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Sport and physical activity level impacts health-related quality of life among collegiate students

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Abstract

Purpose—To examine and compare the role of self-assessed sport and physical activity involvement on the health-related quality of life among undergraduate student-athletes and general undergraduate college students.

Design—Cross-sectional survey. Dataset was examined for differences in physical and mental health by self-assessed sport and physical activity level.

Setting—Large Midwestern University in the fall of 2016.

Subjects—A combined dataset representing undergraduate Division I student athletes (n=842) and general undergraduate students (n=1322).

Measures—VR-12, as measure of health-related quality of life, comprised of physical component score (PCS) and mental component score (MCS). Self-assessed sport and physical activity level categorized as Division I athlete, club athlete, intramural player, student who works out regularly, or student who is physically inactive.

Analysis—Standard univariable statistics described the study population. Two-sample t-tests and Chi-Square tests were conducted, as appropriate, to compare Division I student-athletes to the general undergraduate group. Multivariable linear regression models were then built to assess associations between physical activity level and year in school with VR-12 outcomes, after adjusting for sex. All pairwise interactions were considered for inclusion in the final models. Adjusted least-square means were calculated for all variables in the model; pairwise comparisons

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DECLARATION OF CONFLICTING INTERESTS

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were adjusted for multiple comparisons via Tukey-Kramer adjustment criteria. A linear test for trend was also conducted for the association between VR-12 MCS and increasing physical activity.

Results—Significant differences in MCS were noted between levels of sport and physical activity; however such differences were not detected in PCS. After controlling for sex, a positive relationship between increased sport and physical activity level and greater MCS was found.

Conclusions—This study represents the first prospective assessment of health-related quality of life among undergraduate athletes and general college students. Higher levels of sport and physical activity were associated with more positive mental health in these populations.

Keywords

VR-12; well-being; physical activity; mental health; college students

INTRODUCTION/PURPOSE

The active promotion of health and well-being, understood as health-related quality of life (HRQOL), among collegiate students is integral to counteracting adverse health outcomes during college and beyond.¹ The college years are seen as instrumental in building a foundation of positive health-related behaviors that support well-being far into adulthood. Well-being, as a subjective concept, is a global representation of both physical and mental health. It provides a broad lens for the assessment and development of customized health promotion, and disease prevention strategies². While measurable by a number of constructs, overall well-being in college students can, in part, be assessed via their mental health status. Previous studies have demonstrated poor mental health among the collegiate student population, including instances of highly prevalent, diagnosable psychiatric disorders.³⁻⁸ Numerous predictors and sources of psychological difficulty, such as stress, depression, and anxiety, are commonly present within college environments.^{9,10} These mental health factors often co-exist and influence health behaviors that are found to be predictive of self-reported well-being, such as physical activity, tobacco use, sleep quality, and mental health service utilization.¹ As such, tracking and improving mental health in the college population is an important public health initiative.

Physical activity has been shown to have many benefits, including improved mental health and well-being.¹¹⁻¹³ Vigorous physical activity and poor self-reported mental health share an inverse relationship among college students.¹⁴ One noteworthy investigation revealed that students who either participated in team sports or self-identified as athletes reported lower depression scores than collegiate peers who did not participate or identify as athletes.⁴ While these findings may suggest athletics participation as a safeguard to substandard student mental health, paradoxically, specific evaluations of athletes have not validated this premise. Although not limited to college students, a 2015 meta-analysis examining the self-reporting of depressive symptoms between high performance athletes and non-athletes (using strict definitions) found that high-performance athletes were just as likely to report depressive symptoms as non-athletes.¹⁵ Resilience and protective traits tied to athletic participation

have not been consistently demonstrated; comparable levels of risk for depression and other mental disorders have been found in both athlete and non-athlete student bodies^{6,7, 16–21}

The need to assess and support health and well-being in college students is supported by a number of high profile initiatives. The National Collegiate Athletic Association (NCAA) has stressed the importance of well-being and the application of evidence-based best practices for understanding and supporting mental health issues among student-athletes.²³ Initiatives include an increased focus to decrease inter-institutional variability related to routine screening through the establishment and promotion of their publication, “Mental Health Best Practices”.²³ Additionally, focused mental health programs such as the National Alliance on Mental Illness (NAMI) have been established on U.S. college campuses and supplement existing college-based programs that seek to educate, advocate and support all college students on matters of mental health.²⁴ Finally, Healthy People 2020, an initiative representing national objectives identified by the US Department of Health and Human Services, includes the topics of HRQOL and well-being amidst their most recent goals, further strengthening the already present focus on mental health.²⁵ To support these important initiatives, more insight specific to the health and well-being (HRQOL) of collegiate students is essential.

To our knowledge HRQOL among student-athletes compared to the general undergraduate population has not been evaluated. Therefore this study was designed to measure the physical and mental health of college students at a large Midwestern University. Specifically, this research aimed to elucidate the relationship between self-assessed sport and activity level and self-reported HRQOL, using the Veterans RAND 12 Item Health Survey (VR-12).^{26,27} We hypothesized that measures of both physical and mental health would be highest, indicating better health and well-being, among Division I collegiate student-athletes, as their sport and activity level are assumedly higher than the general college student population.

METHODS

Design and Sample

A combined dataset of undergraduate student-athletes and non-athlete students (termed ‘general undergraduates’) enrolled at a large Midwestern University in the Fall of 2016 was utilized to meet the aims of this study. Study inclusion criteria common to both datasets included proficiency in English, current enrollment as an undergraduate student at the university serving as the study site, and completion of the self-administered evaluation of HRQOL, the VR-12, in the Fall of 2016. Subjects were excluded if data pertaining to the VR-12, sex, or year in school was not reported. Additionally, due to small sample sizes in this category, subjects were excluded if they reported >4 years of collegiate status.

Division I Student-Athlete Subjects

All Division I undergraduate student-athletes enrolled in the Fall of 2016 (n=1286) were considered eligible for participation. As part of a routine battery of performance and health measurement testing, all Division I student-athletes enrolled at this University complete VR-12 surveys at the beginning of each semester. De-identified records of potential student-

athletes were extracted and reviewed from the Badger Athletic Performance database at the University of Wisconsin-Madison. The records review was approved by the University's Health Sciences Institutional Review Board and informed consent was not required.

General Undergraduate Subjects

In the fall of 2016, 29,151 undergraduate students enrolled at the same University were sent a voluntary anonymous electronic survey comprised of a number of measures for a larger parent study that assessed their experiences with injury while enrolled at the University (n=1616; response rate 5.5%). Subjects were removed if data was not available for self-assessed sport and activity level, in addition to the inclusion/exclusion criteria noted above. Furthermore, to avoid representation in both groups, individuals who identified as a Division I athlete were removed (final n=1322). Subjects classified their sport and activity level as club athlete, intramural player, student who works out regularly, or student who is physically inactive. To clarify, a club athlete generally is part of a team that practices and competes at a higher level and in a more structured format than an intramural player. Club athletes try out for the team, compete against clubs from other universities and expend more time committed to their sport than intramural players. An intramural player generally is a member of less formal, more casual, socially driven team that does not practice or compete outside of the university. For purposes of this study survey, the subjects chose one of the above classifications when asked 'Which of the following best describes you?' The University's Education and Social/Behavioral Science Institutional Review Board approved this investigation. Subjects completed electronic informed consent by check box prior to beginning study survey.

Outcome Measures

Well-Being—The VR-12 is a valid, reliable, commonly used HRQOL tool that assesses an individual's perspective of his/her own physical and mental health.^{26, 27} Derived from the Veterans RAND 36 Item Health Survey (VR-36), the VR-12 is nearly identical to the abridged version of the SF-36, the 12-Item Short Form Health Survey (SF-12).²⁶ The VR-12 items correspond to eight principal health domains: physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health.²⁵ Survey responses are scored and summarized into two measures, a physical component score (PCS) and a mental component score (MCS). Associated scoring algorithms correct and adjust these metrics to standards representative of the United States population.^{26,28} PCS and MCS were originally standardized using a t-score transformation, with a normed average score of 50 and a standard deviation of 10 (based on a 1990 US population standard). Updated norms completed in 2009 using Medical Expenditure Panel (MEP) data reported 39.82 (SD = 12.2) and 50.08 (SD = 11.4) as new average benchmarks for PCS and MCS, respectively. When interpreting change in this instrument, a difference of 1–2 units or greater in PCS/MCS has been shown to be clinically and socially relevant in population level data.^{29,30} However, an individual change of 6.5 units in PCS or 7.9 units in MCS is considered a clinically relevant change when looking at person-level data.³¹

Despite its use in other populations, an empirical gap exists for the application of VR-12 assessment within current college populations. This instrument has only been used to evaluate former collegiate athletes, resulting in scores that are similar to the general US population.³²

Demographic Characteristics

Data were collected on sex, year in school (Freshman, Sophomore, Junior, Senior) and physical activity level. Physical activity level was classified in order of presumed increasing level of activity. Division I athletes were considered to have the highest level of sport and activity (due to presumed demands of team membership), followed by the general undergraduate students who self-identified as a club athlete, intramural player, student who works out regularly, and student who is physically inactive. These levels are hierarchical in order following the level prescribed to the Division I student-athletes.

Statistical Analysis

Standard univariable statistics were used to describe the study population; means and standard deviations (SD) were used for continuous variables and frequencies and percentages described categorical variables. Two-sample t-tests and Chi-Square tests were conducted, as appropriate, to compare Division I student-athletes to the general undergraduate study group. Multivariable linear regression models were then built to assess associations between sport and activity level and year in school with VR-12 outcomes, after adjusting for sex. All pairwise interactions were considered for inclusion in the final models. Adjusted least-square means were calculated for significant variables in the models; pairwise comparisons were adjusted for multiple comparisons via Tukey-Kramer adjustment criteria due to multiple looks at the data with different reference values. A linear test for trend was also conducted for the association between VR-12 MCS and increasing sport and activity. Lastly, PCS and MCS among the Division I student-athletes and the general undergraduates were compared to US population standards by age and sex. A priori power analyses were not conducted for this study due to the fact that this is retrospective analyses of already collected data. Significance was assessed at the 0.05 level. All analyses were completed using SAS v9.4.³³

RESULTS

Comparisons between the D1 student-athlete group (n=842) and the general undergraduate group (n=1322) are provided in Table 1. Of the N=1,616 total students respondents from the general undergraduate group, subjects missing VR-12 (n=132), year (n=11), and sport and activity level (n=46) data were excluded, as were those reporting Division 1 athletics participation (n=27) and >4 years of student status (n=78). Of the N=1,286 student-athlete VR-12 surveys, those completed outside of the Fall of 2016 (n=404) and those missing year in school data or reporting >4 years of student status (n=40) were likewise excluded. The mean age in both groups was approximately equal at 19.7 years. There was a significant difference in sex between groups with females comprising 70% of the general undergraduate group compared to 49% in the student-athlete group (p<0.001). Year in school differed between the groups with a higher proportion of freshmen (41%) in the student-athlete group

compared to more seniors in the general undergraduate group (22%) ($p<0.001$). Among the general undergraduate group, 53% of students reported they worked out regularly, 9% identified as club athletes, 23% as intramural players, and 23% as physically inactive. Univariable comparisons of the primary VR-12 outcome scores showed Division I student-athletes had higher MCS than the general undergraduate student group ($p<0.001$), indicating more positive mental health overall; the PCS, although statistically significant, did not differ appreciably between groups ($p=0.02$).

PCS Outcome

After adjusting for sex, the association between sport and activity level and PCS outcomes differed by year in school ($p=0.01$, Table 2). No associations were detected between PCS and activity level among freshmen, sophomores or juniors after adjusting for multiple comparisons (Supplementary Table 1). Among seniors, general undergraduate students who worked out regularly had higher mean PCS (55.51 ((SE=0.38)) than those who were inactive (52.86 ((0.61)) ($p=0.03$), once again, indicating more positive mental health overall. No other comparisons of interest were found to be statistically different (Figure 1, Supplementary Table 1).

MCS Outcome

After controlling for sport and activity level and year in school, females had, on average, MCS that were 2.91 points (95% CI: $-3.79, -2.03$) lower than males (Table 2; $p<0.001$). No association was detected between MCS and year in school ($p=0.09$) and no pairwise interactions were determined to be significant. After adjusting for sex and year in school, sport and activity level was found to be associated with MCS outcomes ($p<0.001$). A linear test for trend suggests that with increasing sport and activity, MCS also increases ($p<0.001$). The LS-mean MCS for D1 athletes was 55.46 (SE=0.34); this was significantly higher than club athletes (45.74(0.89)), intramural players (45.46 (0.70)), general college students who work out regularly (44.04(0.39)), and physically inactive college students (41.39 (0.57)) (all p -values <0.001). Moreover, club athletes, intramural players, and college students who reported working out regularly all had higher MCS, on average, than physically inactive students (Supplementary Table 2, all p -values <0.001). No differences in MCS were detected among club athletes, intramural players, and students who worked out regularly.

Comparison of PCS and MCS outcomes to U.S. population standards

Table 3 provides U.S. population standards for PCS and MCS and those of Division I student-athletes and general undergraduate students stratified by age and sex. When combined, Division I student-athletes and general undergraduate students had higher average PCS and MCS ($p <0.001$) compared to the U.S. population ages 18–34 yrs, indicating more positive physical and mental health. Male and female D1 student-athletes scored higher on the PCS and MCS outcomes than the population ($p<0.001$). Despite scoring higher than the U.S. general population on PCS ($p<0.001$), the general undergraduate student scored lower than the U.S. general population on MCS ($p<0.001$).

DISCUSSION

Important to the primary aim of this study is the finding that a significant effect of self-assessed sport and activity level on MCS was noted ($p=.005$), even after adjusting for sex. This result emphasizes a relationship, but not implied causality, between increased sport and activity and overall mental health. As activity level increased, MCS increased across all levels of sport and activity (Figure 2). Highest MCS was noted in the Division I student-athletes, as hypothesized. This result is aligned with a previous study that found those who participated in team sports or identified as an athlete had lower depression scores.³⁴ Our results, however, differ from the overall findings of the Gorczynski *et al* meta-analysis that concluded that high-performance athletes were just as likely to report depressive symptoms as non-athletes.

Mental health benefits related to athletic membership and assumed physical activity are evident in this study sample. Despite the increased challenge of balancing academics and Division I athletic demands, involvement in college athletics affords a number of assumed positive benefits including improved self-esteem, accessibility to academic support, and medical care, potentially protecting and/or mitigating negative mental health effects. This finding contrasts previously cited research suggesting athletic involvement is not a protective risk factor for risk of depression and other mental health disorders.^{6,7,14–20} Additionally, undergraduate students who were not Division I athletes, yet reported participation in team sport or activity, were found to have higher MCS with increasing sport and activity level. This finding may imply a benefit to mental health exists for these students, one similar to that seen in Division I athletics participation, due to the general undergraduate students' engagement in physical activity, team membership, and social interaction with other students. Furthermore, this finding suggests that involvement in elite, organized Division I competitive team sports, may not be prerequisite for college students to attain similar benefits in mental health. Perhaps engaging in any sport and physical activity, regardless of skill level and competition, can contribute to overall well-being. Additionally, while those self-reporting as physically inactive may lack the benefits associated with physical activity, they may be involved in non-athletic pursuits that provide similar social interactions afforded by sport and activity that support mental health. However, the lower MCS outcomes among this inactive group may point to unique mental health benefits of sport and physical activity engagement that are not attained during other activities that include social interactions. These findings are promising as it contributes to evidence that could inform intervention efforts to decrease the growing mental health epidemic among college students in the U.S., emphasizing the value of physical activities and initiatives that support college students' involvement.

When examining differences between PCS by sport and activity, minimal differences were noted. General undergraduate senior students who worked out regularly had statistically higher mean scores than those who were inactive (Figure 2). No other significant associations were found. This finding is not surprising as the age group represented by this study's sample is generally physically healthy and without significant health concerns.

Of further interest, when compared to the population norms, both Division I student-athletes and general undergraduate students were found to have significantly higher PCS and MCS compared to VR-12 instrument population standards. This finding initially suggests overall positive health and well-being of college students (Division I athletes and general students) compared to the general population. However, when examining the results specific to sex, general undergraduate male and female students were found to have lower MCS when compared to both population standards and Division I athletes. This shared finding has only been shown among females in past studies.^{20,22} Caution in interpreting these findings is encouraged. The available population standard is reported as a broader age range (18–34 year olds) and lacks distinction between male and female groups. Therefore these norms are potentially not representative of the younger undergraduate college age group, and should be further mentioned in regard to the differences noted in previous studies that describe greater levels of mental health concerns among females.

Limitations

This study has a number of additional limitations that deem acknowledgement. The investigation was cross-sectional in nature, measuring HRQOL only during the fall semester, and thus may not be representative of the average health and well-being across an academic year. Moreover, the self-assessed hierarchical levels of sport and activity may not truly be an accurate reflection of increasing physical activity. Future studies that utilize a repeated measures design, with more precise recording of activity level, to assess athletes and general students throughout the school year may support a more clear association with sport and activity. Controlling for external stressors that occur across an academic year would also strengthen future investigations. Additionally, the data were collected via electronic self-report, which although anonymous, may introduce bias specific to socially desirable responses and contain individual differences in reporting behavior. Specific to race and ethnicity, limitations within the datasets did not allow for summarization of these variables. The survey response rate (5.5%) for the general student population was low overall with a greater proportion of females and later academic status subjects which may limit representativeness within this university in addition to generalizability. It is assumed that undergraduate students receive a large amount of electronic survey invitations, introducing survey fatigue into the response rate, despite the incentive to win a \$25 gift card. Finally, the inclusion criteria for the general undergraduate sample was limited to those who reported that they were healthy/not injured. When comparing to the athlete sample, this criteria was not assessed. However, potential bias should be viewed conservatively as the findings indicated that the athlete sample exhibited superior MCS, even if there were some who were currently or recently injured.

“SO WHAT?”

These findings provide additional evidence for concerns related to overall well-being, most specifically mental health, in today’s college students. Results support the importance of sport and physical activity and its’ relationship to mental health and bring attention to an interesting finding in that Division I student athletes were found to have a higher mental component benefit even when compared to students who were also physically active. Mental

health initiatives for all students should include physical activity and be a top priority on college campuses. Additionally, future inquiry that examines Division I student athletes versus non-athletes' engagement in health-promotion behaviors beyond sport and physical activity (including use of mental health services) may provide opportunities for expanded initiatives that support all college students. However, simply building a campus environment that encourages physical activity, perhaps in a team or social environment, is essential as this health-promotion behavior is vital for the health of the nation and affords mental health benefits far beyond the college experience.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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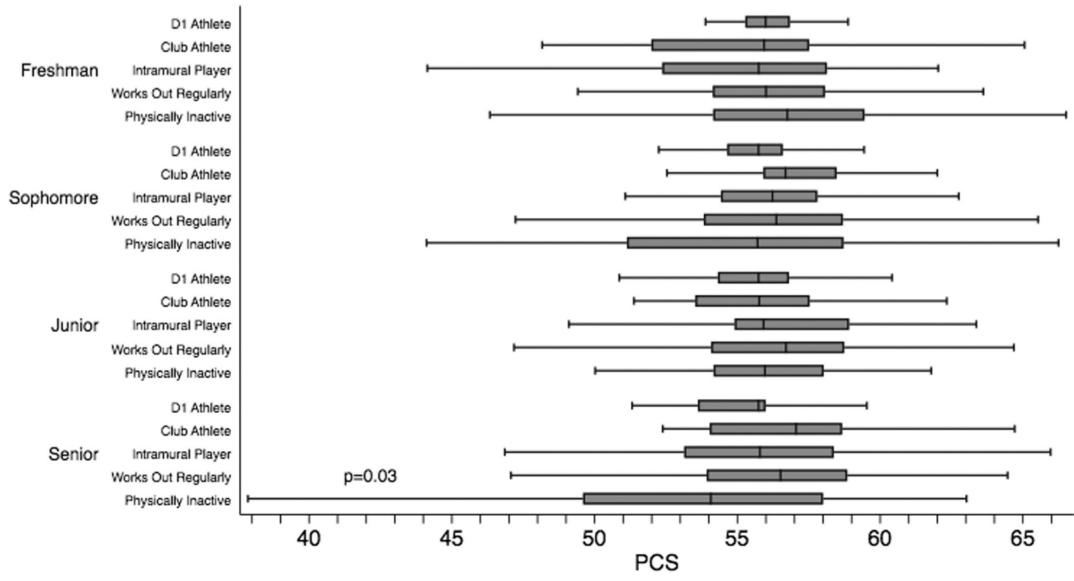


Figure 1:
Physical Component Score by Activity Level and Year in School

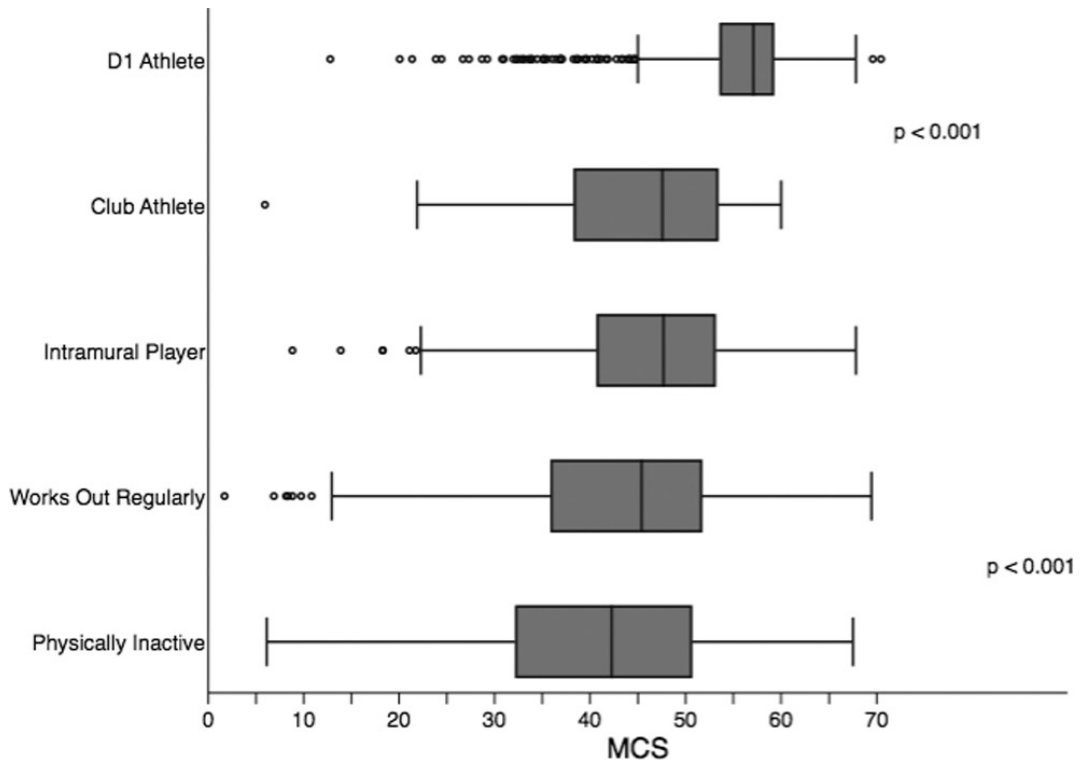


Figure 2:
Mental Component Score by Activity Level

Table 1

Clinical and Demographic Information for Division I Student-Athletes and General Undergraduate Students

Variable	Division I Athlete (n=842)	General Undergraduate (n=1322)	p-value
Age (years), mean (SD)	19.7 (1.3)	19.7 (1.6)	0.72
Sex			
<i>Male</i>	430 (51.1%)	392 (29.7%)	<0.001
<i>Female</i>	412 (48.9%)	930 (70.4%)	
Year in School			
<i>Freshman</i>	349 (41.5%)	429 (32.5%)	<0.001
<i>Sophomore</i>	202 (24.0%)	307 (23.2%)	
<i>Junior</i>	163 (19.4%)	300 (22.7%)	
<i>Senior</i>	128 (15.2%)	286 (21.6%)	
Activity Level			
<i>D1 athlete</i>	842 (100%)	-	N/A
<i>Club athlete</i>	-	122 (9.2%)	
<i>Intramural player</i>	-	193 (23.2%)	
<i>Works out regularly</i>	-	705 (53.3%)	
<i>Physically Inactive</i>	-	302 (22.8%)	
Outcome Scores, mean (SD)			
PCS score	55.02 (3.9)	55.49 (5.3)	0.02
MCS score	55.58 (7.0)	43.26 (11.4)	<0.001

Table 2

Multivariable Linear Regression Models for PCS and MCS Outcomes in Division I Athletes and General Undergraduate Students

PCS OUTCOME			
Covariate	Beta Estimate (b)	Confidence Limit	P-value
Sex			0.51
Female	0.2	-0.3, 0.6	
Male		REFERENCE	
Activity Level			<0.001
D1 Athlete		REFERENCE	
Club athlete	-0.8	-2.2, 0.7	0.28
Intramural player	-0.9	-2.2, 0.3	0.14
Works out regularly	-1.1	-1.0, 0.7	0.75
Physically Inactive	0.3	-0.8, 1.3	0.64
Year in School			0.12
Freshman		REFERENCE	
Sophomore	-1.5	-2.9, -0.1	0.04
Junior	-0.3	-1.8, 1.2	0.66
Senior	-3.1	-4.6, -1.5	<0.001
Activity Level* Year[†]			0.01
MCS OUTCOME			
Covariate	Beta Estimate (b)	Confidence Limit	P-value
Sex			<0.001
Female	-2.9	-3.8, -2.0	
Male		REFERENCE	
Activity Level			<0.001
D1 athlete		REFERENCE	
Club athlete	-9.7	-11.6, -7.9	<0.001
Intramural player	-10.0	-11.5, -8.5	<0.001
Works out regularly	-11.4	-12.4, -10.4	<0.001
Physically Inactive	-14.1	-15.4, -12.8	<0.001
Year in School			0.09
Freshman		REFERENCE	
Sophomore	-1.1	-2.2, 0.0	0.06
Junior	-1.2	-2.3, -0.1	0.04
Senior	-0.2	-1.3, 1.0	0.79

Note:

[†]Due to the large number of categories, beta estimates for each level of the interaction are not displayed. LS-means for each level can be found in Supplementary Table 1

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Table 3

Fall 2016 Comparison of PCS and MCS scores in Division I Student-athletes and General Undergraduates to US population standards by Age and Sex

	VR-12 Population Standards (18–34)	Division I Student- Athletes	General Undergraduates	p-value*
Age 18–34				
PCS	40.8 (13.0)	55.0 (3.9)	55.5 (5.3)	<0.001
MCS	41.7 (14.3)	55.6 (7.0)	43.3 (11.4)	<0.001
Sex				
Female PCS	39.2 (12.3)	55.5 (4.3)	55.5 (5.5)	<0.001
Male PCS	40.7 (12.2)	54.8 (3.6)	55.5 (4.8)	<0.001
Female MCS	49.9 (11.5)	54.3 (7.8)	42.2 (11.3)	<0.001
Male MCS	50.4 (11.4)	56.8 (5.8)	45.7 (11.1)	<0.001

Note:

* All pairwise comparisons between population & D1 athletes and population & controls are significant (p<0.001).