TITLE: Trends in College Student-Athlete Mental Health in the National College Health Assessment (NCHA), 2011-2019

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ABSTRACT

Context: Recently the athletic training community has paid increased attention to college student-athlete mental health, treatment-seeking, and impacts on athletic and academic performance. Ongoing efforts to better-educate and equip athletic trainers to help student-athletes in this regard should result in improved mental health-related outcomes. Objective: Examine changes in student-athlete mental health over the past decade compared to non-athlete students. Design: Cross-sectional study. Setting: United States colleges and universities. Patients or Other Participants: Varsity athletes (n=54,479) and non-athlete students (n=448,301) who completed the National College Health Assessment (NCHA) between 2011 and 2019. Main Outcome Measures: Survey responses (self-report) to questions in five mental health-related domains: symptoms, diagnoses, treatment-seeking, institutional information distribution, and academic impacts. Results: Student-athletes consistently reported significantly lower symptom and diagnose rates than non-athletes, except for attempted suicide, substance abuse, and eating disorders. Diagnoses increased over time in both groups, but remained lower in athletes. Treatment-seeking and openness to future treatment increased over time in both groups, but remained lower in athletes. Student-athletes received more information on stress reduction, substance abuse, eating disorders, and handling distress/violence than non-athletes. Both groups received information more frequently over time. Athletes reported lower academic impacts, especially for depression and anxiety, but impacts grew over time in both groups. Impacts of
injuries and extracurricular activities on academic performance were higher in athletes than in non-athletes. **Conclusions:** Athletes reported overall lower levels of symptoms, diagnoses, and academic impacts than non-athletes. While non-athlete rates climbed over the past decade, athletes’ rates broadly remained flat or climbed less rapidly. Increasingly positive attitudes toward treatment are encouraging, but the deficit relative to non-athletes remains. Ongoing efforts of athletic trainers to educate athletes and guide them to mental health resources are needed in order to continue (or, better yet, accelerate) the observed positive trends in information dissemination and treatment-seeking.

**Key words:** student-athletes, mental health, time series analysis, health education, NCHA

**Abstract word count:** 300

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**Key points:** Student-athletes report lower rates of most mental health symptoms, diagnoses, and impacts on academic performance, compared to non-athlete students.

Self-report of anxiety, mood disorders, and other mental health challenges increased over the past decade in non-athletes, but remained largely flat or increased less rapidly in student-athletes.

Treatment-seeking and willingness to seek future treatment increased over time in student-athletes, but still lagged behind rates in non-athlete students. The observed increase may be related to increases in receiving mental health information from the institution.
INTRODUCTION

The National Institute of Mental Health estimates that 51.5 million U.S. adults live with a mental health condition. Mental health conditions are particularly prevalent among young adults between ages 18-25 y, with a rate of 29.4% compared to 25.0% of adults ages 26-40 y, and 14.1% of adults ≥50 y old. As young adults, college student-athletes are not exempt from mental health conditions. According to the 2016 National College Health Assessment (NCHA), of 55,369 varsity athletes responding to the survey, 19.0% reported they had been diagnosed with a mental health condition. Although it is encouraging that student-athletes self-report mental health diagnoses at a lower rate than their peers, several aspects of college student-athlete mental health remain understudied, and may act as barriers to improvement. One of the most important issues in college student-athlete mental health is underutilization of mental health services. Barriers to treatment-seeking include limited time and lack of services, but also social and self-imposed stigmas on treatment-seeking originating from family, community, teammates, and cultural contexts. Such stigmas exist in the broader society, but may be exacerbated among athletes where concepts like “mental toughness” contribute to a reluctance to address mental health issues. These impediments to seeking appropriate diagnosis and treatment can have detrimental effects on well-being and quality of life, as well as on athletic and academic performance.

Despite persistent barriers to treatment, recognition of athlete mental health and treatment needs has grown recently. Many colleges and universities have become more aware and proactive in helping student populations, offering a variety of on- and off-campus counseling services. This is certainly a step in the right direction of offering primary preventative measures, but the stigma of mental health still exists and has profound impacts on student-athletes.
Therefore, secondary preventative measures need to be addressed. One of the most important and available secondary resources student-athletes can access is the athletic trainer (AT). Most intercollegiate athletic teams have a dedicated AT, meaning that each athlete has direct access to a trained medical professional. While ATs are not typically licensed to practice counseling or psychotherapy, they are educated and trained in recognizing mental health issues and referring athletes to appropriate mental health professionals.\\(^5\)\\(^6\)

The roles and capabilities of ATs in promoting student-athlete mental health have expanded recently, with the intended effects of increasing awareness, reducing stigma, and improving treatment-seeking. In 2012, the Commission on Accreditation of Athletic Training Education (CAATE) released a new set of ten educational competencies for AT students, five related to psychological theory, and five related to psychosocial intervention.\\(^7\) These were revised in 2020 to include 18 competencies related to psychosocial intervention.\\(^8\) In 2013, a group of leading experts from the National Athletic Training Association (NATA) developed a consensus statement of best practices for managing mental health issues among collegiate student-athletes. This statement provides a blueprint for ATs to act as a resource for student-athletes living with mental health conditions, focusing on behaviors to monitor, utilizing pre-participation physical exams as an opportunity to assess student-athlete mental health, and tactics for approaching a student-athlete exhibiting symptoms of a mental health condition.\\(^9\) These NATA guidelines were subsequently used as the basis for the National Collegiate Athletic Association’s (NCAA) 2016 Mental Health Best Practices consensus document.\\(^10\)

The recent increase in awareness of student-athlete mental health, as well as increasing calls for an active role of ATs as the first order of intervention in student-athlete mental health issues, is encouraging. As a consequence, it is reasonable to expect that student-athlete mental health
and treatment-seeking should be improving, as colleges/universities and their ATs provide athletes with more and easier avenues for accessing mental health resources. Whether increased emphasis on student-athlete mental health has produced the desired results, however, remains unclear. The present study uses a retrospective cross-sectional design and eight recent academic years of data from the NCHA (2011/2012-2018/2019) to test the hypothesis that issues related to student-athlete mental health have improved over the recent past. Time trends and differences between athletes and non-athlete students are analyzed in five specific domains: mental health symptoms, mental health diagnoses, treatment-seeking behavior, receiving mental health information from the institution, and impacts on academic performance.

METHODS

Data were obtained from the American College Health Association’s (ACHA) NCHA surveys IIb (2011-2015), and IIc (2015-2019) [ACHA, producer and distributor; date of data file distribution: 02/10/2020]. The NCHA survey is administered nationwide to students at participating institutions, with questions related to health habits, health behaviors, and perceptions of health-related topics. The anonymous, self-reported data are meant to help college health service providers, educators, counselors, and administrators better understand the health of their students and students at comparable institutions. The dataset also provides opportunities to study nationwide trends in student health. Survey reliability and validity are well-documented.11

The authors accessed and analyzed NCHA data under a data sharing agreement with ACHA. The local Institutional Review Board determined this study’s procedures were exempt from oversight. Data from the full national sample from fall 2011 through spring 2019 were accessed. To limit analysis to full-time undergraduate students, respondents self-identifying as graduate,
professional, non-degree-seeking, or part-time students were excluded. Observations from schools with Basic Carnegie Classifications of “Special Focus Institutions” or “Miscellaneous/Not Classified” were also excluded.

Of primary interest were the effects of two independent variables: 1) time, and 2) athlete status. The NCHA is administered each semester, excluding summers, and the dataset includes a variable (“STUDY”) coding for the semester in which responses were obtained. For ease of interpretation and to ensure consistency in ordinal time intervals, we created a dummy variable grouping pairs of semesters into academic years. Thus, the time variable “academic year” included eight levels corresponding to academic years 2011/2012-2018/2019.

Athlete status was determined using survey question 64: “Within the last 12 months, have you participated in organized college athletics at any of the following levels?” with “Yes/No” response options for “Varsity,” “Club sports,” and “Intramurals.” Students replying “Yes” to “Varsity” were assigned to the category “Athlete,” including students who also replied “Yes” “Club” and/or “Intramurals.” Students replying “No” to “Varsity” but “Yes” to “Club” and/or “Intramurals” were excluded, as our specific focus is on scholarship athletes who routinely interact with college-employed ATs. Students replying “No” to all three choices were assigned to the category “Non-Athlete.” We recognize that students in the latter group may be physically active or compete athletically outside of college-organized structures, but that is beyond the ability of the survey to determine.

Outcomes were grouped into five domains: 1) recent mental health symptoms, 2) recent mental health diagnoses, 3) mental health treatment-seeking behavior, 4) receiving mental health information from the institution, and 5) recent impact of mental health factors on academic performance. Table 1 presents specific outcomes within each category. Questions in category 4
were structured in the original survey as binary “Yes”/”No” response choices, and were thus used without recoding. Questions in remaining categories had ≥3 response choices, which we recoded into binary “Yes”/”No” answers to simplify interpretation.

Recent mental health symptom responses were condensed into “No, not in the last 12 months” or “Yes, in the last 12 months.” Recent mental health diagnosis responses were condensed into “No, no diagnosis or treatment within the last 12 months” or “Yes, diagnosis and/or treatment within the last 12 months.” Specific mental health diagnoses were grouped into six larger domains corresponding to established mental health taxonomy: addiction disorders (substance abuse, other addiction), anxiety disorders (anxiety, obsessive compulsive disorder, panic attacks, phobia), eating disorders (anorexia, bulimia), mood disorders (bipolar disorder, depression), sleep disorders (insomnia, other sleep disorders), and other (ADHD, schizophrenia, other mental health conditions).

Past mental health treatment responses were condensed to “No, never” or “Yes, ever.” For consideration of future mental health treatment-seeking, the survey allowed only “Yes/No” responses, so this variable was not recoded. Recent impacts of mental health/other factors on academic performance were chosen to correspond to mental health diagnosis domains above, plus two factors expected to affect Athletes more than Non-Athletes: injuries and extracurricular activities. Responses for each were condensed to “No, did not affect my academic performance in the last 12 months,” or “Yes, affected my academic performance in the last 12 months.”

Gender and sexuality, race and ethnicity, age, and institutional attributes (public vs. private, enrollment/campus size, and degrees awarded/level of research activity) all exert influences on mental health symptoms, diagnoses, treatment-seeking, and stigma. To isolate the effects of time and athlete status independent of these influences, we included them as covariates.
in statistical analyses. Because gender identity questions differed between NCHA-IIb and
NCHA-IIc, for consistency we recoded responses into three mutually exclusive categories: cis-
male, cis-female, and non-binary (anyone not cis-male/cis-female). The “non-binary” category
incorporates a range of specific gender identities, reducing analytical granularity. We also do not
consider sexual orientation or its relationships to gender here. These are limitations with respect
to specifically understanding influences of gender and sexuality on student-athlete mental health,
but this is beyond the scope of the study. The tripartite gender model is likely sufficient to
control for gender as a covariate in this study’s context. We intend to more closely examine
gender identity and sexual orientation influences on student-athlete mental health in future work.

The NCHA asks multiple questions regarding racial and ethnic self-identification. We
recoded data to create a single race/ethnicity variable, with six mutually exclusive categories:
Non-Hispanic White; Non-Hispanic Black; Hispanic of any race; Asian or Pacific Islander;
American Indian, Alaskan Native, or Native Hawaiian; and Biracial or Multiracial. As with
gender, this rubric oversimplifies complex influences of racial/ethnic backgrounds on college
experiences and relationships to mental health, stigma, and treatment-seeking. However, for our
current purposes, this model is likely sufficient. We intend to conduct finer-grained analysis of
these effects in future research.

Chronological age was used a demographic descriptor, but years in college represented age in
the study’s models. Age and years in college were highly correlated (Spearman’s ρ=0.87;
P<0.001), making inclusion of both in statistical models redundant. We chose years in college as
it largely accounts for variation in chronological age and relates to the length of time a student is
exposed to (and can adjust to) stressors of college, has access to college mental health
information and services including ATs, and participates in athletics. Finally, institutional
attributes were incorporated directly from NCHA data, including dichotomous institutional control (public/private), total enrollment (<2500; 2,500-4,999; 5,000-9,999; 10,000-19,999; ≥20,000), and Basic Carnegie Classification (Associates Colleges; Baccalaureate Colleges; Masters Colleges/Universities; Research Institutions).

Statistical Analysis

Statistical analysis was performed in SAS 9.4 (SAS Institute, Cary, NC). Because of the large sample and statistical power to detect significance for even small effect sizes, and to adjust for testing multiple hypotheses (Table 1), the statistical significance criterion was set at \( \alpha = 0.001 \).

Demographic data, academic information, and institutional attributes were compared between groups using independent samples t-tests for continuous variables, and chi square tests for categorical/ordinal variables. Effect size estimates for comparisons were derived as Cohen’s \( d \) (standardized difference between means) for continuous variables, and Cramer’s V for categorical/ordinal variables.\(^{20,21}\)

Effects of time and athlete status on each mental health-related outcome were analyzed using binomial logistic regression analysis. The effect of primary interest for each outcome was the time*athlete status interaction. Where this interaction was non-significant, it was removed from the model and the main effects of time and of athlete status were analyzed. All models included demographic and institutional covariates detailed above. Odds ratios (OR) with 95% confidence intervals (CIs) were calculated for significant interactions and main effects after adjusting for covariate effects. Interaction ORs express log odds of each outcome in Athletes relative to Non-Athletes (reference) on an academic-year-by-academic-year basis. Athlete status main effect ORs express log odds of each outcome in Athletes relative to Non-Athletes (reference) across all
academic years. Time main effect ORs express log odds of each outcome per academic year, relative to the reference academic year of 2011/2012 (OR_{unit}), across all students. Time ORs were also extrapolated to express cumulative effects across the 8-year study period (i.e. 2018/2019 vs. 2011/2012; OR_{range}). To aid in interpretation, ORs were also converted to approximate values of \(d\) (following Hasselblad and Hedges, 1995; see Appendix).^{21,22}

RESULTS

Sample Characteristics

After applying exclusion criteria, a sample of \(n=502,780\) representing 607 unique institutions was analyzed. Median academic years per institution was 2 (IQR: 1-3; range: 0.5-8), and median observations/institution was 540 (IQR: 225-1105; range: 1-8,763). The sample included \(n=54,479\) Athletes, and \(n=448,301\) Non-Athletes. Distributions for demographic variables and institutional characteristics differed significantly between groups (for each, \(P<0.001\)), but, with the exception of age, effect sizes were small to marginal (see Table 2).

Logistic Regression Analysis

See the Appendix for full logistic regression statistical results. Overall models for each outcome were statistically significant (for each, \(P<0.001\)). Detailed results for each outcome category are presented below.

Recent Mental Health Symptoms

The time*athlete status interaction was significant for feeling hopeless, overwhelmed, exhausted, very lonely, very sad, depressed to the point of functional difficulty, overwhelming
anxiety, and overwhelming anger (for each, \(P \leq 0.001\)). In each case, frequencies of “Yes” responses were lower in Athletes than in Non-Athletes for every year (see Figure 1). For intentional self-harm and considering suicide, interactions were not significant (for each, \(P \geq 0.034\)), but main effects of time and athlete status were (for each, \(P < 0.001\)). For both outcomes, rates across groups increased over time (intentional self-harm: 6.4% to 10.0%, considering suicide: 7.8% to 15.0%), but remained slightly lower in Athletes across the study period (intentional self-harm: 1-3 percentage points, considering suicide: 3-6 percentage points). For attempted suicide, neither the interaction nor the athlete status main effect were significant (for each, \(P \geq 0.036\)), but the time effect was significant (\(P < 0.001\)). Athletes and Non-Athletes alike reported increased suicide attempts from ~2% in 2011/2012 to ~3% in 2018/2019.

Recent Mental Health Diagnoses

The interaction was not significant for any diagnosis category (for each, \(P \geq 0.002\)), but the main effect of time was significant for each category (for each, \(P < 0.001\)) with recent diagnoses increasing in all categories from 2011/2012-2018/2019 [Figure 2]. Although some increases were small (e.g., 1 percentage point for addiction disorders), substantial increases over time occurred for anxiety (13.0% to 25.4%), mood disorders (10.8% to 20.3%), and overall rates of any diagnosis (20.1% to 32.5%). The athlete status main effect was significant for the majority of mental health diagnosis categories [Figure 2] except for addiction and eating disorders (for each, \(P \geq 0.132\)). Athletes reported 1-7-percentage-point-lower rates of anxiety, mood, sleep, other, and any mental health diagnoses than Non-Athletes across all years. In particular, diagnosis rates were lower among Athletes for anxiety (7 percentage points), mood disorders (6 percentage points), and overall (7 percentage points).
Mental Health Treatment-Seeking Behavior

The interaction was not significant for past mental health treatment or consideration of future treatment (for each, $P \geq 0.008$). Time and athlete status main effects were significant for each outcome (for each, $P < 0.001$; [Figure 3]). Among all students, treatment-seeking rates increased from 37.8% in 2011/2012 to 45.9% in 2018/2019, as did consideration of future treatment (70.2% to 79.6%). Across all years, Athletes reported lower rates than Non-Athletes for past treatment (32.7% vs. 42.0%) and consideration of future treatment (69.5% vs. 74.6%).

Receiving Mental Health Information from the Institution

The interaction was significant only for information on stress reduction ($P < 0.001$; for each other outcome $P \geq 0.003$). Athletes more frequently received information on stress than Non-Athletes, but the gap narrowed slightly over the study period (65.7% vs. 59.4% to 69.0% vs. 65.9%). For remaining outcomes, the time and athlete status main effects were significant (for each, $P < 0.001$). More students reported receiving mental health information in more recent years, except for information on eating disorders, which decreased by ~4% from 2011/2012 to 2018/2019. Especially large increases in receiving information occurred for depression and anxiety (52.8% to 68.7%), helping others in distress (37.0% to 54.0%), sexual assault/relationship violence (65.5% to 82.5%), and suicide prevention (36.0% to 55.7%). Across all years, Athletes reported receiving mental health information at rates 4.4 to 16.3 percentage points higher than Non-Athletes. Athletes were especially more likely to receive information about alcohol/drug use (87.8% vs. 78.5%), eating disorders (42.9% vs. 33.6%), helping others in distress (55.4% vs. 46.4%), and violence prevention (71.1% vs. 54.8%).
Recent Impacts on Academic Performance

The interaction was significant for academic impacts of anxiety and extracurricular activities (for each, \( P<0.001 \)), but not for any other factors (for each, \( P\geq0.012 \)). Non-Athletes reported increasing rates of anxiety impacting academic performance across the study period (21.9% to 30.4%), whereas Athletes consistently reported lower rates of anxiety impacting academics, with a slight increase over time (16.1% to 20.7%, [Figure 4]). Non-Athletes maintained steady rates of extracurricular activities impacting academic performance (8.1-9.4% across the study period), while Athletes reported consistently higher impacts with a slight decrease over time (from 24.4% to 21.0%, [Figure 4]).

Of the remaining outcomes, the time main effect was significant for all but injuries (\( P=0.708; \) all others \( P<0.001 \)), and the athlete status main effect was significant for all but eating disorders (\( P=0.387; \) all others \( P<0.001 \)). Athletes consistently less frequently reported impacts of depression than Non-Athletes (9.9% vs. 17.0%), but rates grew over time in both groups (12.8% to 21.2%). For sleep disturbances, 18.0% of Athletes reported an impact on academic performance vs. 22.9% of Non-Athletes, with only marginal increases over time (22.0% to 23.8%). Injury impacts were low in both groups, but slightly higher among Athletes (4.6% vs. 1.8%). Overall rates were low in both groups for impacts of substance use (Athletes: 5.1%, Non-Athletes: 4.5%) and eating disorders (Athletes: 1.5%, Non-Athletes: 1.5%), with marginal changes over time (substance use: 5.2% to 4.1%; eating disorders: 1.1% to 1.9%).

DISCUSSION

This study investigated trends from 2011-2019 in Athlete and Non-Athlete college
students’ self-reported rates of mental health symptoms, diagnosis, treatment-seeking, receiving information from institutions, and academic impacts. Overall, the data show athletes reported mental health symptoms and diagnoses at lower rates than non-athletes across the study period. Non-Athlete symptom reporting rates increased over the study period, while Athlete rates tended to remain flat. In contrast, both groups increasingly reported mental health diagnoses over the study period, although Athletes consistently reported lower rates than Non-Athletes. Both groups demonstrated increases in treatment-seeking behavior and openness to future treatment, but Athletes continued to report treatment-positive attitudes at significantly lower rates than Non-Athletes. The gap in treatment-seeking is especially interesting in light of Athletes receiving mental health information from their institutions at significantly higher rates than Non-Athletes, and an increase over time in both groups receiving such information. Finally, a non-trivial percentage of Athletes and Non-Athletes reported impacts of anxiety on academic performance, but the Athlete rate was lower and grew more slowly over time. Other factors (depression, sleep disturbances) also affected academic performance in both groups, but in a smaller proportion of Athletes vs. Non-Athletes.

Notably, although mental health symptoms have remained relatively flat over time in Athletes, diagnosis rates have increased. Several factors may explain the observed increase in diagnoses, the first being increased awareness afforded to student-athletes either through ATs or campus mental health services. It has been documented that ATs can and have played a vital role as a resource for student-athletes regarding mental health concerns. For the past decade, the governing bodies for Athletic Training (NATA, BOC, and CAATE) have made significant strides in educating new and existing ATs on how to recognize and refer student-athletes struggling with mental health symptoms. The 2015 NATA position statement clearly
delivers evidence-based guidelines for ATs to follow to provide the best possible care for
student-athletes suffering from any type of mental health issue. Therefore, it should come as no
surprise that we see an increase in student-athletes receiving information on mental health issues
and services, as well as an increase in treatment-seeking behavior among the same population.
Athletic trainers are uniquely positioned as a first line of defense in the battle against mental
health issues among student-athletes.

Another factor could be the anonymity of the NCHA survey. In theory anonymity should
remove issues of stigma from the accuracy of self-report, in which case the observed trends of
rising mental health symptoms are cause for concern. Recent work with the NCHA has
uncovered similar trends across all students, but does not shed light on underlying explanatory
factors. Despite anonymity, it is possible that stigma among athletes may be powerful enough
to drive untruthful responses. This concept is consistent with a study of anonymous survey
respondents showing an increase in the reporting of socially inappropriate attributes, but also
showing inconsistencies in the honesty of responses due to either stigma or lack of
accountability. Based on these findings, it is possible that student mental health is truly
growing worse, but it is also possible that student mental health self-reporting is simply
becoming more forthcoming, open, and honest, such that previously unreported mental health
issues are now out in the open. In the latter case, the rise in reporting among non-athletes
compared to the relatively flat rates in student-athletes may be cause for concern, in that athletes
may not be growing more open with discussing their mental health challenges, even when
anonymous. It is beyond the capacity of the present study to determine whether this is the case,
but it should be addressed in future research.

The results of the study showed increased rates of treatment-seeking and openness to
future treatment among all students which is encouraging. However, the deficit in athletes
relative to non-athletes remains, which is discouraging. Ideally, efforts to reduce stigma and
increase awareness among athletes should increase treatment-seeking behavior. Due to the fact
that the treatment-seeking questions (no timeline) and the diagnosis/symptom questions
(timeline) lack continuity amongst timeline comparisons, it is difficult to make direct
comparisons to determine precisely how many mental health condition sufferers are going
untreated. However, high rates of some mental health symptoms in the past 12 months far exceed
rates of treatment-seeking, suggesting that many college students, perhaps especially athletes, are
not seeking treatment when they may need to. For example, over 50% of student-athletes
reported feeling overwhelming anxiety in the 2018/2019 academic year, but just under 35%
reported having ever sought treatment for any mental health condition.

Of particular concern is the rise in attempted suicides over the study period, and the much
larger rise in consideration of suicide and self-harm among all college students regardless of
athlete status. Seeking the sources of these increases is vital to protecting students from self-
harm. The phenomenon could be linked to use of social media, which has increased drastically
over the past decade to become the preferred form of communication among college students. A
2018 study using data from 2010-2015 showed a correlation between increased use of social
media and higher numbers of suicides and suicide attempts in adolescents.25 Ways to limit social
media use, or encourage its healthy as opposed to negative use, could be an important tool for
ATs to help reduce self-harm and suicidal ideation among student-athletes. Another possible
explanation for increased suicidal behavior over the past decade could be related to emotional
exhaustion and cultural background. A 2021 study showed an increase in suicidal intent and
attempts by African-American college students who were suffering from either emotional
exhaustion or multiple psychiatric symptoms.\textsuperscript{26} The group with the second highest rate of suicidal intent in this study was Asian/Pacific Islanders.\textsuperscript{26} These correlations merit future studies of the impact of mental health issues in the context of ethnic and cultural background for college student-athletes.

In conclusion, this study showed that student-athletes reported an increase in treatment-seeking behaviors for mental health conditions, possibly related to increased exposure to information through their ATs. Increased knowledge among ATs related to recognizing mental health symptoms and taking action in referring the student-athlete to appropriate medical professionals is necessary to continuing this positive trend in the future. Continued progress can perhaps help further reduce the number of student-athletes suffering from untreated mental health challenges, despite their already lower rates compared to non-athlete students. Further reducing the impact of anxiety, depression, and other mental health factors on academic performance and overall wellbeing is important to promoting well-rounded, academically successful student-athletes. Athletic trainers are well-positioned to continue play an important and growing role in this pursuit.

LIMITATIONS AND FUTURE RESEARCH

A limitation is that study data were based on self-report of prior diagnosis and treatment seeking. These data may thus underestimate the real mental health burden in this population if there are issues related to misreporting, or if students suffer from undiagnosed mental health disorders. However, anonymous surveys may encourage more accurate reporting than non-anonymous methods, especially in individuals who attach stigma to mental health conditions.\textsuperscript{28} Another limitation to this study is the potential for individual students taking the survey at the
same institution in multiple academic years. Given the anonymity of the survey, we have little
ability to assess how often this may have happened, although roughly half of included schools
only administered the survey once, or administered it twice with a four-year gap between
surveys, meaning those students are likely not repeated in the sample. In terms of interpreting the
results, incidental repeated measures in the dataset would mean that the reported 95% confidence
intervals are somewhat narrower than they would be in a purely cross-sectional sample.

Two areas of future research that can provide additional benefits to students suffering
from mental health challenges include a better understanding of the effects of social media, as
well as a deeper understanding of individual and school factors that predict mental health
symptoms, diagnoses, and treatment seeking. With the increased role of social media in students’
daily lives and increased societal pressures placed on students through social media, it is possible
that social media has played a role in the increased suicide attempt rates demonstrated in this
study. In addition to social media exposure, little is known about the manner in which other
factors such as race/ethnicity, gender, sexual orientation, school type (e.g., public vs. private) on
their own and in combination affect the likelihood of experiencing mental health symptoms,
being diagnosed with a mental health condition, or seeking treatment. Further analysis of the
relative impact of these and other factors could help ATs develop screening and early warning
tools to enhance their ability to intervene in athlete mental health issues and promote early and
effective treatment-seeking.

DISCLAIMER

The opinions, findings, and conclusions reported in this article are those of the authors, and are
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FIGURE LEGENDS

**Fig. 1:** Frequencies of “Yes” responses and odds ratios (ORs) for mental health symptoms in the past 12 months (A: Hopelessness; B: Overwhelmed; C: Exhausted; D: Very lonely; E: Very sad; F: Depressed; G: Overwhelming anxiety; H: Overwhelming anger) where the time*athlete status interaction was significant (for each, $P<0.001$). Black bars represent Athletes, and white bars represent Non-Athletes. Frequencies and ORs are presented by academic year (horizontal axis). The ORs compares Athlete log odds of a “Yes” response to the Non-Athlete reference for each academic year, with dots representing the OR and error bars representing 95% confidence intervals (CIs). An OR less than 1 means that Athletes were less likely than Non-Athletes to respond “Yes” for a given mental health symptom in a given academic year, whereas an OR greater than 1 means Athletes were more likely than Non-Athletes to respond “Yes” for a given mental health symptom in a given academic year. Where the 95% CI includes the value of 1, there is no difference in log odds between Athletes and Non-Athletes.

**Fig. 2:** Frequencies of “Yes” responses for mental health diagnosis categories in the past 12 months in Athletes (black bars) and Non-Athletes (white bars), by academic year (horizontal axis). Mental health diagnosis categories are as follows: A: Any mental health diagnosis; B: Anxiety disorders; C: Mood disorders; D: Addiction disorders; E: Eating disorders; F: Sleep disorders; G: Other disorders. The time main effect was significant for each category (for each, $P<0.001$). Odds ratios (ORs) for the athlete status main effect are in panel H. Circles represent the log odds of Athlete “Yes” responses compared to the Non-Athlete reference across all academic years, and error bars represent 95% confidence intervals (CIs). An OR less than 1 means that Athletes were less likely than Non-Athletes to respond “Yes” for a given mental health symptom.
health diagnosis, whereas an OR greater than 1 means Athletes were more likely than Non-Athletes to respond “Yes” for a given mental health diagnosis. Where the 95% CI includes the value of 1, there is no difference in log odds between Athletes and Non-Athletes. The athlete status main effect was significant \((P<0.001)\) for each diagnosis category, except for addiction and eating disorders (for each, \(P\geq0.132\)).

**Fig. 3:** Frequencies of “Yes” responses for mental health treatment-seeking in the past (A) or consideration of seeking mental health treatment in the future (B) in Athletes (black bars) and Non-Athletes (white bars) by academic year (horizontal axis). The time and athlete status main effects were both significant \((P<0.001)\) for each treatment-seeking question. Odds ratios (ORs) for the athlete status main effect are in panel C. Circles represent the log odds of Athlete “Yes” responses compared to the Non-Athlete reference across all academic years, and error bars represent 95% confidence intervals (CIs). An OR less than 1 means that Athletes were less likely than Non-Athletes to respond “Yes” for treatment-seeking, whereas an OR greater than 1 means Athletes were more likely than Non-Athletes to respond “Yes” for treatment-seeking. Where the 95% CI includes the value of 1, there is no difference in log odds between Athletes and Non-Athletes.

**Fig. 4:** Frequencies of “Yes” responses and odds ratios (ORs) for the impact of mental health and other factors on academic performance in the past 12 months (A: Anxiety; B: Extracurricular activities) where the time*athlete status interaction was significant (for each, \(P<0.001\)). Black bars represent Athletes, and white bars represent Non-Athletes. Frequencies and ORs are presented by academic year (horizontal axis). The ORs compares Athlete log odds of a
“Yes” response to the Non-Athlete reference for each academic year, with dots representing the OR and error bars representing 95% confidence intervals (CIs). An OR less than 1 means that Athletes were less likely than Non-Athletes to respond “Yes” for a given impact on academic performance in a given academic year, whereas an OR greater than 1 means Athletes were more likely than Non-Athletes to respond “Yes” for a given impact on academic performance in a given academic year. Where the 95% CI includes the value of 1, there is no difference in log odds between Athletes and Non-Athletes.
| Category                        | Outcome                                                                 | NCHA Question |
|--------------------------------|-------------------------------------------------------------------------|---------------|
| Recent mental health symptoms (last 12 months) | Felt things were hopeless                                               | NQ30A         |
|                                | Felt overwhelmed by all you had to do                                   | NQ30B         |
|                                | Felt exhausted (not from physical activity)                             | NQ30C         |
|                                | Felt very lonely                                                        | NQ30D         |
|                                | Felt very sad                                                          | NQ30E         |
|                                | Felt so depressed that it was difficult to function                     | NQ30F         |
|                                | Felt overwhelming anxiety                                               | NQ30G         |
|                                | Felt overwhelming anger                                                 | NQ30H         |
|                                | Intentionally cut, burned, bruised, or otherwise injured yourself       | NQ30I         |
|                                | Seriously considered suicide                                            | NQ30J         |
|                                | Attempted suicide                                                      | NQ30K         |
| Recent mental health diagnoses (last 12 months) | Anxiety                                                                 | NQ31A2, NQ31B1-3 |
|                                | Mood                                                                    | NQ31A4, NQ31A6 |
|                                | Addiction                                                               | NQ31B5-6      |
|                                | Eating                                                                  | NQ31A1, NQ31A5 |
|                                | Sleep difficulties                                                      | NQ31A7-8      |
|                                | Other                                                                   | NQ31A3, NQ31B4, NQ31B7 |
|                                | Any                                                                     | NQ31A1-8, NQ31B1-7 |
| Mental health treatment-seeking behavior | Ever received psychological or mental health services from any provider | NQ34A-D, NQ35 |
|                                | Consider seeking help from a mental health professional in the future   | NQ36          |
| Receipt of mental health information from the institution | Alcohol and other drug use                                              | NQ2A1         |
|                                | Depression/anxiety                                                     | NQ2A3         |
|                                | Eating disorders                                                        | NQ2A4         |
|                                | Grief and loss                                                          | NQ2A5         |
| Topic                                                   | Question No. |
|--------------------------------------------------------|--------------|
| How to help others in distress                         | NQ2A6        |
| Relationship difficulties                              | NQ2B2        |
| Sexual assault/relationship violence prevention        | NQ2B3        |
| Sleep difficulties                                     | NQ2B5        |
| Stress reduction                                       | NQ2B6        |
| Suicide prevention                                     | NQ2B7        |
| Violence prevention                                    | NQ2B9        |
| Recent impacts on academic performance (last 12 months)|              |
| Anxiety                                                | NQ45A3       |
| Depression                                             | NQ45B4       |
| Substance use                                          | NQ45A1, NQ45B6 |
| Eating disorder/problem                                | NQ45B7       |
| Sleep difficulties                                     | NQ45D4       |
| Injury                                                 | NQ45C3       |
| Participation in extracurricular activities            | NQ45C6       |

a. All of the listed question numbers and wordings are the same for NCHA IIb and IIc.
Table 2. Student demographics and other characteristics

| Variable                        | Athletes (n=54,479) | Non-Athletes (n=448,301) | Effect Size<sup>d</sup> | <sup>P</sup>     |
|---------------------------------|---------------------|--------------------------|-------------------------|------------------|
| Age (y)                         | 19.7 ± 1.4          | 20.5 ± 2.3               | 0.65                    | <0.001           |
| Years in college (y)            | 2.2 ± 1.2           | 2.5 ± 1.2                | 0.25                    | <0.001           |
| Gender (%F, %M, %NB)            | 62.4%, 36.7%, 0.9%  | 72.1%, 26.2%, 1.7%       | 0.07                    | <0.001           |
| Race/ethnicity<sup>a</sup>      | 74.5%, 5.4%, 4.5%, 4.7%, 0.4%, 10.5% | 60.3%, 4.9%, 10.5%, 11.6%, 0.4%, 12.3% | 0.09                | <0.001           |
| Institutional control (%public, %private) | 40.3%, 59.7%      | 69.3%, 30.7%             | 0.19                    | <0.001           |
| Total enrollment<sup>b</sup>    | 28.7%, 18.3%, 20.1%, 16.9%, 16.0% | 9.6%, 8.9%, 16.9%, 25.1%, 39.4% | 0.24                | <0.001           |
| Basic Carnegie Classification<sup>c</sup> | 3.8%, 31.9%, 34.0%, 30.3% | 5.2%, 12.7%, 31.6%, 51.5% | 0.18               | <0.001           |

<sup>a</sup> Racial/ethnic self-descriptions were condensed into six mutually-exclusive categories. Frequencies of students in each category within the two study sub-samples are presented above in the following order: non-Hispanic White; non-Hispanic Black; Hispanic of any race; Asian or Pacific Islander; American Indian, Alaskan Native, or Native Hawaiian; Biracial or Multiracial. See text for additional details.

<sup>b</sup> Enrollment categories are as follows, in the order presented in the table: <2,500, 2,500-4,999, 5,000-9,999, 10,000-19,999, ≥20,000.

<sup>c</sup> Carnegie Classifications are as follows, in the order presented in the table: Associates Colleges, Baccalaureate Colleges, Masters Colleges and Universities, Research Institutions.

<sup>d</sup> Effect sizes are Cohen's $d$ for continuous variables (Lakens, 2013) and Cramer's V for categorical variables (Grissom and Kim, 2012).

<sup>e</sup> $P$-values are for independent samples t-tests (continuous variables), or chi square tests (categorical variables).
### Appendix: Complete logistic regression statistical results.

| Category | Outcome | Statistical Results |
|----------|---------|---------------------|
| Recent mental health symptoms (last 12 months) | | |
| | | x² | p | OR | 95% CIlower | 95% CIupper | d approx |
| | | | | | | | |
| | | 8414.8 | 0.0001 | 48.4 | 0.0001 | | |
| | | | | | | | |
| | | 18839.4 | 0.0001 | 89.7 | 0.0001 | | |
| | | | | | | | |
| | | 15603.0 | 0.0001 | 87.3 | 0.0001 | | |
| | | | | | | | |
| | | 10692.5 | 0.0001 | 48.4 | 0.0001 | | |
| | | | | | | | |
| | | 11190.0 | 0.0001 | 58.2 | 0.0001 | | |
| | | | | | | | |
| | | 9773.8 | 0.0001 | 32.8 | 0.0001 | | |
| | | | | | | | |
| | | 4765.3 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 999.7 | 0.0001 | 0.7 | 0.0001 | | |
| | | | | | | | |
| | | 2263.7 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16159.2 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 11149.2 | 0.0001 | 1.9 | 0.0001 | | |
| | | | | | | | |
| | | 1303.0 | 0.0001 | 0.5 | 0.0001 | | |
| | | | | | | | |
| | | 1361.0 | 0.0001 | 3.4 | 0.0001 | | |
| | | | | | | | |
| | | 1488.3 | 0.0001 | 3.4 | 0.0001 | | |
| | | | | | | | |
| | | 4778.0 | 0.0001 | 3.4 | 0.0001 | | |
| | | | | | | | |
| | | 4717.9 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 15778.8 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 18719.5 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 14447.5 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 10325.9 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 2453.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 20633.7 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
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| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |
| | | | | | | | |
| | | 3207.7 | 0.0001 | 17.4 | 0.0001 | | |
| | | | | | | | |
| | | 4258.5 | 0.0001 | 16.0 | 0.0001 | | |
| | | | | | | | |
| | | 16118.9 | 0.0001 | 77.0 | 0.0001 | | |