

Examination of the Impact of Substance Use on Sport Training and Competition in Collegiate Athletes

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Abstract

Objectives: There is a need to psychometrically develop self-report measures of substance use in athletes, particularly those that assess the impact substance use has on sport performance. *Method:* In this study, a four-item measure assessing the extent to which alcohol and illicit drug use interfere with sport performance in training and competition, validated measures of psychiatric symptomology and substance use frequency, and a structured clinical interview assessing substance use diagnostic criteria were administered (N=285 athletes). *Results:* One-week test-retest reliability of the four-item measure was good, and positive relationships between this set of items and validated measures of psychiatric symptomology, substance use frequency, and age were found. Males demonstrated higher scores on the four-item measure, and its scores were not influenced by ethnicity and athlete type (NCAA, club, intramural). In a sub-sample of 74 participants who reported substance use and interest in pursuing psychological intervention, there was a non-significant trend for participants who were diagnosed with a substance use disorder to demonstrate higher scores on the four-item measure of substance use interference with sport performance than participants who were not diagnosed with a current substance use disorder ($p = .08$). *Conclusion:* Results suggest the developed four-item measure may be helpful in determining the extent to which substance use impacts sport training and competition in collegiate athletes.

Keywords: athlete, sport, mental health, substance use, assessment

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Studies of drug and alcohol use in collegiate athletes have chiefly focused on the assessment of substance use prevalence rates, usually comparing rates among sub-populations of elite collegiate athletes utilizing non-validated surveys (Buckman et al., 2011; Martens et al., 2006; NCAA, 2013). Research examining the negative consequences of alcohol and drug use in collegiate athletes' life outside of sports is emerging (NCAA, 2022). However, the impact of substance use on collegiate athletes' performance in sports training and competition has yet to be explored (Donohue et al., 2018).

Accurately assessing substance use can be a challenge (van den Berg et al., 2018). Indeed, the accuracy of substance use self-reporting practices have been questioned within the context of sports due to negative consequences associated with reporting substance use (Williams & Nowatzki, 2005). For instance, the most cited prevalence studies of substance use among collegiate athletes have been conducted by the National Collegiate Athletic Association (NCAA, 2013). The NCAA explicitly indicates there are no consequences to reporting illicit substance use in surveys administered by this organization. However, there are co-existing rules governed by this organization that consequence NCAA athletes when illicit substance use is determined to occur in contexts outside these survey administrations, making it difficult to compare rates of substances between NCAA athletes and intramural and club sport athletes. Along these lines, the context in which collegiate athletes are assessed plays a vital role in the truthfulness of responses, as reports of substance use are likely to be biased when perceived adverse consequences for reporting substance use are present (van den Berg et al., 2018).

The most widely used assessment

of substance use involves quantity or frequency (Martin et al., 2021), which may be impacted by errors due to memory lapses. The Timeline Follow-back incorporates a calendar with substance-associated events to aid recall (TLFB) (Sobell et al., 1986). The TLFB has demonstrated psychometric support in various non-athlete populations (Donohue, Azrin, et al., 2004; Panza et al., 2012), and in collegiate athletes this measure has successfully measured changes in substance use outcomes (Donohue et al., 2018). However, the TLFB, consistent with other self-report frequency measures of substance use, has yet to be psychometrically examined in collegiate athletes who may be inherently less likely than non-athletes to report substance use.

The Structured Clinical Interview for DSM-5 (SCID-5) (First et al., 2016) assesses presence or absence of mental health disorders, including substance use disorders. This instrument has acceptable reliability and validity in determining the presence or absence of substance use disorders, and is arguably the most frequently used diagnostic measure of substance use in non-athlete adults. However, consistent with other diagnostic methods, this measure has yet to be examined in collegiate athletes.

The Sport Interference Checklist (SIC) (Donohue et al., 2007) was developed as a screening instrument to assess the extent to which various mental health associated factors interfere with sport performance during training (Problems in Sport Training Scale; PSTS) and competition (Problems in Sport Competition Scale; PSCS) using a *never* (1) to *always* (7) response scale. This 26-item measure has demonstrated validity and reliability in collegiate athletes (Donohue et al., 2007; Donohue et al., 2019; Donohue et al., 2020). However, the SIC does not assess the

impact of illicit drug and alcohol use on sport performance. In the current study, the aforementioned SIC response scale was used to complement a set of four-item stems hypothesized to assess the impact alcohol use (2 items) and illicit drug use (2 items) have on sport performance (i.e., *How often does alcohol use interfere with your performance in training, and separately, in competition; How often does drug use, or use of prescribed drugs more than a medical doctor's prescription, interfere with your performance in training, and separately, in competition*). A potential benefit to using the SIC format is that athletes may be more compelled to report the negative impact of substance use on sport performance than non-sport consequences (van den Berg et al., 2018), and knowing the impact of substance use on sport performance is important to intervention planning.

Based on the adverse effects substance use has in sport training and competition (e.g., injury), and the lack of psychometric examination of assessment measures of substance use in athletes, there is a need to comprehensively evaluate the impact that substance use has on sport performance. Indeed, sport-specific substance use assessments within the college athlete population are limited, and existing survey methods of substance use are highly susceptible to false negatives. Lastly, substance use diagnostic interviews have yet to undergo psychometric examination in athlete populations. Therefore, in this study, multiple methods of assessing substance use were concurrently administered to collegiate athletes who were involved in one of three levels of collegiate athlete competition (NCAA, club, intramural) to examine psychometric properties of the aforementioned four-item measure assessing perceived impact of drug and alcohol use on sport performance, in-

cluding its test-retest reliability, concurrent validity, and relationship with an established measure of psychiatric symptomatology. Unique to existing studies, a certificate of confidentiality from the National Institutes of Health was obtained to protect the participants' data from being disclosed to others when requested, even in the event of court and university mandates. It was hypothesized that participants with substance use disorders would evidence higher scores on the four-item substance use interference measure than participants who were not assessed to evidence these disorders. Lastly, relationships between the four-item substance use interference with sport scores and age, gender, ethnicity/race, year in school, and level of competition were examined.

Method

Participants

Demographic data for the overall sample (285) are presented in Table 1. Five of the participants did not provide demographic data. As can be seen, most of the participants were in the NCAA, approximately 20 years old, male, White/Caucasian, and freshmen.

Procedures

There was no patient and public involvement in the design, conduct, reporting, or dissemination plans of this research. Participants were enrolled in a Division 1 southwestern university in the United States. They were referred by various sources to determine their interest in participating in goal-oriented programming aimed at performance optimization in sports and life (Donohue et al., 2021). Three hundred and sixteen athletes were referred, and 285 agreed to complete consent and an initial assessment consisting of demographic ques-

Table 1

Participant Demographics for Overall Sample

Demographic	<i>M</i>	<i>SD</i>
Age in Years	19.87	1.99
Gender		%
<i>Male</i>	145	51.8
<i>Female</i>	135	48.2
Ethnicity		
<i>White/Caucasian</i>	111	39.6
<i>Black/African-American</i>	43	15.4
<i>Asian/Asian American</i>	24	8.6
<i>Hispanic/Latino</i>	32	11.4
<i>Pacific Islander</i>	11	3.9
<i>Other (multiple or not listed)</i>	59	21.1
Year in school		
<i>Freshman</i>	102	36.4
<i>Sophomore</i>	83	29.6
<i>Junior</i>	60	21.4
<i>Senior</i>	35	12.5
Athlete Type		
<i>NCAA</i>	124	44.3
<i>Club</i>	33	11.8
<i>Intramural</i>	123	43.9

Note. $n = 280$. _ = frequency. Five participants did not provide demographic data and were excluded from Table 1.

tions, psychiatric functioning and the aforementioned four-item questionnaire assessing the impact of alcohol and drug use on sport training and competition. Participants were then randomly assigned to one of two standardized interviews developed to facilitate engagement in intervention programming (Donohue et al., 2020). Seventy-four participants who reported drug and/or alcohol use and interest in receiving psychological intervention were scheduled for a second psychological assessment battery one week after the initial assessment was

completed. This second battery included re-administration of the four-item measure of substance use impact on sport performance and psychiatric measures, as well as a semi-structured diagnostic measure of substance use disorders and substance use frequency.

To participate in the first assessment phase, participants had to be at least 18 years old, actively participate in an official university club, intramural, or NCAA sport, and report alcohol or non-prescribed drug use during the previous four months. To participate in

the second assessment phase, participants had to agree to invite at least one significant other to attend 12 scheduled intervention sessions across four months and be available for a follow-up assessment eight months post-randomization to one of the interventions. The University's Institutional Review Board approved this study, and participants' confidentiality specific to study data was legally protected due to a Certificate of Confidentiality from the National Institutes of Health. Deidentified data will be provided upon request. The study was supported by a grant from the National Institute on Drug Abuse (1 R01 DA031828). Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of the research.

Measures

Items assessing the impact of substance use on sport performance. To determine how drug and alcohol use negatively impact sports training and competition, the following four items were administered:

How often does drug use interfere with your performance:

1. during training?
2. during competition?

How often does alcohol use interfere with your performance:

3. during training?
4. during competition?

Participants were instructed to respond using a 7-point Likert scale (1 = *never*, 7 = *always*). Response scores were combined to compute a total score. These item stems and response set were consistent with the structure of the Sport Interference Checklist; (Donohue et al., 2007; Donohue et al., 2019; Donohue et al., 2020) and as such were administered within the context of this measure.

The Symptom Checklist-90-R (SCL-90-R) (Derogatis et al., 1976) is a 90-item questionnaire used to determine overall severity of mental health symptomatology. Each item is scored on a 5-point Likert scale (ranging from 0 = *not at all* to 4 = *extremely*). The SCL-90-R has acceptable validity and reliability in community samples, (Derogatis, 1994) college students (Martinez, 2005; Todd et al., 1997) and demonstrates clinical utility in college athletes (Donohue, Covassin, et al. 2004; Donohue et al., 2015).

The Structured Clinical Interview for DSM-IV (SCID-IV) (First et al., 2002) substance abuse and dependence diagnostic criteria were modified slightly to be consistent with diagnostic criteria for substance use disorder in the Diagnostic and Statistical Manual for Mental Health Disorders (5th edition) (American Psychiatric Association, 2002). This diagnostic approach has been effectively used to assess treatment outcomes in collegiate athletes (Donohue et al., 2018).

The Timeline Follow-Back (TLFB) (Sobell et al., 1986) was used to determine the number of days of alcohol and drug use reported by participants during the four months prior to the psychological assessment. A calendar is used that includes various events (e.g., parties, competitions) to assist recall of substance use days. The TLFB has evidenced validity and reliability in college students (Panza et al., 2012; Sobell et al., 1986), and clinical utility in college athletes (Donohue, Azrin, et al., 2004).

Equity, Diversity, and Inclusion Statement

Encouraging participation of a diverse sample of athletes permits social validity. Therefore, equity, diversity, and inclusion was planned in recruitment and considered in statistical analyses.

Specific to recruitment, participants were randomly assigned to complete interviews that were actively focused on study engagement, such as the importance of (and difficulties experienced due to) various cultures (e.g., ethnicity/race, sexual orientation, sport, religion, gender). These interviews were developed utilizing a diverse team of student investigators (greater than 50% women and ethnic minority/international students). Participant ethnicity/race and gender were explicitly examined in statistical analyses, and relevant to inclusion all collegiate athletes (i.e., intramural, club, NCAA) were recruited and examined in all analyses.

Results

Data Screening

Data screening procedures were conducted to examine whether all variables met assumptions for statistical analyses. Descriptive statistics and box-plots were visually inspected, and outliers were identified and moved closer to the distribution by adjusting the most extreme value closer to the next value in the distribution. As recommended by Tabachnick and Fidell (2013), the four-item *substance use interference with sport performance items* were transformed using the inverse formula (1/variable). These four items evidenced significant relationships with one another, with good internal consistency in the 1st study phase ($\alpha = 0.88$) and acceptable internal consistency in the 2nd study phase ($\alpha = 0.75$)[26]. These items were combined into a single-item composite score, permitting consistency with the TLFB, which combined alcohol and other drugs into one substance use frequency score.

Table 2

*Independent-Samples *t*-Test Comparing Substance Use Interference with Sport Performance Scores Between Participants with and without Current Substance Use Disorder*

	Current SUD		No Current SUD		<i>t</i> (35.15)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Substance Use Interference Scores	1.73	.79	1.48	.58	-1.43	.08	.65

Note. *n* = 74. SUD = Substance use disorder.

Primary Analyses

Hypothesis 1

There will be a statistically significant 1-week test-retest reliability for the four-item substance use interference with sport performance composite scores. Intraclass correlation coefficient analysis revealed “good” agreement between scores (ICC = 0.74, 95% CI [0.57, 0.85], $p < .001$). The root mean square error (RMSE) was determined to be 0.68, suggesting that, on average, there will be a 0.68-point difference in scores when assessed across one week.

Hypothesis 2

There will be a statistically significant positive relationship between the four-item substance use interference with sport performance composite scores and mental health/psychiatric symptomatology. The relationship between substance use interference with sport composite scores and SCL90R was investigated using a partial Pearson product-moment correlation coefficient while controlling for the participant's age, gender, and athlete type (i.e., NCAA, Club, Intramural). There was a statistically significant, positive correlation between the two measures, $r = .217$, $n = 280$, $p < .001$.

Hypothesis 3

There will be a statistically significant positive relationship between substance use interference with sport performance and 30-day TLFB substance use frequency.

There was a significant positive correlation between these variables, $r = .255$, $n = 74$, $p = .014$.

Hypothesis 4

Athletes diagnosed with a current SCID-V substance use disorder will demonstrate higher substance use interference with sport performance scores than athletes not diagnosed with a SCID-V current substance use disorder. An independent-samples *t*-test was conducted to compare the four-item substance use interference with sport performance composite scores for athletes diagnosed with a current substance use disorder and athletes not diagnosed with a current substance use disorder (see means and results in Table 2). There was no significant difference.

Secondary Analyses

Substance Use Interference with Sport Performance and Age

Pearson product-moment correlation coefficient indicated a statistically significant positive correlation between the four-item substance use interference with sport performance composite

scores and age, $r = .185$, $n = 280$, $p = .002$.

Comparison of Gender on Substance Use Interference with Sport Performance

As summarized in Table 3, an independent-samples *t*-test revealed substance use interferes with sport performance more for male athletes than female athletes.

Comparison of Ethnicity/Race on Substance Use Interference with Sport Performance

A one-way between-groups analysis of the variance (see Table 4) showed no difference in substance use interference with sport performance composite scores among racial/ethnic groups.

Comparison of Year in School on Substance Use Interference with Sport Performance

A one-way between-groups analysis of variance showed no statistically significant difference between freshmen, sophomores, juniors, and seniors on substance use interference with sport performance composite scores (see Table 5).

Table 3*Comparison between Gender on Substance Use Interference with Sport Performance*

Variable	Male		Female		<i>t</i> (264.02)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Substance Use Composite Scores	.35	.27	.27	.20	3.02	.001	.36

Note. *n* = 280.**Table 4***Comparison of Substance Use Interference with Sport Performance Across Ethnicity/Race*

Variable	White		Black		Pacific Islander		Asian		Hispanic/Latino		Other		<i>F</i> (5, 274)	p-value	²
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Substance Use Composite Scores	.31	.22	.30	.26	.29	.25	.27	.20	.39	.30	.32	.26	.865	.505	.02

Note. *n* = 280.

Comparison of Athlete Type on Substance Use Interference with Sport Performance

A one-way between-groups analysis of variance (see Table 6) showed there was a statistically significant difference in the four-item substance use interference with sport performance composite scores among NCAA, Club, and Intramural athletes. A post-hoc Tukey HSD test indicated NCAA athletes reported significantly less interferences in sport performance in training and competition than Club athletes and Intramural athletes, and Club and Intramural athletes did not differ.

Discussion

Much of the information about substance use in collegiate athletes is obtained from large-scale surveys conducted by the NCAA. Indeed, this organiza-

tion regularly administers substance use surveys to participating NCAA Division I, II, and III universities (NCAA, 2013). Increasingly, however, there has been an effort to additionally ascertain substance use information in club and intramural athletes (Donohue et al., 2018) because these groups represent the vast majority of college students who formally participate in university-supported sports teams worldwide. The current study results provide important information about the consequences of substance use in these athletes. Given the importance of developing methods to improve accuracy in substance use reports (Williams & Nowatzki, 2005), confidentiality of participants in the current study was assured utilizing a certificate of confidentiality from the U.S. NIH, and sport-specific consequences of substance use were explicitly determined within the context of sport training and competition.

Clinical Implications

Therefore, the current study advances substance use assessment within the context of sports, which is a great need in the field of sport psychology (van den Berg et al., 2018). The four-item substance use interference with sport performance composite scores demonstrated good test-retest reliability, and the positive correlation of this measure with a well-established measure of substance use frequency demonstrates its concurrent validity. This latter result complements the results of other studies that have found competitive athletes may experience greater negative consequences from substance use than non-athletes in life situations outside of sports (NCAA, 2022). Although there was no difference in substance use interference in sport performance scores between athletes diagnosed with a current substance use disorder and those without a diagnosis,

Table 5*Comparison of Substance Use Interference with Sport Performance Across Year in School*

Variable	Freshman		Sophomore		Junior		Senior		<i>F</i> (3, 276)	p-value	²
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Substance Use Composite Scores	.28	.23	.34	.27	.30	.23	.37	.23	1.981	.117	.02

Note. *n* = 280.

Table 6*Comparison of Substance Use Interference with Sport Performance Across Athlete Type*

Variable	NCAA		Club		Intramural		<i>F</i> (2, 277)	p-value	²
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Substance Use Composite Scores	.25	.18	.39	.27	.36	.28	8.111	< .001	.06

Note. *n* = 280.

it is important to mention this analysis approached significance ($p = .08$).

Substance use frequency has been shown to increase with age (NCAA, 2013; Tomon & Ting, 2010). These findings are consistent with the current study results showing a significant positive relationship between substance use interference in sport training and competition scores and age. This finding is important because administrators often terminate substance use prevention programs after the student athletes' first year of college (when collegiate athletes are generally younger) primarily to lower cost and avoid program redundancy. As an alternative strategy, these organizations may consider implementation of performance optimization programs, which uniquely address both substance use prevention and intervention (Donohue et al., 2018), effectively managing deleterious consequences of substance use in athletes throughout college and regardless of frequency or severity.

In the current study, male athletes

reported greater substance use interference with sport performance than female athletes, which is consistent with previous studies that have found higher substance use frequency in male athletes than female athletes (Buckman et al., 2011; Knettel et al., 2021). Interestingly, some NCAA survey reports have indicated higher alcohol use in female athletes than male athletes (NCAA, 2013). Given that males consistently report significantly greater perceived stigma for mental health disorders than females (Wang et al., 2007), these combined results suggest male athletes may feel more stigmatized in reporting substance use problems than female athletes.

It makes sense that club and intramural athletes reported greater severity of substance use interference than NCAA athletes because NCAA athletes are generally considered more elite than club and intramural athletes and are probably more sensitive to the ill effects substance use has on sport performance

(Barry et al., 2015).

There were no significant differences between substance use interference scores and ethnicity. Previous self-report assessments suggest Black individuals are more likely to underreport substance use than White individuals, perhaps because marginalized populations are more likely to perceive negative consequences for reporting substance use (Fendrich & Johnson, 2005). Participants from the current study were informed of the NIH certificate of confidentiality, which protects data from court mandates. This methodology may have assisted Black athletes in feeling more comfortable reporting substance use.

The SIC substance use interference with performance scores offer advantages over existing substance use screens. Indeed, its response set is specific to the sports environment, it is quick and easy to administer and interpret, is publicly available at no cost, is relatively non-intrusive, and it was developed in a real-world context involving student-ath-




letes who were pursuing intervention focused on mental wellness while methods were put into place to encourage accurate self-reporting of substance use. Given the conspicuous absence of sport-specific substance abuse screens in collegiate athletes (van den Berg et al., 2018), the current study results fill a substantial gap in this literature.

Limitations

It should be mentioned that the N was relatively low in the second phase of the study, as some of the participants were required to pursue goal-oriented psychological programming in order

to be included. We consider this to be a relative strength in approximating real-world interest in the pursuit of healthcare, thus enhancing study generalizability. However, a higher N would have provided greater power to determine the influence of substance use interference more effectively with sport performance on diagnostic assessment. Although all collegiate athletes were encouraged to participate in the study, marginalized groups were not explicitly recruited (e.g., study notices in disability services); thus, generalizability of study results to these populations must be interpreted with caution.

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