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Relationship of high school and college sports participation with alcohol, tobacco, and illicit drug use: A review

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Abstract

This study provides an exhaustive review of 34 peer-reviewed quantitative data-based studies completed on high school and college sports involvement and drug use. The studies reviewed suggest that participation in sport is related to higher levels of alcohol consumption, but lower levels of both cigarette smoking and illegal drug use. Additional research is needed in this domain to further elucidate the relationship between these variables.

Keywords

Sports participation; Teens

1. Introduction

There is substantial evidence that athletes (particularly at an elite level) use drugs more than their non-athlete counterparts (Ambrose, 2004; Hoberman, 2002; Juhn, 2003; Millman & Ross, 2003). Generally, the drugs studied are performance enhancing substances (Kutscher, Lund, & Perry, 2002). However, it is unclear where persons who engage in athletics use other substances such as alcohol, tobacco, marijuana, or other illicit drugs. Research on this topic is sparse. Only one systematic review has been completed in this domain (Martens, Watson, & Beck, 2006), and it focused solely on alcohol consumption in athletes at the college level. Currently, there is a strong interest in the relationship between sport participation and drug abuse. The recent revitalization of this priority area is highlighted by the National Institute of Health's recent call for proposals (RFA DA 09-013 and 014). The present review seeks to elucidate the relationship between sport participation and use of alcohol, cigarettes, and illicit drugs among high school and college athletes.

Traditionally, participation in sports has been viewed as a protective factor against drug use and abuse (Pate, Heath, Dowda, & Trost, 1996). There is a well demonstrated link between

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Contributors

Nadra Lisha conducted literature searches and provided summaries of previous research, conducted the statistical analysis and wrote the first draft of the manuscript. Steve Sussman provided guidance throughout the paper writing process, edited the paper, and made changes to the content. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All other authors declare that they have no conflicts of interest.

physical activity, positive health outcomes, functional capacity, positive mood, and general wellbeing (Plante & Rodin, 1990; Penedo, 2005; Warburton et al., 2006). Exercise is specifically found to be one of the seven indicators of healthy aging (Vaillant, 2003). One may speculate that participation in sports quells recreational drug use or abuse. However, there is a substantial gap in the current literature on sports participation and substance use and therefore no conclusive evidence that such a relationship exists.

High school and college athletes appear to enjoy positions of higher social status or privilege than most non-athletes (Harvey, 1999; Martens, Dams-O'Connor, & Beck, 2006; Sussman, Pokhrel, Ashmore, & Bradford, 2007). However, increased social standing does not come without challenges. Student athletes are expected to balance full course loads, practice, work outs, and social life. Heyman (1986) suggested that the pressures associated with this multitude of obligations may be overwhelming; thus, at the collegiate level athletes are often subject to developmental, emotional, and psychological problems (Heyman, 1986).

The current review is the first systematic examination of the relationship between participation in sport (at high school and college levels) and drug use or abuse. Presently, it is unknown (1) how many data-based peer-reviewed studies on high school and college athletes and drug use/abuse exist, (2) what the relationship is between sports participation and drug use/abuse, and (3) if that relationship changes with substance. The present review attempts to address these questions by first identifying all the data-based peer-reviewed studies that identify the relationship between athletes versus non-athletes and drug use. We expected that lower levels of cigarette smoking should be found among sports participants because cigarette smoking shows immediate physical ramifications on athletic performance (Penderson, Poulin, Lefcoe, Donald, & Hill, 1992). Tentatively we also expected that sports participation would also be inversely related to alcohol use and illicit drug use as well, assuming that alcohol and illicit drug use would be used primarily by "at risk" youth who were marginalized within school environments (Sussman et al., 2007).

2. Method

2.1. Selection of studies

Electronic databases (Google Scholar, PubMed, Ovid, Web of Science, and Cochrane Reviews Database) were searched to identify empirical articles relevant to sports participation and substance use among youths (accessed February 3rd, 2009 to March 5th, 2009). The database was searched by crossing the terms "sports types," and "sport type," with "substance abuse," "drug addiction," and "drug abuse." Only studies published in the English language that included some type of number count or survey to determine the association of sports participation with drug use behavior at the high school or collegiate compared to other non-athletes, and also investigated engagement in any type of drug use behavior other than steroids were included. Using the term "athletics" and using specific sports names (e.g. "basketball") yielded no additional studies. Searches were refined to include articles published between January 1982 and December 2008. The year 1982 was selected as a starting point since it was the earliest date an electronic database provided access to a full text article relevant to this study. In addition, we limited the age of athlete to between 13 and 24 years to focus on adolescent and college undergraduate sports participation. In addition to computer-assisted searches, bibliographies of acquired articles were scanned to acquire additional studies. Excluded were studies that did not provide any type of nomothetic data count, such as participant observation studies or single case studies. Also excluded were studies that did not compare athletes' drug use to non-athletes'. Using these inclusion and exclusion criteria, the number of empirical paper web pages to examine were 50 (Google Scholar) and 215 (across PubMed, Ovid, Web of Science, and Cochrane

Reviews Databases) and the number that met the inclusion criteria that were retained were 34.

2.2. Subjects

Subjects across all but one of the studies varied in age from 13 to 24 years; one study included a sample that ranged from 18 to 69 years of age, but we examined only those younger than 25 years old to be consistent with the other studies (O'Brien, Ali, Cotter, O'Shea, & Stannard, 2007) (see Table 1). While 24 of the studies involved collegiate athletes, 9 included high school athletes (Elder, Leaver-Dunn, Wang, Nagy, & Green, 2000; Escobedo, Marcus, Holtzman, & Giovino, 1993; Ewing, 1998; Hildebrand, Johnson, & Bogle, 2001; Leichter, Meilman, Presely, & Cashin, 1998; Pate, Trost, Levin, & Dowda, 2000; Pate et al., 1996; Peretti-Watel, Francois, & Legleyel, 2001; Thorlindsson & Bemburg, 2006), and one included a general population sample from New Zealand (O'Brien, Ali, Cotter, O'Shea, & Stannard). In 26 of the 34 studies, the sports activities studied were included under the umbrella term "involvement in an organized sports team". However, seven studies included "recreational sports" or "general high involvement in physical activity" (Dunn & Wang, 2003; Emmons, Wechsler, Dowdall, & Abraham, 1998; Pate et al., 1996; Kunz, 1997; Lorente, Peretti-Watel, Griffet, & Grelot, 2003; Nelson, & Wechsler, 2001; Peretti-Watel et al., 2001; Thorlindsson & Bemburg, 2006). Specific sport type was typically not differentiated ($n=23$). Sports that were cited include soccer, cricket, handball, basketball, hockey, volleyball, handball, aerobics, football, rugby, and general participation in physical activity, among others. See Table 1.

2.3. Assessing results and type of drug

The studies were further divided by the type of substance they evaluated. Studies were divided into three main categories: cigarettes, alcohol, and illicit drugs. The illicit drug category included multiple types of drugs such as marijuana, cocaine/crack, amphetamines, inhalant, LSD, and others. Also, due to the small number of studies involved, we examined all of these illicit drugs together. See Table 2.

3. Results

3.1. Drug use patterns and sport

3.1.1. Alcohol—Twenty-nine of the 34 total studies examined the relationship between participation in sport and alcohol consumption. In 22 of the studies participation in sports was positively associated with alcohol; that is, those who participated in sports reported higher levels of drinking than those who did not participate. Seven of the studies did not fit this type of relationship. Among these, two found an inverse relationship (Elder et al., 2000; Thorlindsson & Bemburg, 2006); involvement in sports was correlated with decreased alcohol consumption. Another two failed to find a relationship between the variables (Kokotailo et al., 1996; Overman & Terry, 1991), and three found that the relationship was dependent on sport and gender (Ford, 2007; Pate et al., 1996; Peretti-Watel et al., 2001).

Ford's (2007) findings indicated that for alcohol, male hockey and female soccer players were the most likely to report high levels of consumption, while cross-country/track athletes reported the lowest levels. For males, Pate et al. (1996) found that sport participation was associated with increased alcohol consumption among female students but was unrelated to drinking practices among males. Peretti-Watel et al. (2001) found that regular practice of individual sport or a team sport was correlated positively with repeated use of alcohol for both sexes. A sex difference was found where regular practice of sport was correlated with recent drunkenness for males only, and repeated use of alcohol for females only (Peretti-Watel et al., 2001).

Based on our sample of 29 studies, Chi Square Goodness of Fit analysis revealed that there was a significant difference between the number of studies that reported each relationship, $\chi^2(3)=40.10, p<.001$, indicating that the majority of the studies pointed toward a positive relationship between the variables. In general, alcohol use is increased among those who participate in sport versus those who do not.

3.1.2. Cigarettes—Of the 34 total studies reviewed, 15 examined the relationship between participation in sport and smoking cigarettes. Of these studies, the majority, 14, found an inverse relationship; participation in sports was negatively related to cigarette use. One study failed to find a relationship (Rockafellow & Saules, 2006). Chi Square Goodness of Fit analysis revealed that there was a significant difference between the number of studies that reported each relationship, $\chi^2(2)=16.63, p<.001$, indicating that the majority of the studies found an inverse relationship between the variables. These findings suggest that participation in sport may serve as a protective factor against cigarette use.

3.1.3. Illicit drugs—A total of 15 studies examined the relationship between participation in sports and illicit drug use. Seven of the articles examined marijuana as the sole illicit drug (Elder et al., 2000; Ewing, 1998; Ferron, Narring, Caudey, & Michaud, 1999; Kirkcaldy, Shephard, & Siefen, 2002; Peretti-Watel et al., 2001; Rockafellow, & Saules, 2006; Thorlindsson & Bemburg, 2006). Eight of the articles reviewed examined the relationship between sport and other illicit drugs in addition to marijuana (Anderson, Albrecht, McKeag, Hough & McGrew, 1991; Dunn & Wang, 2003; Ford, 2007; Green et al., 2001; Kokotailo et al., 1996; Pate et al., 1996; Pate et al., 2000; Wechsler, Davenport, Dowdall, Grossman and Zanakos, 1997). However, while some of these studies differentiated between marijuana and other drugs, no distinction was made among the other types of drugs. Also, due to the small number of studies involved, we examined all of these illicit drugs together. The most common relationship found was an inverse relationship; participation in sport was related to lower illicit drug use; this was found in nine of the studies (n of marijuana only studies=4). However, two of the studies (Green et al., 2001; Rockafellow & Saules, 2006) found a positive relationship, and three studies found that it depended on sport and gender (Ewing, 1998; Ford, 2007; Peretti-Watel et al., 2001).

Ewing (1998) found that for males, those who participated in sport engaged in higher marijuana use than those who did not, but Ford (2007) found increased marijuana rates only for male hockey players and female soccer players. Ewing (1998) found that female athletes engage in less marijuana use. Ford (2007) found that for both genders, runners engaged in the lowest marijuana and illicit drug use. The “U-curve” was investigated by Peretti-Watel et al. (2001); this graph represented the conception that the amount of drug use is highest at low levels and high levels of sport, while some intermediate level exhibits the lowest drug use. This relationship was only found true for males in relation to marijuana use (Peretti-Watel et al., 2001). Two studies failed to find any relationship (Anderson, Albrecht, McKeag, Hough & McGrew, 1991; Dunn & Wang, 2003) (among these n of marijuana only studies=2). Chi Square Goodness of Fit analysis revealed that there was a significant difference between the number of studies that reported each relationship, $\chi^2(3)=8.50, p<.05$, suggesting that the majority of the studies indicated an inverse relationship between the variables.

While most of the articles found consistent relationships between drug use and participation in athletics, four of the articles found that the relationship was moderated by sport or gender (Ewing, 1998; Ford, 2007; Pate et al., 1996; Peretti-Watel et al., 2001). These articles found that marijuana use was higher in male athletes than non-athletes (Ewing, 1998); that male hockey and female soccer players exhibit the highest levels of marijuana use while runners show almost none (Ford, 2007); there is no relationship between drinking and athletic

participation in males (Pate et al., 1996), and that a “U-Curve” relation was found only in males and only for marijuana use (Peretti-Watel et al., 2001).

4. Discussion

The relationship between athletic participation and substance use differs by type of drug. As expected, it appears that both cigarette smoking and illicit drug use are inversely related to participation in athletics. However, we found a generally positive association between participation in sports and alcohol consumption. No differences were found in relation to level of sport activity (i.e., high school versus college level). Indeed, 22 of the 29 studies on alcohol found that drinking was positively related to participation in athletics. While this relationship seems intuitively paradoxical, we speculate on reasons for this association. These reasons are not mutually exclusive.

First, perhaps the competitive nature of athletes encourages sportspeople to drink larger quantities (e.g., to show that they can “hold their liquor”). It has been found that while athletes report only slightly higher drinking rates than non-athletes, they are much more likely to engage in binge drinking and consistently consume larger quantities than non-athletes (Martens, Dams-O'Connor, & Beck, 2006). There is some evidence that not only do athletes drink more, but those who are more involved in or invested in the sport more drink larger amounts than their less involved counterparts (Hildebrand et al., 2001; Leichliter et al., 1998).

A second, alternative explanation for the relationship between drinking and athletic participation, is that of stress related drinking (Damm & Murray, 1996; Marcello, Danish, & Stolberg, 1989; Tricker, Cook, & McGuire 1989). Engagement in sport can be very stressful for individuals at all levels of sport. Stress is especially high for athletes at the college level who aspire to be professional athletes. High level athletes are constantly being tested and evaluated on their performance. Sport participation at lower levels can be just as cutthroat and stressful as high levels for those who are competitive in nature. Alcohol might be introduced as a coping mechanism for the sport-related anxiety that athletes experience. In addition, alcohol is very accessible to youth and dissipates from the body quickly; thus, perhaps fewer immediate negative consequences are expected by athletes. A third potential explanation lies in the environmental influences of athletes. Being an athlete plays a large role in the individual's identity (Brewer, VanRaalete, & Linder, 1993), and athletes often associate with teammates or other athletes (Thombs & Hamilton, 2002). Athletes might consume more alcohol due to the perceived norms of other athletes. Sportspeople estimate that others consume more drinks per week than they do, and perceptions of these social norms predict personal use (Dams-O'Connor, Martin & Martens, 2007).

A fourth possible explanation is that larger culture encourages an association between athletics and drinking behaviors. During televised sports events more commercials appear for alcohol products than for any other beverage (Madden & Grube, 1994). The audience and athletes at the sporting events are also exposed to alcohol advertising through stadium signs and other on-site promotions. By comparison, the number of messages and public service announcements displaying the risks of alcohol use are rare.

However, we did find the expected inverse relationship between participation in athletics and cigarette use (14 of the 15 studies). This suggests a protective nature of athletics towards smoking behaviors. There are several explanations for these results. First, as athletes predominantly associate with other athletes (Thombs & Hamilton, 2002), it is likely that the perceived norms of this group do not favor smoking (Dunn & Wang, 2003); smoking more generally is associated with at risk youth (Sussman et al., 2007). In addition, while alcohol is

often associated with sports in the mass media (Madden & Grube, 1994), cigarettes are less advertised. Second, smoking cigarettes affects both heart and lung functioning so this drug causes immediate detrimental effects to one's ability to participate in physical ability (Penderson et al., 1992). Oxygen intake and therefore cardiovascular endurance and stamina are reduced in smokers (Dunn & Wang, 2003).

So why would the relationship between smoking and athletics be different than its relationship with alcohol? Athletes depend on their lungs to perform at the highest level. While alcohol has detrimental effects on performance, the effects do not occur right away and are less noticeable. Both youth and superior physical conditioning compared to the general population might impart on athletes a temporary resistance to the physical effects of alcohol (Anderson, 2005). Conversely, cigarettes show more immediate physical impairments (e.g. breathing difficulties) (Dunn & Wang, 2003).

Nine of the 16 studies examining illicit drug use found an inverse relationship between participation in sports and substance use. Illicit drugs include substances such as marijuana, cocaine, crack, inhalants, barbiturates, amphetamines, tranquilizers, heroin, other opiate-type drugs, LSD and other psychedelics or hallucinogenics, and heroin. It appears that participation in sports is protective against illegal drug use. Illicit drugs have immediate injurious effects on performance. For those who are playing at a competitive level, these detrimental effects are likely sufficient to inhibit illicit substance use. Since norms often guide behavior, it is important to note that hard drug use, like cigarette smoking, is not the perceived norm of athletes (Sussman et al., 2007). Still, the results on illicit drug use were not as consistent as with cigarette smoking or alcohol consumption.

Not all the studies indicated uni-directional relationships between drug use and sport participation; some found that the relationship was moderated by sport or gender (Ewing, 1998; Ford, 2007; Pate et al., 1996; Peretti-Watel et al., 2001). In an examination of high school students who participated in athletics, Ewing (1998) found that male athletes have a higher incidence of marijuana use than non-athletes, but that for females, athletes actually exhibit lower marijuana use rates than their non-athlete counterparts. Ford (2007) determined that in college athletes there is a difference in substance used based on type of sport. For example, male hockey players and female soccer athletes showed the highest levels of marijuana use, while cross country and track athletes were found to have the lowest rates of marijuana and other illicit drug use. Peretti-Watel et al. (2001) examined the "U-Curve" (where the relationship between the intensity of physical activities and illicit drug use changes in the form of a U with intensity of sport). The authors determined that this relationship only held true for males and marijuana use; whereas the relationship did not exist for females or for both genders regarding other substances. These articles provide possible explanations for the studies that do not fit the typical pattern. It is possible that substance abuse affects certain types of athletic performance less than others. Drugs that are stimulants increase heart rate and might make it very difficult to exercise. It might be interesting to examine whether sports that require lower physical demand (e.g. bowling or golf) have higher substance use than those where lung and heart functioning determines performance. In addition, one may speculate that sports involving relatively more antisocial/aggressive behavior (e.g., hockey) might be associated with greater illicit drug use. Future research is needed to discern the discrepancies between type of sport and gender on substance use.

4.1. Limitations, future directions, and conclusions

There are several limitations present in the current review. In particular, most of the studies do not adequately differentiate type of sport. Oftentimes surveys are given to a variety of athletes in different sports and then combined without looking at specific levels of drug use

in each sport. Individual sports are frequently omitted due to a fear of lack of confidentiality when administering a survey in a more individualized setting. Thus, it is not possible to provide more precision in this review regarding exceptions to the pattern of results found.

Second, studies fail to report the intensity of drug use. For example, alcohol was occasionally broken into binge drinking versus occasional social drinking, but typically levels were not broken down adequately to ascertain the small variations that might indicate more precise levels of drug use. It is possible, that as level of drug use increases, more consistency across studies will be found. Certainly at very high levels, we would expect to find inverse relationships across all drug types.

Third, studies used self-report data to determine levels of drug use. When self-report methodologies are used, in particular written questionnaires assessing both the independent and dependent variables, some cause for concern about the validity of causal conclusions can be made (Crano & Brewer, 2002). Reports are most effective when they ask specific, clear questions and are administered frequently so that participants do not have to recall activities over a long period of time. Still, simple rating scale items have been shown to have adequate psychometric qualities among general populations of teens (e.g., Stacy et al., 1990).

Forth, future work should use better indicators of physical activity involved in sports participation. For example, information could be collected using pedometers or accelerometers (Hurling et al., 2007). This data would provide a more systematic way to ascertain the precise amount of time spent exercising and would circumvent the problem of response bias.

A fifth, more general problem is due to the lack of longitudinal data. The information available does not allow for assessment of order of precedence between participating in sports and drug use.

Regardless of these limitations, we did find some consistencies across studies. It appears that participation in sports is related to higher alcohol consumption in the majority of studies. The relationship between cigarette smoking and sport involvement appears to be inversely related. The most complex relationship is that between involvement in sport and illicit drug use. There is evidence for an inverse relationship, but the inconsistencies cannot be ignored.

Future research is needed to reinforce and expand our understanding of the relationship between these variables across different types of sports, levels of physical activity, and across different types of drugs. For example, it is important to explore to what extent drug use in athletes is affected by perceived stress, peer norms, socialization, and the mass media (Dunn & Wang, 2003).

Future research also should examine differences in substance use associated with time of year (off season versus season). Perhaps the most substance use occurs when performance is not as important or when drug testing is not occurring. Another important future direction is a closer examination of whether individuals involved in athletics are simply replacing the addiction to cigarettes with a substitute addiction (Sussman & Black, 2008), such as smokeless tobacco products (Gingiss & Gottlieb, 1991). It also has been found that when athletes understand that substance use will hamper performance they are less likely to engage in this behavior (Wechsler et al., 1997). It would be interesting to examine whether athletes are knowledgeable of the long-term effects of substance use on their physical abilities when the effects are not immediately perceived.

In conclusion, the 34 studies included in the present review indicate that sports participation is positively correlated with alcohol use, but inversely correlated with cigarette smoking and illicit drug use. However, the relationship with illicit drugs is less consistent, and should be further examined while considering specific type of drug. It is important to determine the directionality of these relationships to better inform future drug prevention efforts in this domain. As sports participation is positively related to alcohol use it is important that intervention campaigns stress the incompatibility of drinking and athletic performance (Wechsler et al., 1997). Included in the messages should be information on the detrimental side effects on peak performance and the increased incidence of behaviors that are extremely harmful to the individual or others. Since involvement in sports is often regarded as protective against drug use, a more in depth understanding of these correlations is necessary to determine the true consequences of sports on youth and adolescents.

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References

- Ambrose PJ. Drug use in sports: A veritable arena for pharmacists. *Journal of the American Pharmaceutical Association*. 2004; 44:502–514.
- Anderson, MB. Sport psychology in practice. *Human Kinetics*; 2005.
- Anderson WA, Albrecht RR, McKeag DB, Hough DO, McGrew CA. A national survey of alcohol and drug use by college athletes. *Physician and Sports Medicine*. 1991; 19:91–104.
- Brewer BW, VanRaalete JL, Linder DE. Athletic identity: Hercules' muscles or Achilles heel? *International Journal of Sport Psychology*. 1993; 51:249–257.
- Crano, WD.; Brewer, MB. Principles and methods of social research. Reigert, D., editor. New Jersey: Lawrence Erlbaum Associates; 2002.
- Damm, J.; Murray, P. Alcohol and other drug use among college student-athletes. In: Etzel, EF.; Ferrante, AP.; Pinkney, W., editors. *Counseling college student-athletes: Issues and interventions*. 2. Morgantown, WV: Fitness Information Tecnology; 1996. p. 185-220.
- Dams-O'Connor K, Martin JL, Martens MP. Social norms and alcohol consumption among intercollegiate athletes: The role of athlete and nonathlete reference groups. *Addictive Behaviors*. 2007; 32:2657–2666. [PubMed: 17544589]
- Dunn MS, Wang MQW. Effects of physical activity on substance use among college students. *American Journal of Health Studies*. 2003; 18:126–132.
- Elder C, Leaver-Dunn D, Wang MQ, Nagy S, Green L. Organized group activity as a protective factor against adolescent substance use. *American Journal of Health Behavior*. 2000; 24:108–113.
- Emmons KM, Wechsler H, Dowdall G, Abraham M. Predictors of smoking among US college students. *American Journal of Public Health*. 1998; 88:104–107. [PubMed: 9584013]
- Escobedo LG, Marcus SE, Holtzman D, Giovino GA. Sports participation, age at smoking initiation, and risk of smoking among US high school students. *Journal of the American Medical Association*. 1993; 269:1391–1395. [PubMed: 8441214]
- Ewing BT. High school athletes and marijuana use. *Journal of Drug Education*. 1998; 28:147–157. [PubMed: 9673074]
- Ferron C, Narring M, Caudey M, Michaud P-A. Sport activity in adolescence: Associations with health perceptions and experimental behaviours. *Health Education Research*. 1999; 14:225–233. [PubMed: 10387502]
- Ford JA. Substance use among college athletes: A comparison based on sport/team affiliation. *Journal of American College Health*. 2007; 55:367–373. [PubMed: 17517549]

- Gingiss P, Gottlieb N. A comparison of smokeless tobacco and smoking practices of university varsity and intramural baseball players. *Addictive Behaviors*. 1991; 16:335–340. [PubMed: 1776549]
- Green GA, Uryasz FD, Petr TA, Bray CD. NCAA study of substance use and abuse habits of college student-athletes. *Clinical Journal of Sport Medicine*. 2001; 11:51–56. [PubMed: 11176146]
- Grossbard JR, Geisner IM, Mastroleo NR, Kilmer JR, Turrissi R, Larimer ME. Athletic identity, descriptive norms, and drinking among athletes transitioning to college. *Addictive Behaviors*. 2009; 34:352–359. [PubMed: 19095359]
- Harvey SJ. Hegemonic masculinity, friendship, and group formation in an athletic subculture. *Journal of Men's Studies*. 1999; 8:91–125.
- Heyman SR. Psychological problem patterns found with athletes. *Clinical Psychologist*. 1986; 39:68–71.
- Hildebrand KM, Johnson DJ, Bogle K. Comparison of patterns of alcohol use between high college athletes and non-athletes. *College Student Journal*. 2001; 35:358–365.
- Hoberman J. Sports physicians and the doping crisis in elite sports. *Clinical Journal of Sports Medicine*. 2002; 12:203–208.
- Hurling R, Catt M, De Boni M, Fairly BW, Hurst T, Murray P, Richardson A, et al. Using internet and mobile phone technology to deliver an automated physical activity program: Randomized controlled trial. *Journal of Medicine on the Internet*. 2007;9.
- Juhn M. Popular sports supplements and ergogenic aids. *Sports Medicine*. 2003; 33:921–939. [PubMed: 12974658]
- Kokotailo PK, Henry BC, Kosciak RE, Fleming MF, Landry GL. Substance use and other health risk behaviors in collegiate athletes. *Clinical Journal of Sport Medicine*. 1996; 63:183–189. [PubMed: 8792050]
- Kirkcaldy BD, Shephard RJ, Siefen RG. The relationship between physical activity and self-image and problem behavior among adolescents. *Social Psychiatry and Psychiatric Epidemiology*. 2002; 37:544–550. [PubMed: 12395145]
- Kunz JL. Drink and be active? The associations between drinking and participation in sports. *Addiction Research*. 1997; 5:439–450.
- Kutscher EC, Lund BC, Perry P. Anabolic steroids: A review for the clinician. *Sports Medicine*. 2002; 32:285–296. [PubMed: 11929356]
- Leichliter JS, Meilman PW, Presely CA, Cashin JR. Alcohol use and related consequences among students with varying levels of involvement in college athletics. *Journal of American College Health*. 1998; 46:257–262. [PubMed: 9609972]
- Lorente FO, Peretti-Watel P, Griffet J, Grelot L. Alcohol use and intoxication in sport university students. *Alcohol and Alcoholism*. 2003; 38:427–430. [PubMed: 12915518]
- Lorente FO, Souville M, Griffet J, Grelot L. Participation in sports and alcohol consumption among French adolescents. *Addictive Behaviours*. 2004; 29:941–946.
- Madden PA, Grube JW. The frequency and nature of alcohol and tobacco advertising in televised sports, 1990 through 1992. *American Journal of Public Health*. 1994; 84:297–299. [PubMed: 8296959]
- Marcello RJ, Danish SJ, Stolberg AL. An evaluation of strategies developed to prevent substance abuse among student-athletes. *Sport Psychologist*. 1989; 3:196–211.
- Martens MP, Cox RH, Beck NC. Negative consequences of intercollegiate athlete drinking: The role of drinking motives. *Journal of Studies on Alcohol*. 2001; 64:825–828. [PubMed: 14743945]
- Martens MP, Dams-O'Connor K, Beck NC. A systematic review of college student-athlete drinking: Prevalence rates, sport-related factors, and interventions. *Journal of Substance Abuse Treatment*. 2006; 31:305–316. [PubMed: 16996393]
- Martens MP, Watson JC, Beck NC. Sport-type differences in alcohol use among intercollegiate athletes. *Journal of Applied Sport Psychology*. 2006; 18:136–150.
- Martin M. The use of alcohol among NCAA division I female college basketball, softball, and volleyball athletes. *Journal of Athletic Training*. 1998; 33:163–167. [PubMed: 16558505]
- Millman RB, Ross EJ. Steroid and nutritional supplement use in professional athletes. *American Journal of Addiction*. 2003; 12:48–54.

- Nattiv A, Puffer J. Lifestyles and health risks of collegiate athletes. *Journal of Family Practitioners*. 1991; 33:585–590.
- Nelson TF, Wechsler H. Alcohol and college athletes. *Medicine and Science in Sports and Exercise*. 2001; 33:43–47. [PubMed: 11194110]
- O'Brien CP, Lyons F. Alcohol and the athlete. *Sports Medicine*. 2000; 29:295–300. [PubMed: 10840864]
- O'Brien KS, Ali A, Cotter JD, O'Shea RP, Stannard S. Hazardous drinking in New Zealand sportspeople: Level of sporting participation and drinking motives. *Alcohol & Alcoholism*. 2007; 42:376–382. [PubMed: 17494990]
- Overman SJ, Terry T. Alcohol use and attitudes: A comparison of college athletes and nonathletes. *Journal of Alcohol and Drug Education*. 1991; 21:107–117.
- Pate RR, Trost SG, Levin &, Dowda M. Sports participation and health-related behaviors among US youth. *Archives of Pediatric and Adolescent Medicine*. 2000; 154:904–911.
- Pate RR, Heath GW, Dowda M, Trost SG. Association between physical activity and other health behaviors in a representative sample of US adolescents. *American Journal of Public Health*. 1996; 86:1577–1581. [PubMed: 8916523]
- Penderson LL, Poulin M, Lefcoe NM, Donald AW, Hill JS. Does cigarette smoking affect the fitness of young adults? Rationale and protocol for future research. *Journal of Sports Medicine and Physical Fitness*. 1992; 32:96–105. [PubMed: 1405581]
- Peretti-Watel P, Francois B, Legleyel S. Beyond the U-curve: The relationship between sport and alcohol, cigarette and cannabis use in adolescents. *Addiction*. 2001; 97:707–716. [PubMed: 12084140]
- Penedo FJ. Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*. 2005; 18:189–193. [PubMed: 16639173]
- Plante TG, Rodin J. Physical fitness and enhanced psychological health. *Current Psychology: Research and Review*. 1990; 9:3–24.
- Rockafellow BD, Saules KK. Substance use by college students: The role of intrinsic versus extrinsic motivation for athletic involvement. *Psychology of Addictive Behaviors*. 2006; 20:279–287. [PubMed: 16938065]
- Stacy AW, Flay BR, Sussman S, Brown KS, Santi S, Best JA. Validity of alternative self-report indices of smoking among adolescents. *Psychological Assessment: Journal of Consulting & Clinical Psychology*. 1990; 2:442–446.
- Sussman S, Black DS. Substitute addiction: A concern for researchers and practitioners. *Journal of Drug Education*. 2008; 38:167–180. [PubMed: 18724656]
- Sussman S, Pokhrel P, Ashmore RD, Bradford BB. Adolescent peer group identification and characteristics: a review of the literature. *Addictive Behaviors*. 2007; 32:1602–1627. [PubMed: 17188815]
- Thombs DL, Hamilton MJ. Effects of a social norm feedback campaign on drinking norms and behavior of Division 1 student athletes. *Journal of Drug Education*. 2002; 32:227–244. [PubMed: 12379053]
- Thorlindsson T, Bemburg JG. Peer groups and substance use: Examining the direct and interactive effect of leisure activity. *Adolescence*. 2006; 41:321–339. [PubMed: 16981620]
- Tricker R, Cook DL, McGuire R. Issues related to drug abuse in college athletes: Athletes at risk. *Sport Psychologist*. 1989; 3:155–165.
- Vaillant G. Mental health. *American Medical Journal of Psychiatry*. 2003; 160:1373–1384.
- Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*. 2006; 174:801–809. [PubMed: 16534088]
- Wechsler A, Davenport AE, Dowdall GW, Grossman SJ, Zanakos SI. Binge drinking, tobacco, and illicit drug use and involvement in college athletics: A survey of student at 140 American colleges. *Journal of American College Health*. 1997; 45:195–200. [PubMed: 9069676]
- Wichstrom T, Wichstrom L. Does sports participation during adolescence prevent later alcohol, tobacco and cannabis use? *Addiction*. 2005; 104:138–149. [PubMed: 19133899]

Wilson GS, Pritchard ME, Schaffer J. Athletic status and drinking behavior in college students: The influence of gender and coping styles. *Journal of American College Health*. 2004; 52:269–273. [PubMed: 15134101]

Table 1

Study, title, subjects, and sport.

Study	Title	Subjects	Sport type
Dunn and Wang (2003)	Effects of physical activity on substance abuse in college students.	Students ranging in age from 18 to 23 ($n=2436$), from the 1995 National College Health Risk Behavior Survey	Not specified—general physical activity
Anderson et al. (1991)	A national survey of alcohol and drug use by college athletes.	3264 intercollegiate varsity athletes at 11 NCAA member institutions across the nation. The sample comprised ten sports.	Football, baseball, basketball, tennis, track/field, swimming/diving
Elder et al. (2000)	Organized group activity as a protective factor against adolescent substance use.	3556 adolescents from public schools. 52.3% female ($n=1859$), 47.7% male ($n=1697$), 80.8% White ($n=2875$), 15.7% Black ($n=558$) and 3.5% Other ($n=123$). White females accounted for 43% of the respondents, white males 40%, Black females 9%, and Black males 8%. Respondents were in 10th through 12th grades with 40.3% Grade 10, 29.4% Grade 11 and 27.8% Grade 12. Ages for respondents were ages 14 through 17 and older with 9.3% age 14, 25.9% age 15, 29.8% age 16, and 35% age 17 or older.	Not specified—participation in organized sports
Emmons et al. (1998)	Predictors of smoking among US college students.	A random sample of 25 627 undergraduate students received a study survey; 17 592 students responded, yielding an overall response rate of 69% (response rate range=60% to 80%).	Not specified—participation in any athletics
Escobedo et al. (1993)	Sports participation, age at smoking initiation, and risk of smoking among US high school students.	11,631 high school students. Nationally representative sample.	Not specified—number of organized sports
Ewing (1998)	High school athletes and marijuana use.	National Longitudinal Survey of Youth (NLSY). Restrict sample to 1458 students in high school in 1979, who have been interviewed yearly since then.	Not specified—participation in organized sports
Ferron et al. (1999)	Sport activity in adolescence: Associations with health perceptions and experimental behaviors.	9268 young people (15–20 years old) attending post-mandatory school in Switzerland.	Not specified—participation in organized sports
Ford (2007)	Substance use among college athletes: A comparison based on sport/team.	The data I used in this study are from the Harvard School of Public Health College Alcohol Study (CAS). 2, 316 college students.	Football, volleyball, soccer, swimming/diving, basketball, hockey, baseball/softball, and running
Gingiss and Gottlieb (1991)	A comparison of smokeless tobacco and smoking practices of university varsity baseball players.	248 undergraduates varsity and intramural athletes. Fifty-two (18.3%) of the respondents were varsity athletes and 232 (81.7%) played on intramural teams. The mean age was 20.5 years ($SD=1.6$). The majority (82.2%) were non-Hispanic white; 7.5%, black; 8.5%, Hispanic; and 1.8%, Asian or other.	Baseball—Varsity and intramural
Green, Uryasz, Petr, and Bray (2001)	NCAA Study of Substance Use and Abuse Habits of College-Student Athletes	13, 914 male and female student athletes from 30 sports competing at 991 NCAA, Division, I, II, and III institutions—ages not reported	Men's: Baseball, basketball, cross country, fencing, football, golf, gymnastics, ice hockey, lacrosse, rifle, soccer, swimming, tennis, water polo, wrestling Women's: Basketball, cross country, fencing, field hockey, golf, gymnastics, ice hockey, lacrosse, skiing, soccer, swimming, tennis, volleyball
Grossbard et al. (2009)	Athletic identity, descriptive norms, and drinking among athletes transitioning to college.	Participants were 1119 freshmen (56.6% female) from two large, National Collegiate Athletic Association (NCAA) Division I-A campuses (one northwest urban, one northeast rural), each of which has enrollment of over 40,000 students. Participants	Not specified

Study	Title	Subjects	Sport type
		were included if they reported alcohol use in their lifetime. Athlete classification was determined by assessing participation in varsity or elite club sports at the high school level. Within the sample, 15.8% (13% of females, 19% of males) indicated they would be participating in intercollegiate athletics during their upcoming first-year of college. Participants were primarily Caucasian (81%), with 9% Asian, 4% Hispanic, 2% African American, and 4% reporting other or multiple ethnicities. The mean age of the sample was 17.97 (SD=1.66) years.	
Hildebrand et al. (2001)	Comparison of patterns of alcohol use between high school and college athletes and non-athletes.	1287 college students.	Not specified
Kirckcaldy et al. (2002)	The relationship between physical activity and self-image and problem behaviour among adolescents.	Students ranged in age from 14 to 18 years. 988 adolescents included an approximately equal proportion of boys and girls (47.2 and 52.8%, respectively).	Not specified—general physical activity
Kokotailo et al. (1996)	Substance use and other health risk behaviors in collegiate athletes	A convenience sample of 86% of 1210 eligible students (271 athletes and 775 non-athlete peers) completed a self-administered, anonymous questionnaire during class sessions or team meetings.	Baseball, basketball, crew, football, golf, gymnastics, ice hockey, soccer, softball, spirit squad, swimming, tennis, track and cross country, volleyball, wrestling, non-specified
Kunz (1997)	Drink and be active? The associations between drinking and participation in sports.	49,154 individuals 20 years of age or older from households in Ontario.	Not specified
Leichliter et al. (1998)	Alcohol use and related consequences among students with varying levels of involvement in college athletics.	Data from the 51,483 students who provided information on gender and degree of participation in intercollegiate athletics. Of the 20,595 men, three quarters (76.4%) reported that they were not involved in intercollegiate athletics and 17.6% were actively involved; 6.0% were in positions of leadership. The vast majority (87.4%) of the 30,888 women who responded to the survey did not have any involvement in intercollegiate athletics; 9.8% were actively involved, and 2.8% were in leadership positions.	Not specified
Lorente et al. (2003)	Alcohol use and intoxication in sport university students.	915 university students from 3 different sport science departments in Southern France.	Not specified
Lorente et al. (2004)	Participation in sports and alcohol consumption among French adolescents.	816 French high school students	Soccer, basketball, hockey, volleyball, handball, football, rugby, and general participation in physical activity
Martens et al. (2001)	Negative consequences of intercollegiate athlete drinking: The role of drinking motives.	273 intercollegiate athletes. The mean (SD) age for the sample was 19.38 (1.34) years. The majority of the participants were female (54.6%), white (89.7%) and first- or second-year students (62.0%). When compared with the athletic department as a whole, our sample contained a slightly disproportionate number of female and white athletes (approximately 40% and 75% of all athletes at the university are female and white, respectively).	Not specified
Martens, Dams-O'Connor, & Beck (2006)	Sport type differences in alcohol use among intercollegiate athletes.	340 intercollegiate athletes who competed at one of two NCAA Division I universities. The mean age for the sample was 19.56 years (SD=1.23). The gender distribution was fairly equal (50.3% male), and the majority of the participants identified themselves as White (78.5%). Other ethnic representations were as follows: 16.5% African American, 2.4% "other," 1.5% Hispanic, and 1.2% Asian American.	Not specified—largely team sports

Study	Title	Subjects	Sport type
Martin (1998)	The use of alcohol among NCAA Division I female college basketball, softball, and volleyball athletes.	NCAA Division I women athletes. Subjects included 106 (28.6%) basketball players, 138 (37.2%) softball players, and 127 (34.2%) volleyball players from across the southeastern, eastern, and Midwestern regions of the United States. Participants ranged in age from 17 to 23 years, with a mean age of 19.5 years. With reference to ethnic background, 78% ($n=291$) of the participants were white, 18% ($n=67$) were African American, and 3% ($n=13$) were from other ethnic backgrounds.	Baseball, softball, and volleyball
Nattiv & Puffer (1991)	Lifestyles and health risks of collegiate athletes.	109 undergraduate intercollegiate athletes. Specific sports teams were chosen so that there were a variety of athletes included and a relatively equal number of male and female participants.	Men's: Cross country/track, football, soccer, volleyball, water polo, other Women's: Basketball, cross country/track, gymnastics, volleyball, other
Nelson and Wechsler (2001)	Alcohol and college athletes.	130 randomly selected students in a nationally representative sample of 4-yr colleges in the United States complete self-report questionnaires in the spring of 1997. Athletes were defined as students who participated in one or more hours of intercollegiate athletics per day.	Not specified—general physical activity
O'Brien & Lyons (2000)	Alcohol and the athlete.	Athletes (18- to 24-year-old males)	Gaelic football, soccer, hurling, rugby, basketball, US football, track and field, cycling, rowing, horse racing, cricket, tennis, and golf
O'Brien et al. (2007)	Hazardous drinking in New Zealand sportspeople: Level of sporting participation and drinking motives.	1214 New Zealand sportspeople (18–69 years). 584 female $N=584$, 48.2%; no gender listed for $N=4$, over the age of 18 years (Mean=29.9, SD=12.3 years; range 18–69 years).	Not specified
Overman and Terry (1991)	Alcohol use and attitudes: A comparison of college athletes and non-athletes.	146 college students in Mississippi.	Track and field, baseball, softball, football, other
Pate et al. (1996)	Associations between physical activity and other health behaviors in a representative sample of US adolescents.	Total sample of 11 631 high school students. 14.1% were low active and 22.8% were high active. Data for this analysis were taken from the 1990 Youth Risk Behavior Survey.	Not specified—school sports teams
Pate et al. (2000)	Sports participation and health-related behaviors among US youth.	14,221 US high school students—no age given, but it is 9th through 12th grade students.	Not specified—school sports teams or vigorous physical activity
Peretti-Watel et al. (2001)	Beyond the U-curve: The relationship between sport and alcohol, cigarette and cannabis use in adolescents.	National school survey ($N=10,807$; ages 14–19 years) conducted in France in 1999.	Not specified
Rockafellow and Saules (2006)	Substance use by college students: The role of intrinsic versus extrinsic motivation for athletic involvement.	Intercollegiate athletes ($N=98$) and exercisers ($N=120$). 218 college students who ranged in age from 18 to 24 years ($M=21.09$, $SD=1.50$) and who were also involved in athletics or exercise. Participants engaged in a wide variety of sports and physical activities, with no particular sport or activity predominating. Of the sample, 64% were women, and 36% were men; the racial distribution was 61% Caucasian, 29% African American, and 10% from other racial/ethnic backgrounds.	Not specified
Thorlindsson and Bemburg (2006)	Peer groups and substance use: Examining the direct and indirect effect of leisure activity.	3431 cases for analysis. 15 and 16 years old	Not specified

Study	Title	Subjects	Sport type
Wechsler et al. (1997)	Binge drinking, tobacco, and illicit drug use and involvement in college athletics.	215 students at each of 127 colleges and 108 at each of 13 colleges (12 of which were in the oversample). The final student sample included 28,709 students. Students were divided into three groups on the basis of their involvement in athletics: whether they were involved, partly involved, or not involved.	Not specified
Wichstrom and Wichstrom (2005)	Does sports participation during adolescence prevent later alcohol, tobacco and cannabis use?	Norwegian high school students (aged 13–19 years) in 1992 (T1) followed-up in 1994 (T2), 1999 (T3) and 2006 (T4) ($N=3251$).	Soccer, handball, aerobics, horse riding, gymnastics, and martial arts
Wilson et al. (2004)	Athletic status and drinking behavior in college students: The influence of gender and coping styles.	218 undergraduate students.	Not specified

Table 2

Studies, substance(s), and results.

Study	Substance (s)	Results
Anderson et al. (1991)	Alcohol, marijuana, cocaine/crack, smokeless tobacco, amphetamines, and steroids	The percentage of athletes using alcohol and other drugs was lower than non-athletes.
Dunn and Wang (2003)	Alcohol, cigarettes, smokeless tobacco, marijuana, cocaine, crack, inhalants, steroids, and heroin	The results of this study found that recreational physical activity was associated with increased levels of alcohol use and binge drinking, but lower rates of cigarette use among males and females. No practical significance was found for any illegal substance.
Elder et al. (2000)	Cigarettes, alcohol, and marijuana	Adolescents who participated in organized group activities were less likely to smoke cigarettes, drink alcohol, and smoke marijuana when compared to their nonparticipant peers.
Emmons et al. (1998)	Cigarettes	High-risk behaviors (e.g. marijuana use) and lifestyle choices (e.g. non-participation in athletics) increased the likelihood of being a smoker.
Escobedo et al. (1993)	Cigarettes	Students who had participated in interscholastic sports were less likely to be regular and heavy smokers than were others who had not participated.
Ewing (1998)	Marijuana	Male athletes have high marijuana use than non-athletes. Female athletes engage in less marijuana use than non-athletes.
Ferron et al. (1999)	Cigarettes and marijuana	Athletic adolescents were found to have a lower use of tobacco, wine, and marijuana.
Ford (2007)	Alcohol, cigarettes, and other drugs grouped together (crack cocaine, other forms of cocaine, barbiturates, amphetamines, tranquilizers, heroin, other opiate-type drugs, LSD, other psychedelics or hallucinogens, or ecstasy)	Findings indicated that male hockey and female soccer athletes were the most likely to report substance use and that male basketball and cross country/track athletes reported lower levels of substance use.
Gingiss and Gottlieb (1991)	Smokeless tobacco and cigarettes	We found that despite the exceptionally high prevalence of ST users among varsity baseball players, fewer varsity athletes smoked than do other college students.
Green et al. (2001)	Anabolic steroids, smokeless tobacco, Alcohol, ephedrine, amphetamines, marijuana, hallucinogens, and cocaine	For the eight categories of substance use, alcohol was the most widely used drug in the past year at 80.5%, followed by marijuana at 28.4%, and smokeless tobacco at 22.5%. There were wide variations in the pattern of substance abuse according to sport. The results were also analyzed according to division, and it was found that the likelihood of alcohol, amphetamines, marijuana, and psychedelics use is highest in Division III. In addition, the probability of ephedrine use is highest in both Divisions II and III, while Division II had the highest likelihood of cocaine use.
Grossbard et al. (2009)	Alcohol	Perceived athletic identity is positively correlated with alcohol consumption.
Hildebrand et al. (2001)	Alcohol	Non-athlete groups abused alcohol less and engaged less frequently in alcohol related risk behaviors than did those in the high school or college athlete groups.
Kirckcaldy et al. (2002)	Alcohol, cigarettes, and marijuana	Overall, the groups differed significantly in drug and alcohol usage. Adolescents who were regularly involved in endurance sport also reported a significantly lower usage of cigarettes. There was no main effect associating "sport" and drinking beer. Conversely, cannabis use was significantly more frequent among those adolescents who "never" engaged in endurance sports.
Kokotailo et al. (1996)	Cigarettes, alcohol, marijuana, and cocaine	Athletes reported lower cigarette use, marijuana and cocaine use than non-athletes. Alcohol use was comparable.
Kunz (1997)	Alcohol	Drinkers are more physically active than non-drinkers.
Leichliter et al. (1998)	Alcohol	In comparisons with non-athletes, both male and female athletes consumed significantly more alcohol per week, engaged in binge drinking more often, and suffered more adverse consequences from their substance use. No support was found for the hypothesis that athletic leaders were more responsible than other team participants in using alcohol. Male team leaders appeared to be at significantly greater risk than female team leaders; they also consumed more

Study	Substance (s)	Results
		alcohol, binged more often, and suffered more consequences than other team members.
Lorente et al. (2003)	Alcohol	Sports students drank less frequently, but reported more periods of intoxication. No differences due to competitive level.
Lorente et al. (2004)	Alcohol	Athletes more likely to report alcohol use. Participants who practiced only in a formal context, as a member of a club or association, who practiced at the regional level, and who reported a frequency of practice between three to five times per week, were more likely to report alcohol consumption.
Martens et al. (2001)	Alcohol	Athletes consume more alcohol than non-athletes.
Martens, Dams-O'Connor, & Beck (2006)	Alcohol	Sport type differences on alcohol consumption, with athletes from the sports of swimming and diving reporting the highest levels of alcohol consumption. Sixty-five percent of swimmers/divers were classified as high-risk drinkers, compared to 50% of baseball/softball players, 33% of soccer players, 32% of basketball/volleyball players, and 28% of track/cross country athletes.
Martin (1998)	Alcohol	Almost 79% of the subjects consumed alcohol, with light beers being the most popular beverage. More softball (89.1 %) and volleyball (88.9%) athletes reported drinking than did basketball (63.2%) athletes.
Nattiv & Puffer (1991)	Alcohol, driving while intoxicated w/alcohol or other drugs	Athletes had a significantly higher proportion of "risky" lifestyle behavior patterns compared with the non-athletes in the following areas: Quantity of alcohol consumed; driving while intoxicated with alcohol or other drugs; and riding with an intoxicated driver.
Nelson and Wechsler (2001)	Alcohol	Athletes reported more binge drinking, heavier alcohol use, and a greater number of drinking-related harms.
O'Brien & Lyons (2000)	Alcohol	88% of intercollegiate American athletes use alcohol. Athletes use alcohol more than non-athletes.
O'Brien et al. (2007)	Alcohol	Hazardous drinking behaviors differed across levels of sporting participation, with elite-provincial sportspeople showing the highest level of hazardous drinking, club/social sportspeople the next highest and elite-international sportspeople the lowest.
Overman and Terry (1991)	Alcohol	No significant differences in alcohol consumption between athletes and non-athletes.
Pate et al. (1996)	Cigarettes, alcohol, marijuana, and cocaine	Low activity associated w/marijuana use. For alcohol consumption, significant interactions were found w/race/ethnicity or sex, suggesting that socio-cultural factors may affect the relationships between some physical activity and some health behaviors.
Pate et al. (2000)	Anabolic steroids, smokeless tobacco, alcohol, ephedrine, amphetamines, marijuana, hallucinogens, and cocaine	Male sports participants were less likely than male nonparticipants to report cigarette smoking, cocaine and other illegal drug use on the previous day.
Peretti-Watel et al. (2001)	Alcohol, tobacco, and marijuana	The U-shaped curve between the intensity of physical activities and illicit drug use appeared not to be systematic. It depended mainly on the product and the level of use. It only remained significant for boys and heavy smoking once gender and age effect were taken into account.
Rockafellow and Saules (2006)	Alcohol, tobacco, and marijuana	Athletes and exercisers who were extrinsically motivated had significantly higher rates of alcohol use than their intrinsically motivated counterparts.
Thorlindsson and Bemburg (2006)	Alcohol and marijuana	The findings show that alcohol and substance use varies significantly across the three leisure patterns. The findings reveal that adolescents who engage in leisure activities such as sports and organized club activity are less likely to use alcohol and drugs.
Wechsler et al. (1997)	Alcohol, marijuana (or hashish); crack cocaine; cocaine; barbiturates; amphetamines; tranquilizers; heroin; other opiate-type drugs; LSD and other psychedelics or hallucinogenics, such as PCP; anabolic steroids; cigarettes, and chewing tobacco.	A greater percentage of college men and women involved in athletics are binge drinkers than are students who are not involved in athletics. On the other hand, students involved in athletics more often abstain from smoking cigarettes than do students who are not involved. Similarly, fewer men involved in athletics than uninvolved men use marijuana.
Wichstrom and Wichstrom (2005)	Alcohol, cigarettes, and marijuana	Latent growth curve analyses showed that initial level of participation in organized sports predicted growth in alcohol intoxication. Those involved initially in team sports had greater growth in alcohol intoxication, but lower growth in tobacco use and cannabis use, during the adolescent and early adult

Study	Substance (s)	Results
		years compared to those involved in technical or strength sports. Practicing endurance sports, as opposed to technical or strength sports, predicted reduced growth in alcohol intoxication and tobacco use.
Wilson et al. (2004)	Alcohol	Athletes reported they drank more frequently than non-athletes.