AOR	[95% CI]	n	%	AOR	[95% CI]
Baseball	1,711	23.5	0.849	[0.513, 1.40]	1,417	17.6	1.11	[0.676, 1.84]
Basketball	2,830	38.8	1.05	[0.675, 1.207]	1,849	23.0	1.07	[0.626, 1.82]
Cheerleading	38	0.5	0.877	[0.097, 7.95]	1,102	13.7	1.17	[0.634, 2.18]
Crew	88	1.2	1.67	[0.316, 8.81]	62	0.8	1.24	[0.161, 9.62]
Cross country	405	5.6	0.940	[0.307, 2.88]	369	4.6	1.71	[0.679, 4.31]
Equestrian	29	0.4	1.70	[0.187, 15.5]	180	2.2	1.12	[0.293, 4.26]
Field hockey	102	1.4	0.691	[0.067, 7.15]	186	2.3	0.197	[0.014, 2.74]
Football	2,904	39.8	1.25	[0.834, 1.88]	326	4.1	2.21	[0.997, 4.91]
Golf	758	10.4	1.53	[0.831, 2.83]	222	2.8	1.58	[0.520, 4.78]
Gymnastics	78	1.1	1.09	[0.114, 10.5]	531	6.6	1.23	[0.556, 2.71]
Ice hockey	244	3.3	0.956	[0.347, 2.64]	51	0.6	0.474	[0.042, 5.29]
Lacrosse	336	4.6	2.52	[1.20, 5.29]	220	2.7	0.394	[0.047, 3.28]
Soccer	1,435	19.7	0.844	[0.464, 1.54]	1,482	18.4	1.19	[0.696, 2.03]
Swimming	628	8.6	0.734	[0.321, 1.68]	895	11.1	0.436	[0.178, 1.06]
Tennis	493	6.8	0.470	[0.155, 1.43]	636	7.9	0.852	[0.362, 2.00]
Track and field	1,298	17.8	0.921	[0.501, 1.69]	1,350	16.8	1.41	[0.786, 2.53]
Volleyball	433	5.9	0.708	[0.239, 2.10]	1,980	24.6	0.725	[0.425, 1.24]
Water polo	87	1.2	0.368	[0.015, 8.84]	59	0.7	3.66	[0.686, 19.5]
Wrestling	775	10.6	1.74	[1.01, 2.98]	91	1.1	1.23	[0.273, 5.52]
Other sport	1,236	16.9	1.40	[0.882, 2.21]	1,608	20.0	1.02	[0.623, 1.67]
McFadden pseudo R^2			.132[a]				.153[a]	

Notes: AOR and CI are for 2011. Not shown in this table are the following variables: North Central, South, West, lives in the country/farm, single-parent family, high school degree only, some college, college or higher, 10th grade, non-Hispanic Black, Hispanic, "missing" race, past medical stimulant use, current medical stimulant use, self-reported grades, has a paying job, involved in the school newspaper/yearbook, involved in music or performing arts at school, involved in other activities at school, and actively participates in sports almost every day. CI = confidence interval. [a]McFadden's pseudo R^2 was calculated without taking the complex survey design into consideration.

and nonparticipants in competitive sports for either males (adjusted odds ratio [AOR] = 1.30, 95% CI [0.789, 2.14]) or females (AOR = 0.802, 95% CI [0.502, 1.28]). Similarly, Models 2 and 4 indicated no significant association between the number of different competitive sports adolescents participated in during the past year and nonmedical use of Adderall for either males (AOR = 1.04, 95% CI [0.936, 1.15]) or females (AOR = 1.07, 95% CI [0.948, 1.21]). However, when each of the 20 different sports were entered into the logistic regression model simultaneously (AOR for control variables were not shown in Table 2), we found that certain sports were more predictive of past-year nonmedical use of Adderall for males but not females. Model 5 in Table 2 indicated that males participating in lacrosse (AOR = 2.52, 95% CI [1.20, 5.29]) and wrestling (AOR = 1.74, 95% CI [1.01, 2.98]) were associated with significantly higher odds of past-year nonmedical use of Adderall when compared with their male peers who did not participate in these sports.

Discussion

Among the 8th- and 10th-grade students sampled by the MTF survey during 2010 and 2011, approximately 3.7% of males and 3.1% of females nonmedically used Adderall during the past year. Interestingly, the odds of past-year nonmedical use of Adderall among males were higher for male respondents who participated in lacrosse and wrestling. However, no particular sport among females was found to be associated with past-year nonmedical use of Adderall.

These findings suggest that there is some link between the nonmedical use of Adderall and participating in certain types of sports that facilitate the misuse of Adderall among males. The above findings may suggest that males who participate in lacrosse and wrestling are at a greater risk for using Adderall nonmedically to enhance their performance on the playing field (i.e., a form of positive deviance). Although this study cannot fully determine if these participants used Adderall nonmedically to enhance their performance in their respective sports, it does identify a population of adolescents who are at a greater risk for using prescription stimulants nonmedically. Despite this limitation, the sports found to be associated with higher odds of past-year nonmedical use of Adderall are male-dominated sports at the high school level (National Federation of State High School Associations, 2012). Given that sports are highly valued for social status among male adolescents, these sport participants may resort to using performing-enhancing substances, such as Adderall, to gain an advantage on the playing field to enhance their social status among their peers (Shakib et al., 2011). Moreover, the chances of using performance enhancers may be further exacerbated by the propensity of male athletes to define their self-worth based on competent athletic performances in order to maintain highly valued relationships with either their fathers, coaches, or male peers (Messner, 1990a, 1990b).

The sports found to be associated with greater odds of past-year nonmedical use of Adderall were high-contact sports. Several studies from the National Collegiate Athletic Association on college athletes also found that participants in lacrosse (12.2%), wrestling (7.6%), and ice hockey (6.0%) had the highest prevalence of using amphetamines in 2009 (Bracken, 2012). Intriguingly, these studies also found that amphetamines were primarily taken after practice or competition. This may suggest that the amount of physical damage that athletes in high-contact sports endure requires a boost of energy to handle their academic commitments in order to remain eligible for competition. Accordingly, this may parallel what is happening among high school adolescents who participate in these high-contact sports (i.e., student athletes who are trying to balance their academic studies and extracurricular activities).

Finally, one of the major strengths of this exploratory study is that it is one of the first to examine the relationship between athletics and Adderall use among adolescents, and it shows that there is a modest relationship between participating in certain types of sports and past-year nonmedical use of Adderall among males. Moreover, the analyses accounted for several other school-based extracurricular activities that adolescents commonly participate in during the school year. Several associations that need further examination emerged among these school-based extracurricular activities. Namely, males who participated in the school newspaper or yearbook had higher odds of past-year nonmedical use of Adderall, whereas participation in other extracurricular activities lowered the odds of past-year nonmedical use of Adderall for both males and females. These associations in non-sport-related extracurricular activities need to be examined in more detail to understand why some activities elevate the risk of misusing prescription stimulants whereas others lower the risk. Given the major emphasis on adolescents and young adults in the new millennium to build a well-rounded portfolio to be competitive in the college admissions process, further research is needed to examine how all of these different extracurricular activities affect the well-being of adolescents and young adults (Arum and Roksa, 2010; Guest and Schneider, 2003; Schneider and Stevenson, 1999). As a final point, the results of this study must be interpreted with some caution because of a substantial number of respondents who were excluded from the analysis (27% of the total sample). The sample used for this study is skewed toward higher achieving students who are involved in multiple extracurricular activities; therefore, the conclusions from this study may not be entirely generalizable to the entire population of students.

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