

Suicide in National Collegiate Athletic Association athletes: a 20-year analysis

Bridget M Whelan ¹, Stephanie A Kliethermes ², Kelly A Schloredt,¹
Ashwin Rao,¹ Kimberly G Harmon ¹, Bradley J Petek ³

¹Family Medicine, University of Washington, Seattle, Washington, USA

²Department of Orthopedics and Rehabilitation, University of Wisconsin-Madison, Madison, Wisconsin, USA

³Division of Cardiology, Oregon Health & Science University, Portland, Oregon, USA

Correspondence to

Bridget M Whelan, Family Medicine, University of Washington, Seattle, WA 98195, USA; bwhelan@uw.edu

KGH and BJP are joint senior authors.

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ABSTRACT

Objectives To determine the incidence rate of suicide from 2002 to 2022 among athletes from the National Collegiate Athletic Association (NCAA) and assess for potential differences by, sex, race, division and sport.

Methods NCAA athlete deaths over a 20-year period from 2002 to 2022 were identified. Poisson regression models were built to assess changes in incidence rates over time. Linear and quadratic fits between year and suicide incidence for males and females were evaluated.

Results Of 1102 total deaths, 128 (11.6%) deaths by suicide were reported (male n=98, female n=30). The overall incidence was 1:71 145 athlete-years (AYs). Over the last decade, suicide was the second most common cause of death after accidents. The proportion of deaths by suicide doubled from the first 10 years (7.6%) to the second 10 years (15.3%). The suicide incidence rate for males increased linearly (5-year incidence rate ratio 1.32 (95% CI 1.14 to 1.53)), whereas a quadratic association was identified among female athletes ($p=0.002$), with the incidence rate reaching its lowest point in females in 2010–2011 and increasing thereafter. Male cross-country athletes had the highest suicide incidence rate (1:29 815 AYs) and Division I and II athletes had a higher suicide incidence rate than Division III athletes. No significant differences in suicide incidence rates by sex, race or sport were identified.

Conclusion Deaths by suicide among NCAA athletes increased in both males and females throughout the 20-year study period, and suicide is now the second most common cause of death in this population. Greater suicide prevention efforts geared towards NCAA athletes are warranted.

INTRODUCTION

Suicide represents a serious global public health problem, with over 700 000 people dying by suicide every year.¹ In the USA, suicide rates across all ages increased by approximately 36% between 2001 and 2021.² Data from 2001 to 2020 demonstrate suicide rates, specifically among young adults,^{3–9} have also increased, rising to their highest level in 2020.¹⁰ Death by suicide is now the third leading cause of death in the USA in the general population ages 18–24 after accidents and homicide.¹⁰ Similar to the general population of young adults, suicide has previously been identified as one of the leading causes of death among National Collegiate Athletic Association (NCAA) athletes.^{11 12}

In the last decade, the NCAA has placed increasing emphasis on the mental health and well-being of student-athletes, publishing a consensus document on mental health best practices noting

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Rates of death by suicide have increased among young individuals in the general US population over the last decade; however, rates of suicide among National Collegiate Athletic Association (NCAA) student-athletes have not been fully characterised in the scientific literature.

WHAT THIS STUDY ADDS

⇒ The rate of suicide in NCAA athletes has increased and is now the second most common cause of sudden death. This study highlights the prevalence and characteristics of suicide in collegiate athletes to inform prevention initiatives.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Awareness regarding the increase in suicide rates supports the provision of greater mental health services for NCAA athletes. Coaches, team, academic advisors, medical staff and other athlete support personnel should be trained in suicide prevention, recognition and early intervention.

that mental health concerns among student-athletes are similar to their non-athlete peers.¹³ However, our understanding regarding the impact of these recommendations and how participation in competitive sports affects rates of suicidality has not previously been well documented in the literature. Some studies suggest that athletes have lower levels of depression, higher levels of self-esteem and social connectedness and are less likely to contemplate suicide than their non-athlete peers; all factors that one may expect should reduce the likelihood of suicidality.^{14 15} One study, however, found that female athletes reported higher levels of depressive symptoms and social anxiety than male athletes as well as male and female non-athletes,¹⁶ and a study in Swedish Olympic athletes found the prevalence of suicidal ideation was 15.6%.¹⁷ Other studies have reported on the relationship between sport participation and suicide. Rao and colleagues found that compared with non-athlete college students and individuals of collegiate age, suicide rates in NCAA student-athletes appeared to be substantially lower, and the greatest risk of dying by suicide was found among male athletes; specifically, those participating in the sport of American football.¹¹ A better understanding of the incidence of suicide over time in NCAA athletics is needed to inform



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policy and suicide prevention efforts. The purpose of this study was to determine the rate of suicide over the past two decades among NCAA athletes and identify differences or trends in the incidence of suicide by age, sex, race, division, sport, time of year and day of week.

METHODS

The current study included NCAA athlete deaths over a 20-year period from 1 July 2002 to 30 June 2022. The NCAA death database includes death from any cause. For this study, total deaths and death by suicide were analysed. Data were collected retrospectively from 2002 to 2004 and prospectively from 2005 to 2022. Each individual year was defined as the period from 1 July to 30 June of the following year. Athletes were defined as those competing in at least one varsity sport at NCAA Division I, II or III institutions. Athletes who were not enrolled at the time of death and athletes from other athletic associations at the time of death were not included. Athlete deaths from all causes were identified through four independent methods including the (1) NCAA Resolutions List, (2) Parent Heart Watch Database/prospective media searches, (3) NCAA insurance claims and (4) the National Center for Catastrophic Sports Injury database which have been previously described.^{12 18 19} Total athlete deaths were compiled into one database, and duplicates were removed. For multi-sport athletes, their primary sport was classified as the sporting discipline with competitive season closest in time to their time of death. As long-distance runners often compete in cross-country and track and field, these athletes were included within both the track and field and cross-country sporting groups.

The aetiology of each athlete death was ascertained through a variety of methods, primarily by internet searches for online media reports and also obituaries and review of autopsy and other official documents documenting cause of death. Most cases of suicide were identified by media or other publicly accessible reports and no further investigation was performed. In cases listed as ‘unknown’, the autopsy was requested. If an autopsy was not performed or not available, communication was sent either by mailed letter or electronically using publicly available contact information to schools or next-of-kin. The communication sent included an expression of sorrow, a description of the study, the importance of the study, information about the researchers and an invitation to discuss further by email or phone if desired. Follow-up contact was not pursued if the initial communication was not answered.

Demographic characteristics including age, race and sporting discipline were also determined using these methods. The athlete’s race was determined from autopsy report, as described in media reports or, as a last resort, athlete photos. Deaths were categorised broadly as accident, homicide, suicide, drug/alcohol overdose or medical. If a drug overdose appeared to be intentional, it was included as a suicide; if it was unknown or accidental, the death was included in the drug/alcohol overdose category. The medical causes were further broken down into cardiac, cancer, heat stroke, sickle cell trait, sport-related head injury, meningitis and others. If the cause of death could not be reasonably determined, it was recorded as unknown.¹² The total number of NCAA athletes competing per year and during the entire study period was calculated using the NCAA Sports Sponsorship and Participation Rates Report, NCAA Student-Athlete Ethnicity Report and the NCAA Sports Sponsorship and Participation Rates Dashboard.^{20–22}

Equity, diversity and inclusion statement

Our study included all identified cases of suicide in collegiate student-athletes inclusive of all genders, race/ethnicities, socioeconomic levels and occurrence in a marginalised community. Data collection was similar in all cases, and we did not alter methods based on regional, educational or socioeconomic differences of the community in which the case occurred. While the data collected were from a single, high-income country, there are vast differences in the socioeconomic status among individuals and areas within the country. Our author team consisted of four women and two men ranging from junior to mid-career and senior researchers from different disciplines.

Statistical analysis

Standard descriptive statistics were used to describe the demographic data. Continuous variables are presented as means and SDs, and categorical variables are presented as frequencies (n) and percentages (%). The incidence of suicide was calculated as the total adjudicated suicide cases/total number of athletes participating in sport. Given the low incidence of suicide deaths per year, the incidence rate was multiplied by 100 000 to calculate the incidence per 100 000 athlete-years (AYs). Incidence rates for individual sports were calculated if there were ≥ 5 suicide deaths within a given sporting discipline. Incidence rates over a typical athlete’s collegiate career were calculated by multiplying incidence by four and reported throughout the manuscript as 4AYs. Given the non-normal distribution of suicide and non-suicide deaths over the period, Poisson regression was used to assess changes in incidence rates over time. Based on preliminary scatterplots of the data, both linear and quadratic fits between year and suicide incidence for males and females were evaluated. Incidence rate ratios (IRRs) and their corresponding 95% CIs are only presented for associations that were deemed to be linear over time. IRRs were scaled from 1-year to 5-year intervals so that the exponentiated parameters represent the average change in the incidence rate of suicide and non-suicide death per five units (years). Because an IRR estimate would differ across subsequent years in a quadratic model, it is not a reasonable summary statistic for a model with a quadratic fit. Instead, the estimated inflection point is provided for quadratic models. Visual representations of the model-based predicted incidence of suicides for males and females over the 20-year period were created and are presented in conjunction with the observed yearly incidence rates. Statistical analyses were performed with R: A Language and Environment for Statistical Computing (R Core Team, Vienna, Austria, year 2023, <https://www.R-project.org/>) using the `tableone` and `ggplot2` packages and SAS (V.9.4, SAS Institutes, Cary, North Carolina, USA).

RESULTS

Study population

There was a total of 1102 athlete deaths over 9 106 516 AYs throughout the 20-year study period (1 July 2002 through 31 June 2022). One hundred twenty-eight deaths were attributed to suicide. Individuals who died by suicide ranged in age from 17 to 24 years (mean: 20, SD=1) were predominantly male (77%) and white (59%). Full baseline characteristics among the total death and suicide groups are presented in [table 1](#).

Incidence of suicide

The overall incidence rate of suicide among NCAA athletes over the study period was 1:71 145 AYs (95% CI 1:62 058 to 1:88 328). Incidence rates stratified by sex, race, NCAA division and

Table 1 Patient demographics of total deaths and total suicide cases among NCAA athletes

Demographics*	Total deaths N=1102 (%)	Total suicide N=128 (%)
Age†	20 (2)	20 (1)
Sex		
Male	861 (78)	98 (77)
Female	241 (22)	30 (23)
Race		
White	702 (64)	91 (59)
Black	330 (30)	27 (21)
Hispanic/Latino	26 (2)	6 (5)
Asian	21 (2)	2 (2)
Native Hawaiian/Pacific Islander	6 (1)	2 (2)
Other/mixed race	6 (1)	0
Unknown	11 (1)	0
NCAA division		
Division I	466 (42)	58 (45)
Division II	314 (29)	38 (30)
Division III	322 (29)	32 (25)
Primary sport		
American football	334 (30)	34 (27)
Basketball	132 (12)	12 (9)
Track and field	100 (9)	16 (13)
Soccer	105 (10)	12 (9)
Baseball	84 (7)	8 (6)
Swimming	43 (4)	7 (6)
Other	304 (28)	39 (30)

*Presented as n (%) unless otherwise noted.
†Mean (SD).
NCAA, National Collegiate Athletic Association.

sporting discipline are presented in [table 2](#). No significant differences in the suicide incidence rate when stratified by sex, race or sport were identified; however, a difference among NCAA divisions was noted ([table 2](#)). Male and female athletes had suicide incidence rates of 1:52 637 AYs (95% CI 1:18 569 to 1:79 134) and 1:131 603 AYs (95% CI 1:40 188 to 1:534 362), respectively. Division I and II athletes had a higher observed suicide incidence rate compared with Division III athletes (D1=1:59 777 AYs (95% CI 1:46 246 to 1:77 268), D2=1:55 599 AYs (95% CI 1:40 510 to 1:76 308), DIII=1:110 206 AYs (95% CI 1:78 068 to 1:155 573)). The incidence of suicide over a typical athlete's 4-year career was 1:17 786 per 4AYs (95% CI 1:15 515 to 1:22 082). The highest calculated suicide incidence rate by sport was in male cross-country athletes (1:29 815 AYs). When considering a 4-year career, male cross-country athletes had an incidence of 1:7454 4AYs (95% CI 1:3922 to 1:14 167).

[Figure 1](#) presents the absolute number of suicide deaths by day of the week and month of the year. Notably, the most suicide deaths occurred at age 20 (n=33, 26%), which would be in the middle of a collegiate athlete's career if they started as a freshman at age 17 or 18. The most suicide deaths occurred on Mondays (n=25, 20%) and Tuesdays (n=26, 20%; [figure 1A](#)); however, the absolute difference between other days of the week was small. The mean number of suicide deaths during the summer months (June–August) was 6.7 (SD 3.2) deaths/month, whereas the mean number of suicide deaths during the non-summer months was 12 (SD 3.5) deaths/month over the entire study period ([figure 1B](#)).

Table 2 Incidence of suicide by patient demographics

Demographics	Suicide cases n (%)	Incidence rate (athlete-years)	95% CI
Total	128 (100)	1:71 145	(1:62 058 to 1:88 328)
Sex			
Male	98 (77)	1:52 637	(1:18 569 to 1:79 134)
Female	30 (23)	1:131 603	(1:40 188 to 1:534 362)
Race			
White	91 (59)	1:68 844	(1:56 078 to 1:84 516)
Black	27 (21)	1:52 418	(1:36 027 to 1:76 267)
NCAA division			
Division I	58 (45)	1:59 777	(1:46 246 to 1:77 268)
Division II	38 (30)	1:55 599	(1:40 510 to 1:76 308)
Division III	32 (25)	1:110 206	(1:78 068 to 1:155 573)
Primary sport			
American football	34 (27)	1:40 145	(1:28 730 to 1:56 097)
Basketball	12 (9)	1:55 896	(1:31 976 to 1:97 709)
Male	9 (7)	1:39 329	(1:20 692 to 1:74 753)
Female	3 (2)	1:105 596	(1:35 913 to 1:310 493)
Track and field*	21 (16)	1:49 493	(1:32 373 to 1:75 667)
Male	16 (13)	1:32 560	(1:20 043 to 1:52 894)
Female	5 (4)	1:103 681	(1:44 287 to 1:242 732)
Soccer	12 (9)	1:79 954	(1:45 739 to 1:139 764)
Male	8 (6)	1:57 143	(1:28 956 to 1:112 769)
Female	4 (3)	1:125 576	(1:44 444 to 1:293 884)
Cross-country	11 (9)	1:51 038	(1:28 500 to 1:91 400)
Male	9 (7)	1:29 815	(1:15 687 to 1:56 669)
Female	2 (2)	1:146 542	(1:40 188 to 1:534 362)
Baseball	8 (6)	1:81 078	(1:41 085 to 1:160 004)
Swimming	7 (6)	1:60 157	(1:29 141 to 1:124 186)
Male	4 (3)	1:44 994	(1:17 498 to 1:115 700)
Female	3 (2)	1:80 375	(1:27 335 to 1:236 335)

Sports with ≥5 suicide cases were reported.
*Of the track and field athletes, 11 were distance runners competing in track and field and cross-country so are also counted in the cross-country section.
NCAA, National Collegiate Athletic Association.

Suicide and non-suicide deaths over time

When comparing the first 10 years with the last 10 years of the study period, the proportion of suicide deaths doubled from 7.6% to 15.3%, making suicide the second leading cause of death over the last decade after accidents ([figure 2](#)). Male suicides increased from 31 in the first 10 years to 67 in the last 10 years; similarly, female suicides increased from 9 to 21 over the two 10-year time periods.

The yearly incidence rates for both suicide and non-suicide deaths are presented in [figure 3](#). A linear increase in male suicide incidence rate was noted over the study period (5-year IRR 1.32 (95% CI 1.14 to 1.53)), whereas a quadratic association was identified among female athletes (p=0.002). The incidence rate for females remained small between the years 2002 and 2010 and reached its lowest point in the years 2010–2011. From 2011 to 2022, the incidence rate of suicide increased among female athletes. A linear decrease in non-suicide deaths was noted for both males (5-year IRR 0.93 (95% CI 0.87 to 0.99)) and females (5-year IRR 0.83 (95% CI 0.74 to 0.93)) during the study period.

DISCUSSION

Athletes are generally thought of as one of the healthiest populations in our society, yet the pressures of school, internal and external performance expectations, time demands, injury,

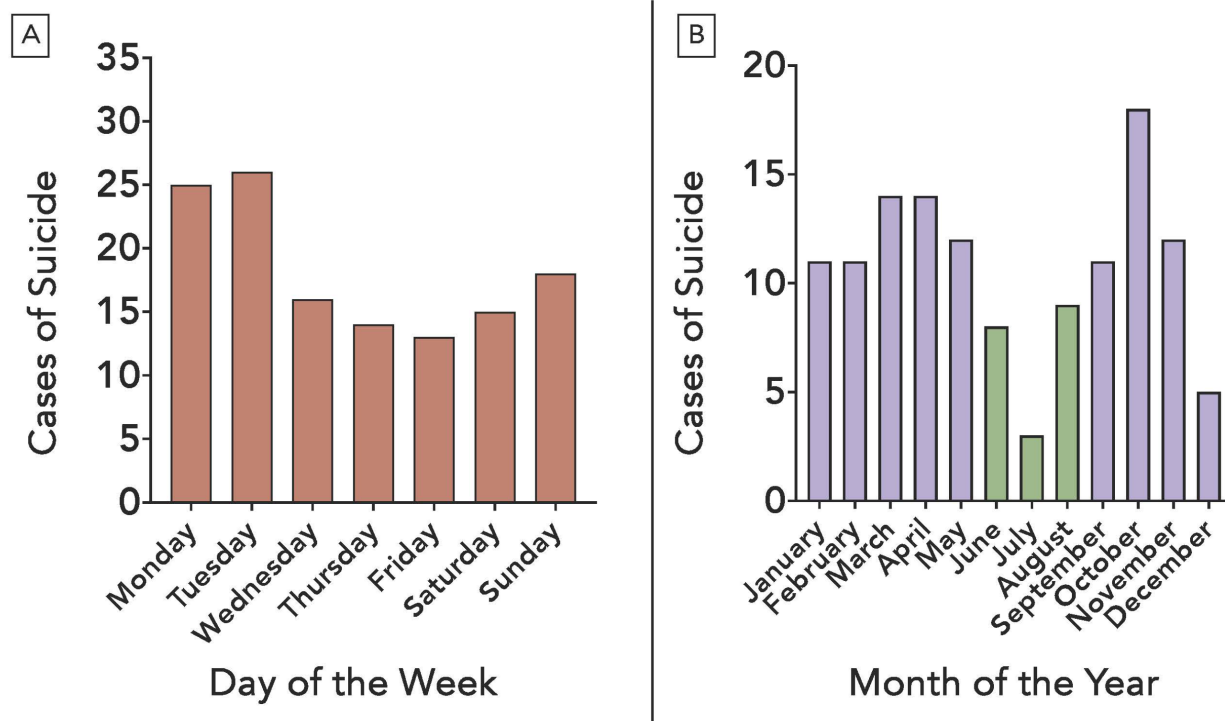


Figure 1 Suicide deaths among NCAA athletes by day of the week and month of the year. (A) Histogram presenting the absolute number of suicide deaths stratified by the day of the week at time of death. (B) Histogram presenting the absolute number of suicide deaths stratified by the month of the year at time of death. Green bars represent summer months (June–August), and purple bars represent non-summer months (September–May). NCAA, National Collegiate Athletic Association.

athletic identity and physical fatigue can lead to depression, mental health problems and suicide.²³ This study examined the incidence of suicide among NCAA athletes over a 20-year period and the key findings are as follows. First, the yearly incidence rate of suicide for males increased throughout the 20-year study period and the yearly incidence rate for females increased after 2010–2011, while the incidence rate of non-suicide deaths

in both sexes decreased over the entire study period. Second, suicide was the second leading cause of death over the second decade of the study and the proportion of deaths attributable to suicide doubled from the first decade to the second decade. Third, the overall suicide incidence rate varied by NCAA division, but not by sex, race or sport. Fourth, the highest incidence rates were identified in male cross-country athletes. Fifth,

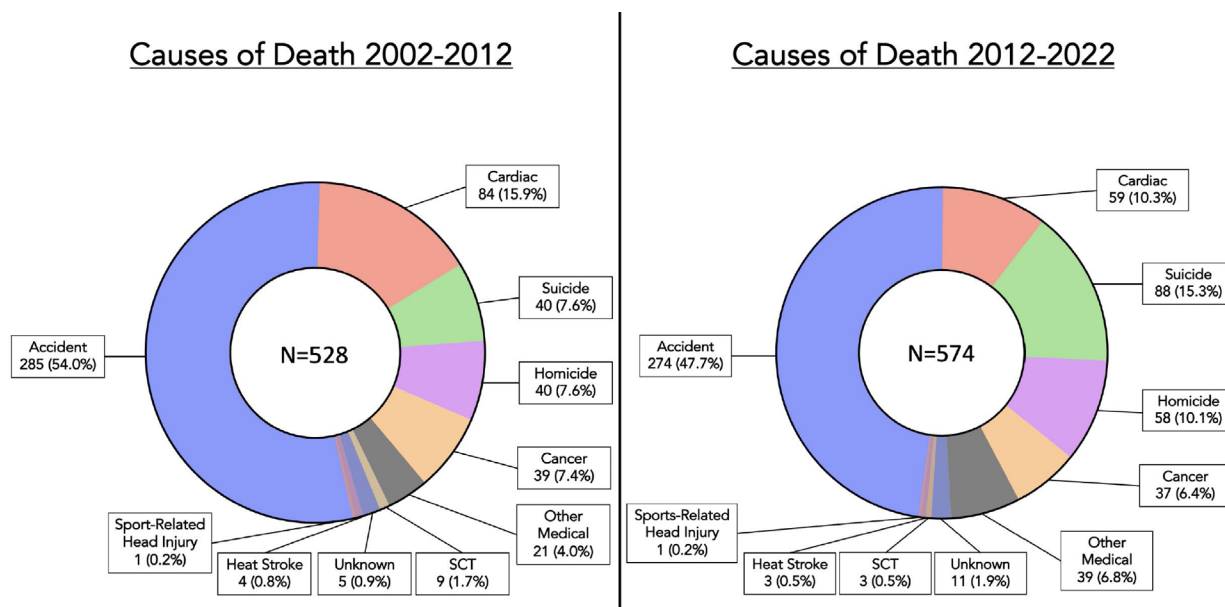


Figure 2 Causes of death among NCAA athletes by decade over the 20-year study period. Donut graphs comparing causes of death between the first (2002–2012) and second decade (2012–2022) of the study period. Presented as n (%). NCAA, National Collegiate Athletic Association; SCT, sickle cell trait.

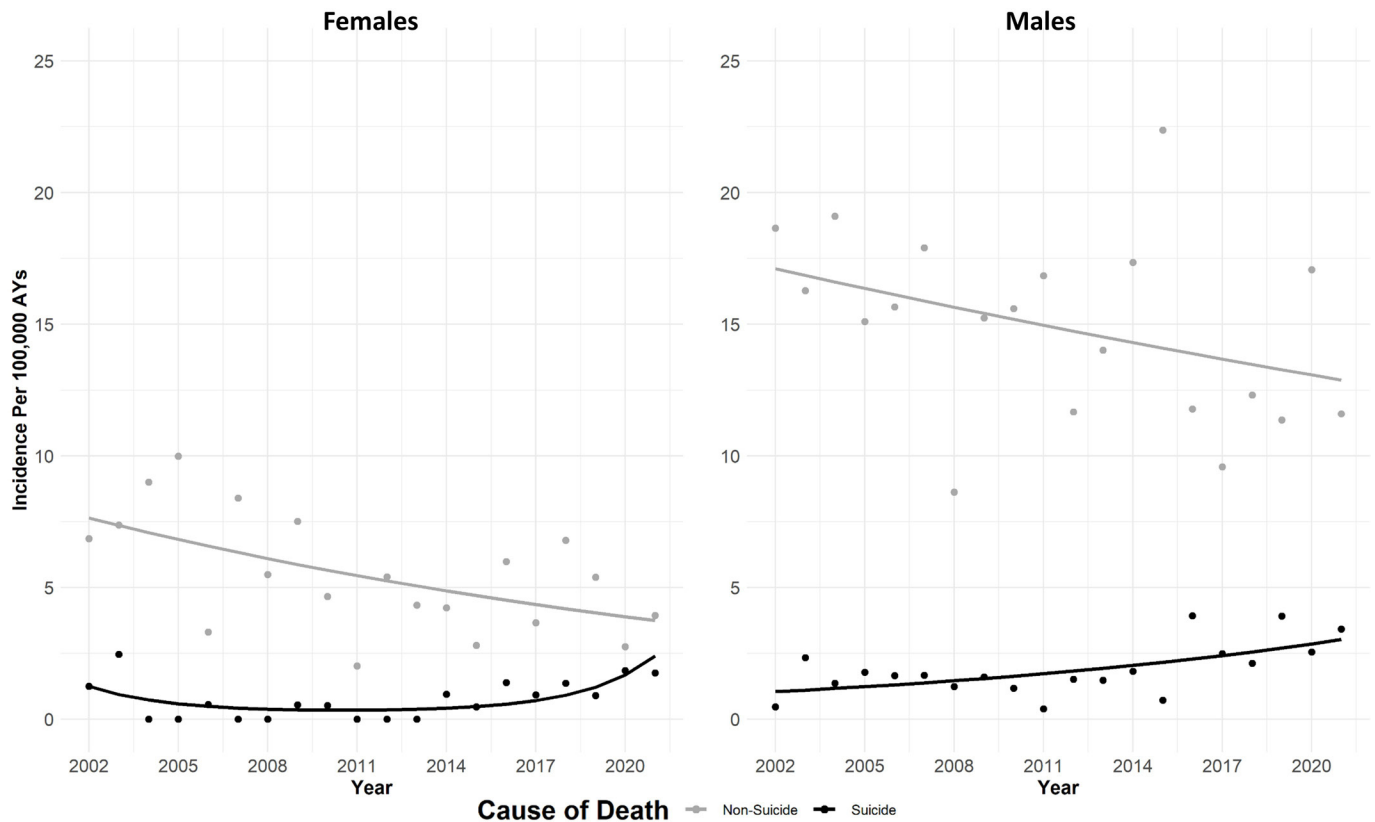


Figure 3 Yearly suicide and non-suicide death incidence among NCAA athletes over the 20-year study period. Scatter plots presenting the yearly non-suicide death and suicide incidence throughout the study period by sex. Grey dots=non-suicide death yearly incidence rate, grey line=predicted estimates via Poisson regression of non-suicide death incidence over the study period. Black dots=suicide death yearly incidence rate, black line=predicted estimates via Poisson regression of suicide death incidence over the study period. AYs, athlete-years; NCAA, National Collegiate Athletic Association.

suicide occurred most frequently among athletes in the middle of a typical college career (age 20), at the beginning of the week (Monday and Tuesday) and during the non-summer months.

Depression, which can lead to suicide, is common in both the young adult general population and athletes. In aggregate, it appears that rates of depression among the young adult general population are higher than among collegiate athletes.^{3 4 24} Although those who compete in collegiate sports may have lower rates of depression compared with the general population, the absolute rate of mental health issues in this population remain concerning with the NCAA and International Olympic Committee recommending regular mental health screening in athletes.⁵⁻⁸

There has been an increased focus on mental health and suicide prevention by the NCAA, despite this, suicide rates continue to increase. Suicide was the second leading cause of death in NCAA athletes over the past decade. Although the rate of suicide among collegiate athletes remains lower than the general population,⁹ it is important to recognise the parallel increase to ensure this population is not overlooked when assessing for risk factors and implementing prevention strategies. In addition to reasons non-athletes consider suicide, athletes may also consider suicide in response to injury and internal or external performance expectations.²³ Athletes may also experience harassment and abuse within their sport, including psychological abuse, physical abuse, sexual abuse, hazing and cyberbullying from the public and members of their team including peer athletes, coaches and members of the entourage. The power dynamics that may be displayed in these acts of harassment and abuse make it hard for

an athlete to feel safe and may lead to thoughts of suicide.^{17 25 26} Social media also has an effect on an athlete's sense of value.²⁷ Athletes are competing during a time when levels of self-oriented perfectionism and socially prescribed perfectionism are at an all-time high.²⁸ Even though athletes are more likely to spend time on non-screen activities than their non-athletic peers,²⁹ the perceptions or messaging around their performance on social media often leads to worse feelings of well-being.²⁷ The struggle for perfectionism in this population can lead to increased feelings of worthlessness and the potential for suicide becomes more possible. The recent emergence of name, image and likeness (NIL) deals in the NCAA, where athletes may earn payment for their personal brand,³⁰ may also compound this issue for some athletes. The rate of suicide was higher among Division I and II athletes than Division III athletes and the stressors associated with NIL may be one explanation, although it is also possible the higher rates of suicide are a function of an increased likelihood for media reports among athletes competing at higher divisions.

Previous studies have also shown higher rates of suicide among male athletes, in particular American football players.^{5 11} While the rate of suicide in males and American football athletes was high in this study, there were no statistically significant differences in the suicide rate between sex, sport or race. It has been suggested that athletes who engage in sports with high levels of physical contact, such as American football, are at the highest risk because of fearlessness about death and elevated pain tolerance.³¹ Although not statistically significant, male cross-country athletes, a non-contact sport, had the highest rates of death by suicide in this study.

Cross-country is not physically violent but is a sport in which athletes endure high levels of physical pain and sport-related injury. This finding correlates with a study reporting track and field athletes are the most likely to experience clinically significant levels of depressive symptoms.³² More study is needed to understand if an increased focus on track and field and cross-country athletes is warranted.

It is known that depression is more common in female athletes than male athletes,^{3 23 32 33} as well as in the general population.³⁴ There has been an increase in the rate of female suicide in non-athlete young people in this age group from 2000 to 2020³⁵ and it appears that this trend may also be present in NCAA athletes, beginning in 2010–2011. Increased attention to the rise of suicides in female athletes is also merited.

The mean age at the time of death in this study was 20 years (SD 2) and the distribution of suicide deaths was spread fairly evenly among years suggesting intervening at certain times in an athlete's college career, such as matriculation, may not be efficacious. The highest number of deaths by suicide was on Mondays and Tuesdays, which has been seen widely in all populations.³⁶ Reasons for this are unclear. This study also showed the months with the highest incidence were October, March and April, with summer months seeing the lowest rates, which also coincides with studies in other populations.³⁷ In this study, reporting of deaths may have been lower if an athlete was off campus and at home during breaks, or rates may have been lower due to reduced stress for some athletes if they were not at school over the summer.

This study has several limitations that warrant further discussion. First, there is no mandatory reporting system for athlete deaths in the USA and our search identified 16 (1.5%) deaths with unknown causes, so reported suicide incidence rates may underestimate the true incidence. Also, in cases of overdose that were not clearly intentional the death was listed as 'overdose' which may also result in under-reporting suicide. We used four independent search strategies to try to increase the accuracy of death estimates, but the reliance on review of media reports could be problematic, especially among Division III student-athletes. The rates may be under-reported or be affected by temporal effects or cultural shifts around reporting and media coverage over time. The differences seen could also be a result of biased reporting; however, the increased media attention to death by suicide over the past 10 years and general improvement in cultural de-stigmatisation around mental health may also be promoting more forthright reporting. Second, the method of suicide-related deaths is unknown, making it difficult to draw conclusions on public policy measures to reduce suicides among this population (ie, firearm control). Third, we do not have data on the rate of suicide among NCAA college student non-athletes over the same period. Fourth, as NCAA sporting disciplines have varying weekly practice and season-based schedules, definitive conclusions on the timing of suicide in association with sport cannot be accurately determined. Fifth, we do not know the incidence of concomitant mental health diagnoses (eg, depression and anxiety) among this population, to be able to draw definitive conclusions on the effect of prior mental health diagnoses on the incidence of suicide. Lastly, race was determined by media reports²² or athlete photos (108) in cases without autopsy/medical examiner reports which could have affected results. These methods were used as a last resort, preferring to rely on direct reporting of race, but in some cases it was unavoidable. We recognise this means some of our data pertaining to race may be misclassified.

CONCLUSION

The rate of suicide in NCAA collegiate athletes has increased over the last 20 years and over the last decade has become the second most common cause of death, after accidents. The highest suicide incidence rate was found in male cross-country athletes. Suicide incidence rates varied by NCAA division, but not by sex, race or sport. Though differences were minimal, Monday and Tuesday saw higher proportions of deaths, as did non-summer months. Despite recent increased focus on mental health in athletes, death by suicide is increasing. Additional mental health resources including efforts to raise awareness, screening for early risk identification, training coaches and support staff on how to identify athletes at risk and providing access to mental health providers trained in sport psychology are examples of ways to help prevent suicide in this population.

Twitter Stephanie A Kliethermes @stephklie2, Ashwin Rao @badash13, Kimberly G Harmon @DrKimHarmon and Bradley J Petek @BradleyPetek

Contributors All authors participated in the planning and reporting of the work described in the article. SAK and BJP assisted with the analysis and interpretation of the statistical models. BMW was the principal writer of the manuscript. KGH was the guarantor. All authors read, revised and approved the final manuscript submitted for publication.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the University of Washington's Division of Human Subjects, an institutional review board established in accordance with the federal regulations for protecting the rights and welfare of human research subjects. Information on participants was voluntarily provided to the databases used for data collection.

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ORCID iDs

Bridget M Whelan <http://orcid.org/0000-0001-7758-0208>
Stephanie A Kliethermes <http://orcid.org/0000-0001-9756-7406>
Kimberly G Harmon <http://orcid.org/0000-0002-3670-6609>
Bradley J Petek <http://orcid.org/0000-0002-6603-2262>

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