Prevalence of clinically elevated depressive symptoms in college athletes and differences by gender and sport

Andrew Wolanin,¹ Eugene Hong,² Donald Marks,¹ Kelly Panchoo,² Michael Gross³

ABSTRACT

Background There are approximately 400 000 National Collegiate Athletic Association (NCAA) student athletes and 5–7 million high school student athletes competing each year. According to the US Department of Health and Human Services, the depression prevalence rate for young adults, which ranges from 10% to 85% across studies, is higher than that of other age groups. Given the relatively high prevalence of depression in individuals of collegiate age in the general population, the prevalence of depression among athletes in this age group warrants further study. This multiyear study examined the prevalence of depressive symptoms in college athletes, as well as demographic factors related to increased or decreased rates of depressive symptoms by gender and sport.

Objective To describe the prevalence of depressive symptoms among NCAA division I student athletes at a single institution over 3 consecutive years.

Method Participants (n=465) completed a battery of measures during their yearly spring sports medicine physical examination. The battery included the Center for Epidemiological Studies Depression Scale (CES-D) and a demographic questionnaire, administered during the course of routine sports medicine physical examinations. Differences in depressive symptoms prevalence and relative risk ratios were calculated by gender and sport.

Results The prevalence rate for a clinically relevant level of depressive symptoms, as measured on the CES-D (CES-D ≥16), was 23.7%. A moderate to severe level of depressive symptoms was reported by 6.3%. There was a significant gender difference in prevalence of depressive symptoms, χ² (1) =7.459, p=0.006, with female athletes exhibiting 1.844 times the risk of male athletes for endorsing clinically relevant symptoms.

Conclusions The CES-D identified clinically relevant levels of depressive symptoms in nearly one-quarter of college student athletes in this large cross-sectional sample. Female college athletes reported significantly more depressive symptoms than males. Findings suggest that depression prevalence among college athletes is comparable to that found in the general college population. In light of these findings, sports medicine personnel may wish to implement depression screening and assessment of depressive symptoms across sports to identify at-risk athletes. Risk factors related to depression in college athletes warrant additional study.

INTRODUCTION

There are approximately 400 000 National Collegiate Athletic Association (NCAA) student athletes and 5–7 million high school student athletes competing each year. According to the US Department of Health and Human Services, the depression prevalence rates for young adults is higher than other age groups; in the 18–25 age group, the 12-month depression prevalence rate was 8.7% in 2008 (compared with a 6.7% overall rate for adults).¹–³ Given the high prevalence of depression in individuals of collegiate age in the general population, the prevalence of depression in the athletic population warrants further study.⁴

In the past, a commonly held misconception was that athletes may be at decreased risk for mental health issues due to increased levels of exercise, a notion has recently come under scrutiny in the popular media.⁵ In fact, initial data suggest that athletes are not immune to, or at decreased risk for, clinical depression. A majority of studies to date investigating the prevalence rate of depression in athletes have been conducted in a college athlete population. Although estimates of the depression prevalence rate in this population remain controversial, prior studies have suggested that the prevalence rate of depression among college athletes ranges from as low as 15.6% to as high as 21%.⁶ ⁷ Additionally, the majority of the studies to date have been completed either over the course of a single year or via a one-time survey intake.

The present study examines the prevalence of clinically relevant depression symptoms in a single university cohort of college athletes over three consecutive years. Additionally, the relationship between potential risk factors, such as gender and participation in specific sports, and clinically relevant depression symptoms are explored.

BACKGROUND ON DEPRESSION PREVALENCE IN ATHLETES

Storch et al⁸ were among the first investigators to compare rates of depressive symptoms in athletes. The authors concluded that female athletes reported experiencing depressive symptoms, social anxiety and non-support to a greater extent than male athletes. In a survey-based study of 257 division I college athletes, Yang et al⁹ identified symptoms of depression in 21% of surveyed athletes and found female athletes to report higher levels of depression than male athletes.

In contrast, Armstrong and Oomen-Early⁵ found that college athletes had lower levels of depression than non-athletes in a study of 227 participants, including 104 athletes. The percentage of athletes endorsing clinically relevant levels of depression was reported to be ‘significantly lower’ than non-athletes. This study also found, however, that
athletic status was not a statistically significant predictor of depression when compared with other variables investigated in the study including gender, self-esteem levels, social connectedness and rested sleep. Armstrong and Oomen-Early also hypothesised that possession of a social network and team support were two protective factors that curbed depression prevalence among college athletes. Proctor and Boan-Lenzo also found lower depression prevalence in a study of 61 division-I male baseball players and 51 male non-athlete college students. In this study, male athletes reported fewer depressive symptoms than male non-athletes, with 15.6% of athletes meeting symptom criteria for a depression diagnosis versus 29.4% of non-athletes.

**METHODOLOGY**

Participants in the present study were recruited at the time of their annual sports medicine physical. The annual physicals were conducted in May of each year of the study. The annual physical was a requirement for all student athletes who would be returning the following year. A total of 722 student athletes had their required sports physical during the 3-year time period of the study. All eligible volunteer participants (varsity division I NCAA athletes) completed informed consent, a brief demographic questionnaire and a battery of patient-reported outcome measures, which took approximately 10–15 min to complete. Participants were permitted to complete the outcome measures before starting their sports medicine physical, during the course of their sports medicine physical (waiting between physical examinations), or at the completion of their sports medicine physical. After consent, participants were permitted to complete and return the self-report measures anonymously.

**Outcome measures**

The primary outcome for the study was depressive symptoms as measured by the Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is a validated 20-item measure designed to assess common symptoms of depression (eg, hopelessness, fatigue), which have occurred over the course of the past week. The CES-D is widely used to conduct epidemiological and clinical research with the general population, and it is considered to be one of the valid screening measures of depressive symptoms in research today. The CES-D was used to assess for depression in order to maintain a degree of consistency with the aforementioned prevalence studies. Traditional cut-off scores were used with the CES-D, which include 16 or higher indicating clinically relevant depressive symptoms and 27 or higher indicating moderate to severe depressive symptoms.

Participants also completed a demographics questionnaire, which included questions related to age, gender, sport and year in school, as well as questions related to injury and concussion history (not included in this analysis).

**Participants**

The sample included 465 participants, all of whom were undergraduate student athletes attending a NCAA division I private liberal arts college in the northeastern USA. Data were collected on three separate occasions from 2013 to 2015. Data were collected in May at the time of athletes’ annual physicals. Participants were 43.1% male (n=199) and 56.9% female (n=266), with 3 participants not specifying gender. Participants included student athletes from each year in the 4-year undergraduate curriculum, though the number of seniors was small: 35.2% (n=164) freshmen, 34.2% (n=159) sophomores, 27.1% (n=126) juniors and 3.2% (n=15) seniors. Twelve sports were represented in the overall sample, including baseball/softball (n=68), basketball (n=26), cheerleading (n=35), crew (n=23), cross-country (n=10), field hockey (n=23), golf (n=9), lacrosse (n=111), soccer (n=52), swimming (n=1), tennis (n=25), and track and field (n=82). Regarding race and ethnicity, participants predominantly identified as Caucasian, 88.8% (n=413); other groups represented in the sample included: 6.2% African-American (n=29), 2.8% Asian (n=13) and 2.2% (n=10) all other groups.

**Data analysis**

The χ² analyses were performed using IBM SPSS V23 to determine differences between groups in rates of participants meeting the cut-off scores on the CES-D (ie, CES-D ≥16 for clinically relevant depressive symptoms; CES-D ≥27 for moderate to severe symptoms). In keeping with recognised limitations of the χ² test, χ² analyses were conducted only for groups including 20 or more student athletes, with significance set at p=0.05. Post hoc analyses of the χ² results were used to determine significant differences between groups. Missing item data on the CES-D were replaced by imputation of the person items for that individual respondent. No cases were missing more than 3 items, and the total number of cases with missing items was 29, or 6.2% of the sample.

**RESULTS**

The prevalence of individuals endorsing clinically relevant depressive symptoms (CES-D ≥16) in the sample was 23.7% (n=110), while the prevalence of individuals endorsing moderate to severe levels of depressive symptoms (CES-D ≥27) was 6.3% (n=28; see table 1). The mean CES-D score for the full sample was 11.15, with a SD of 8.86. There were no differences in prevalence of clinically relevant depressive symptoms according to time when data were collected, χ² (2)=0.671, p=0.715, or according to year in the undergraduate curriculum, χ² (3) =1.931, p=0.587. Similarly, one-way analyses of variance revealed no differences in mean CES-D score either by time of data collection, F (2, 462)=0.360, p=0.698, or by year in the undergraduate curriculum, F (3, 460)=0.615, p=0.605. Differences in depression prevalence by race and ethnicity were not assessed given the limited diversity in the sample and lack of statistical power.

Differences by gender were found in both overall depressive symptoms and in prevalence of clinically relevant symptoms (CES-D ≥16). Male (M=9.62, SD=8.28) and female (M=12.30, SD=9.12) student athletes differed significantly, t (460)=3.249, p=0.001, on CES-D total score. Also, female athletes endorsed clinically relevant levels of depressive symptoms at significantly higher rates, 28.5% (n=75), than male athletes, 17.6% (n=35), χ² (1)=7.459, p=0.006. Female student athletes demonstrated 1.844, 95% CIs (1.158 to 2.936), times greater risk of endorsing clinically relevant depressive symptoms than male student athletes (see table 2). No differences were found
by gender, however, in prevalence of moderate to severe depressive symptoms (CES-D ≥27), $\chi^2 (1) = 1.377$, p=0.241.

Differences in prevalence of clinically relevant depressive symptoms (CES-D ≥16) were also found by sport, $\chi^2 (8) = 15.452$, p=0.051. Nine sports were represented in sufficient numbers (n ≥20) in the sample to be included in these analyses: baseball/softball, basketball, cheerleading, crew, field hockey, lacrosse, soccer, tennis, and track and field (table 3). The highest depression prevalence was found in track and field (35.4%) and the lowest in lacrosse (13.5%). The prevalence of clinically relevant depressive symptoms found among student athletes in track and field and field was statistically significant, $\chi^2 (1) = 7.725$, p=0.005, as was that found among students in lacrosse, $\chi^2 (1) = 8.338$, p<0.004. No significant differences were found by sport in prevalence of moderate to severe depressive symptoms (CES-D ≥27), $\chi^2 (8) = 12.052$, p=0.149. Relative risk ratios of clinically relevant depressive symptoms by sport (table 3) revealed that track and field was associated with the highest risk, with 2.066, 95% CIs (1.230 to 3.470), times greater than that found across all other sports; and lacrosse was associated with the lowest risk with only 0.424, 95% CIs (0.234 to 0.768), times the risk found across all other sports.

Finally, differences in prevalence of clinically relevant depressive symptoms (CES-D ≥16) also were found by sport and gender (table 4). Two groups differed significantly in depressive symptom prevalence from the sample as a whole: Female track and field athletes demonstrated the highest prevalence level (37.5%), significantly higher than the prevalence of the sample as a whole, $\chi^2 (1) = 8.041$, p=0.005; while male lacrosse players exhibited significantly lower prevalence than the sample as a whole, $\chi^2 (1) = 6.524$, p=0.011. Relative risk ratios of clinically relevant depressive symptoms were calculated for sport by gender for all sports with sufficient representation for each gender (n≥20). Female track and field athletes exhibited 2.257, 95% CIs (1.272 to 4.002), times the risk found in the sample overall, while male lacrosse players exhibited only 0.377, 95% CIs (0.174 to 0.817), times the risk of clinically relevant depressive symptoms found in the overall sample.

**DISCUSSION**

This study examines the prevalence of depressive symptoms in NCAA division 1 college athletes using one of the largest multi-year samples to date. In addition, the study expands on previous studies in the literature, which have tended to focus only on specific sports or genders. The overall finding of 23.7% prevalence of clinically relevant levels of depressive symptoms is higher than that found in many previous studies investigating depressive symptom prevalence in college athletes. This particular sample indicates that depressive symptoms are relatively common in college athletes, and in fact may not be markedly different from the prevalence found in non-athlete college students. The 6% prevalence rate of moderate to severe depressive symptoms was also consistent with the major depression prevalence rate in adult population (an estimated 6.7% depression prevalence in a 12-month period). Findings from the present study suggest that, in fact, college athletes are not immune to or at decreased risk for clinically relevant depressive symptoms. Given these results, it may be relevant for sports medicine professionals to consider depression risk among those for whom they are providing services and particularly important to avoid the presumption that athletes are at decreased or minimal depression risk. In the student athlete, depressive symptoms may also contribute to decreased performance on the field or in the classroom, though the effect of mood distress on these activities requires additional study. Depressive symptoms could also exacerbate other health concerns and affect the overall well-being of the athlete.

The study identified a higher prevalence of clinically relevant depressive symptoms among female athletes, suggesting that female college athletes may be at higher risk for depression than are male athletes—a conclusion considered in other preliminary efforts, but confirmed in this study. When analysed by gender and sport, the differences became even more striking, with the highest prevalence of depressive symptoms found in female track and field athletes and the lowest prevalence in male lacrosse athletes. Although gender differences in depression prevalence have been found across a wide range of samples, 16

**Table 2** Gender differences in depressive symptom prevalence

<table>
<thead>
<tr>
<th>Gender</th>
<th>Clinical level of depression CES-D ≥16</th>
<th>Moderate/severe level of depression CES-D ≥27</th>
<th>Relative risk ratio, % clinical level of depression CES-D ≥16</th>
<th>Relative risk ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17.5%</td>
<td>4.8%</td>
<td>1.844</td>
<td>1.158 to 2.936</td>
</tr>
<tr>
<td>Female</td>
<td>28.1%*</td>
<td>7.5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05, CES-D, Center for Epidemiological Studies Depression Scale.

**Table 3** Relative risk ratio by sport for clinically relevant depressive symptoms

<table>
<thead>
<tr>
<th>Sport</th>
<th>Clinical level of depression CES-D ≥16</th>
<th>Moderate/severe level of depression CES-D ≥27</th>
<th>Relative risk ratio Clinical level of depression CES-D ≥16</th>
<th>Relative risk ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track and field</td>
<td>35.4%*</td>
<td>8.5%</td>
<td>2.066</td>
<td>1.230 to 3.470</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>34.3%</td>
<td>5.7%</td>
<td>1.778</td>
<td>0.853 to 3.710</td>
</tr>
<tr>
<td>Crew</td>
<td>26.1%</td>
<td>13.0%</td>
<td>1.152</td>
<td>0.442 to 3.000</td>
</tr>
<tr>
<td>Tennis</td>
<td>24.0%</td>
<td>0%</td>
<td>1.024</td>
<td>0.398 to 2.635</td>
</tr>
<tr>
<td>Basketball</td>
<td>23.1%</td>
<td>5.8%</td>
<td>0.970</td>
<td>0.379 to 2.482</td>
</tr>
<tr>
<td>Soccer</td>
<td>23.1%</td>
<td>0%</td>
<td>0.968</td>
<td>0.487 to 1.921</td>
</tr>
<tr>
<td>Baseball/softball</td>
<td>22.1%</td>
<td>11.8%</td>
<td>0.903</td>
<td>0.485 to 1.678</td>
</tr>
<tr>
<td>Field hockey</td>
<td>17.4%</td>
<td>8.7%</td>
<td>0.669</td>
<td>0.222 to 2.012</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>13.5%*</td>
<td>2.7%</td>
<td>0.424</td>
<td>0.234 to 0.768</td>
</tr>
</tbody>
</table>

*p <0.05, CES-D, Center for Epidemiological Studies Depression Scale.
it was notable in this sample that particular gender and sport combinations (eg, female track and field athletes, male lacrosse players) differed in depression risk from the sample as a whole. This finding could be of particular use for sports medicine clinicians working with athletes and implementing depression screening across a variety of sports. Additional research could explore differential protective factors, and risk factors, for male and female athletes in particular sports. Multisite, multiyear studies, involving more athletic divisions and examining sport and gender interactions, as well as cultural and demographic variables, could prove particularly useful.

It may come as no surprise to some in sports medicine that there appear to be gender differences in endorsement of depressive symptom among student athletes. Unlike some areas of medicine (cardiovascular disease, cancer), which have identified gender differences, sports medicine is only recently beginning to examine the gender differences in injuries and other health conditions affecting athletes. For example, in sports-related concussions, female high school athletes have demonstrated higher rates of injury than males in comparable sports. In high school soccer, for example, females have 3.4 concussions per 10,000 rates of injury than males in comparable sports. In high school football, female high school athletes have demonstrated higher concussions, female high school athletes have demonstrated higher concussions among student athletes. Unlike some areas of medicine (cardiovascular disease, cancer), which have identified gender differences, sports medicine is only recently beginning to examine the gender differences in injuries and other health conditions affecting athletes. For example, in sports-related concussions, female high school athletes have demonstrated higher rates of injury than males in comparable sports. In high school soccer, for example, females have 3.4 concussions per 10,000 rates of injury than males in comparable sports. In high school football, female high school athletes have demonstrated higher concussions among student athletes. Unlike some areas of medicine (cardiovascular disease, cancer), which have identified gender differences, sports medicine is only recently beginning to examine the gender differences in injuries and other health conditions affecting athletes. For example, in sports-related concussions, female high school athletes have demonstrated higher rates of injury than males in comparable sports. In high school soccer, for example, females have 3.4 concussions per 10,000 rates of injury than males in comparable sports. In high school football, female high school athletes have demonstrated higher concussions among student athletes. Unlike some areas of medicine (cardiovascular disease, cancer), which have identified gender differences, sports medicine is only recently beginning to examine the gender differences in injuries and other health conditions affecting athletes. For example, in sports-related concussions, female high school athletes have demonstrated higher rates of injury than males in comparable sports. In high school soccer, for example, females have 3.4 concussions per 10,000 rates of injury than males in comparable sports. In high school football, female high school athletes have demonstrated higher concussions among student athletes. Unlike some areas of medicine (cardiovascular disease, cancer), which have identified gender differences, sports medicine is only recently beginning to examine the gender differences in injuries and other health conditions affecting athletes. For example, in sports-related concussions, female high school athletes have demonstrated higher rates of injury than males in comparable sports. In high school soccer, for example, females have 3.4 concussions per 10,000 rates of injury than males in comparable sports. In high school football, female high school athletes have demonstrated higher concussions among student athletes.

### Table 4 Relative risk ratio by sport and gender for clinically relevant depressive symptoms

<table>
<thead>
<tr>
<th>Gender/sport</th>
<th>Clinical level of depression CES-D ≥16</th>
<th>Moderate/severe level of depression CES-D ≥27</th>
<th>Relative risk ratio</th>
<th>Clinical level of depression CES-D ≥16</th>
<th>Relative risk ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female track and field</td>
<td>37.7%*</td>
<td>6.6%</td>
<td>2.257</td>
<td>1.272 to 4.002</td>
<td></td>
</tr>
<tr>
<td>Female softball</td>
<td>30.4%</td>
<td>13.0%</td>
<td>1.446</td>
<td>0.578 to 3.617</td>
<td></td>
</tr>
<tr>
<td>Female soccer</td>
<td>31.0%</td>
<td>10.3%</td>
<td>1.500</td>
<td>0.661 to 3.403</td>
<td></td>
</tr>
<tr>
<td>Male track and field</td>
<td>25.0%</td>
<td>15.0%</td>
<td>1.094</td>
<td>0.388 to 3.086</td>
<td></td>
</tr>
<tr>
<td>Male baseball</td>
<td>17.8%</td>
<td>11.1%</td>
<td>0.675</td>
<td>0.304 to 1.500</td>
<td></td>
</tr>
<tr>
<td>Female lacrosse</td>
<td>16.7%</td>
<td>4.8%</td>
<td>0.622</td>
<td>0.268 to 1.446</td>
<td></td>
</tr>
<tr>
<td>Male soccer</td>
<td>13.0%</td>
<td>0%</td>
<td>0.471</td>
<td>0.137 to 1.616</td>
<td></td>
</tr>
<tr>
<td>Male lacrosse</td>
<td>11.6%*</td>
<td>1.4%*</td>
<td>0.377</td>
<td>0.174 to 0.817</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05.

CES-D, Center for Epidemiological Studies Depression Scale.

The results from this study highlight the need for increased mental health screening for college athletes as part of standard sports medicine care. Such screening could be implemented formally during yearly physicals and after injury, but it should also be conducted during informal contacts with college athletes.
Considering the relatively high proportion of athletes who endorse depressive symptoms during physicals, it is clear that sports medicine providers working with college athletes must be attentive to mental health concerns. Sports medicine personnel could benefit from training opportunities in screening for mental health issues, responding to mental health risks (eg, suicidality, behavioural emergencies), and evidence-based treatment protocols.

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REFERENCES
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