Differences and Demographic Variations in Perceived Stress and Depressive Symptoms Among US College Students Self-selecting Lecture-based and Physical Activity-based Classes

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ABSTRACT

Background: Colleges in the United States (U.S.) provide general education health and wellness classes to promote physical activity (PA), which may improve student mental health. However, it is unclear whether students experiencing mental health difficulties self-select these classes. This study explored whether levels of perceived stress and depressive symptoms differed between students self-selecting PA-based and lecture-based general health and wellness classes.

Methods: Data were collected through an online survey from a volunteer sample of students at a large Northeastern US university enrolled in general education health and wellness classes. Participants self-reported demographics, class enrollment, perceived stress using the Perceived Stress Scale-10, and depressive symptoms using the Center for Epidemiological Studies Depression Scale short-form.

Results: Overall, $n = 6864$ students responded. Independent samples *t*-tests and chi-squared tests found participants enrolled in PA-based classes reported significantly lower levels of both perceived stress ($p < 0.001$) and depressive symptoms ($p < 0.001$). Levels of stress and depression also varied between demographics (i.e., gender, race, sexual orientation).

Conclusion: The current findings suggest differences exist in how students self-select PA classes based on mental distress. Although certain variables of interest were nonsignificant, this research can still inform tertiary institutions' policy on general education health and wellness classes to maximize their ability to improve student mental health.

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INTRODUCTION

There is an ongoing mental health (MH) crisis among college students (Eisenberg et al., 2023), with steadily increasing rates of generalized anxiety and depression among other issues (Xiao et al., 2017). Researchers and colleges have been exploring ways to address this crisis over recent decades, though the issues certainly remain. Physical activity (PA) is a frequently studied intervention due to consistent evidence linking it to MH benefits, including reductions in depression, stress, and anxiety symptoms (Firth et al., 2016; Ströhle, 2009).

Getting sufficient PA is crucial for the aforementioned reasons among others, and PA guidelines recommend 150–300 minutes per week of moderate-intensity PA or 75–150 minutes per week of vigorous-intensive PA or an equivalent combination, as well as muscle strengthening activities two or more days per week to ensure people can achieve the health benefits (U. S. Department of Health and Human Services, 2018). Among college students, guideline adherence is 42.7% (American College Health Association, 2024). Adherence rates differ across demographic groups, as guideline adherence among women, racial minority, and sexual minority groups appear lower than for men, non-Hispanic white people, and heterosexual individuals (Elliott et al., 2021; Wilson et al., 2019). These rates are particularly worrisome because the stage of life typical to college students, known as emerging adulthood (Arnett, 2000), is characterized by habit formation which tends to endure into adult life, including for PA behaviors (Wilson et al., 2020).

The importance of regular PA during college years cannot be overstated. To support adherence to PA guidelines, many colleges in the United States (U.S.) include PA courses as part of the general education curriculum required for undergraduate graduation. Previous research suggests having physical activity requirements (PAR) for degree credit results in higher PA guideline adherence among students. This has been shown to be particularly true for men and those with underweight or obesity (Bailey et al., 2023) and can lead to increased motivation for exercise (Kim & Cardinal, 2019), which may contribute to building positive PA behaviors that endure through adulthood. However, the proportions of U.S. colleges with PARs have steadily declined across decades from as far back as the 1920s–1930s (Cardinal et al., 2012), and within the last decade PARs have decline by 8% with just 31.7% of U.S. institutions having PARs (Szarabajko & Cardinal, 2024). Many colleges instead have an option to satisfy a general education requirement through either lecture-based general health and wellness (GHW) or physical activity-based (PAC) classes. In this case, research suggests encouragement to self-select PACs only extends to those already active, with the unmotivated more inclined to self-select the non-active GHW option (Kim & Cardinal, 2019).

A wide range of antecedents contribute to the motivation of an individual, and their likelihood to participate in PA. One important category of these antecedents is MH and mental distress. Consistent associations between PA and MH have been evidenced, including for perceived stress (Vankim & Nelson, 2013) and depressive symptoms (Zhang et al., 2021). The relationships between PA and both stress and depression are bi-directional, such that levels of stress and depression impact the amount of PA individuals complete, and simultaneously more completed PA is associated with decreases in both stress and depression (Da Silva et al., 2012; Nightingale et al., 2024). While the understanding behind the relationships depression and stress have with general PA participation is strong, how these aspects of mental distress may influence PA specific to PA class selection is not understood. Exploring this may shed light on the efficacy of college PA classes in conveying the mental health benefits of PA to those who need them most, and perhaps whether self-selection bias exists in regard to lecture-based and PA-based classes in college.

This study sought to explore whether differences exist in levels of perceived stress and depressive symptoms of students self-selecting into lecture-based classes compared to those selecting physical activity-based classes. The study also examined whether differences in the levels of perceived stress and depressive symptoms between those selecting lecture-based and physical activity-based classes varied by gender, race, and sexual orientation.

METHODS

An online, anonymous survey (hosted on Qualtrics) was administered to a volunteer sample of undergraduate students enrolled in general education health and wellness courses at a large, Northeastern U.S. university between 2018–2024. Students were provided a link for the survey at the beginning of each semester (Fall and Spring), and completed around 50 questions including information on demographics, class selection, perceived stress, and depressive symptoms. Those who completed the survey were offered an opportunity to enter a raffle to win a gift card. There was an average completion rate of 86%. The Pennsylvania State University Institutional Review Board approved this study, and an informed consent statement was required to be completed at the beginning of the survey.

Measures

Demographics

Participants reported age, gender identity, sexual orientation, and race/ethnicity. Due to sample sizes, sexual identity was collapsed into heterosexual vs sexual minority (asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, same-gender loving, an identity not listed, prefer not to disclose), and race/ethnicity was collapsed into non-Hispanic white vs other (Black or African American, Hispanic or Latino, Asian American, Pacific Islander, Native American, Biracial, and other). Due to sample sizes, statistical tests were only conducted with men and women for gender identity.

Class Selection

Participants indicated whether they were enrolled in a General Health and Wellness (GHW) or Physical Activity classes (PAC). GHW are lecture-based informational classes about health and wellness topics (e.g. nutrition, introduction to public health), while PAC are movement-focused classes involving some level of PA (e.g. walking, weightlifting, swimming, racquet sports, etc.).

Perceived Stress

The Perceived Stress Scale (PSS-10; Cohen et al., 1983) was used to assess the extent to which life circumstances are detected as stressful by respondents. The 10-item questionnaire uses a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*) to determine how often participants thought or felt certain ways pertaining to stress across the previous month. The scoring of 4 items is reversed, with all scores then being summed to obtain a total score out of 40, with higher scores indicating higher perceived stress. Within statistical analysis, data was run both as a continuous variable, and trichotomized into low (0–13), moderate (14–26), and high (27–40) perceived stress (Cohen et al., 1983). In the current study, reliability of the scale was good ($\alpha = .815$).

Depressive Symptoms

The 7-item Center for Epidemiological Studies Depression Scale short-form (CES-D-SF) was used as a shortened version of the full 20-item CES-D (Radloff, 1977) to assess depressive symptoms. This short-form version has higher internal consistency and unidimensionality compared to the full 20-item version (Levine, 2013), as well as mitigating the issue of 10% of respondents discontinuing halfway through the CES-D (Kohout et al., 1993). The 7 questions address cognitive, emotional, and behavioral aspects of depression, and participants answer how often they have experienced each across a 1-week span, on a 4-point Likert scale ranging from 0 (rarely or none of the time [<1 day]) to 3 (most or all of the time [5–7 days]). Participants are scored out of 21, with an established clinical cutoff of ≥ 8 (Levine, 2013). Within statistical analysis, CES-D-SF was analyzed both as a continuous variable, and dichotomized into subclinical and clinical depressive symptoms based on the cutoff score of ≥ 8. In the current study, reliability of this scale was good ($\alpha = .821$).

Statistical Analysis

All analyses were carried out using IBM SPSS Statistics Version 30.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics and frequencies were used to describe the sample. Independent Samples *t*-tests were used to assess differences in continuous mean PSS-10 and CES-D-SF variables by class selection. Chi-squared tests were used to assess class selection differences in trichotomized PSS-10 and dichotomized CES-D-SF variable scores. In testing for demographic differences, separate t-tests and Chi-squared tests were run for each demographic group. Significance levels for all statistical tests were set at $p < 0.05$.

RESULTS

Sample Demographics

Overall, participants ($n = 6864$) identified as women (55.4%), non-Hispanic White (68.3%), Heterosexual (81.1%), and aged 20.4 ± 2.2 years (Table 1). The majority of those enrolled in PAC ($n = 4201$) identified as women (51%), non-Hispanic White (69%), and Heterosexual (81.7%). The majority of those enrolled in GHW ($n = 2580$) identified as women (64.3%), non-Hispanic White (69.3%) and Heterosexual (82.8%) (Table 1).

Table 1

Demographic Characteristics

	Total (N = 6864)	PAC (N = 4201)	GHW (N = 2580)
	N (%)	N (%)	N (%)
Gender Identity			
Women	3801 (55.4)	2143 (51%)	1658 (64.3%)
Men	2541 (37%)	1778 (42.3%)	763 (29.6%)
Other	151 (2.2%)	119 (2.8%)	32 (1.2%)
Not specified	371 (5.4%)	161 (3.8%)	127 (4.9%)

Race/Ethnicity			
Non-Hispanic White	4687 (68.3%)	2898 (69%)	1789 (69.3%)
Racial/Ethnic Minority	1791 (26.1%)	1135 (27%)	656 (25.4%)
Not specified	386 (5.6%)	168 (4%)	135 (3.2%)
Sexual Orientation			
Heterosexual	5569 (81.1%)	3432 (81.7%)	2137 (82.8%)
Sexual Minority	804 (11.7%)	527 (12.5)	277 (10.7%)
Not specified	491 (7.2%)	242 (5.8)	166 (6.4%)

Perceived Stress

Continuous Variable

Independent samples *t*-tests were used to compare perceived stress levels as a continuous variable in students self-selecting PAC classes (M = 18.46, *SD* = 6.55) as compared to those selecting GHW classes (M = 19.16, *SD* = 6.11). Perceived stress levels were significantly higher among those self-selecting GHW classes compared to PAC classes; t (5157) = -3.797, p <.001. For women, perceived stress levels were significantly higher among those self-selecting GHW classes (M = 19.92, *SD* = 5.79) compared to PAC classes (M = 19.42, *SD* = 6.30); t (2926) = -2.193, p = .028. For non-Hispanic white participants, perceived stress levels were significantly higher among those self-selecting GHW classes (M = 19.13, *SD* = 6.14) compared to PAC classes (M = 18.19, *SD* = 6.63); t (3676) = -4.250, p < 0.001. For Heterosexual participants, perceived stress was significantly higher among those self-selecting GHW classes (M = 18.77, *SD* = 6.02) compared to those self-selecting PAC classes (M = 17.90, *SD* = 6.41); t (4294) = -4.409, p < 0.001. Among men, all non-white races, and all other sexual orientations, perceived stress did not significantly differ between those self-selecting GHW and PAC classes (Table 2).

Table 2

T-Test Results on Continuous Perceived Stress Differences by Class Selection

	PAC		GHW					
Demographics	M	SD	M	SD	*df*	*t*	*p*	Cohen's *D*
Total sample	18.46	6.55	19.16	6.11	5157	-3.797	<.001	.11
Gender Identity								
Men	17.12	6.63	17.38	6.40	2005	-0.790	.429	.04
Women	19.42	6.30	19.92	5.79	2926	-2.193	.028	.08
Race/Ethnicity								
Non-Hispanic white	18.19	6.63	19.13	6.14	3676	-4.250	<.001	.15
All other races	19.12	6.38	19.18	6.00	1372	-0.161	.872	.01
Sexual Orientation								
Heterosexual	17.90	6.41	18.77	6.02	4294	-4.409	<.001	.14
All other orientations	21.49	6.55	21.50	6.22	742	-0.029	.977	.00

Trichotomized Perceived Stress Variable

Chi-squared tests were used to compare perceived stress, as trichotomized into low, moderate, and high perceived stress, in students self-selecting PAC classes compared to GHW classes. The results showed a significant difference in perceived stress between those self-selecting GHW classes (Low: n = 318, 17.2%, Moderate: n = 1327, 71.8%, High: n = 203, 11%) compared to those self-selecting PAC (Low: n = 749, 22.6%, Moderate: n = 2203, 66.6%, High: n = 357, 10.8%), $\chi 2$ (2, n = 5157) = 21.67, $p < 0.001$. Post hoc tests revealed that those self-selecting GHW classes were more likely to report moderate perceived stress (adj. res. = 3.9), while those self-selecting PAC were more likely to report low perceived stress (adj. res. = 4.6). These significant results were similar among women (GHW – Low: n = 170, 13.9%, Moderate: n = 900, 73.5%, High: n = 154, 12.6%; PAC - Low: n = 299, 17.6%, Moderate: n = 1182,

69.4%, High: *n* = 222, 13%), χ2 (2, *n* = 2927) = 7.80, *p* = 0.020, non-Hispanic white participants. (GHW – Low: *n* = 233, 17.4%, Moderate: *n* = 960, 71.5%, High: N = 149, 11.1%; KPAP – Low: N = 567, 24.3%, Moderate: *n* = 1525, 65.3%, High: *n* = 242, 10.4%), χ2 (2, N = 3711) = 25.07, *p* < 0.001, and Heterosexual participants (GHW – Low: *n* = 288, 18.5%, Moderate: *n* = 1128, 72.5%, High: *n* = 139, 8.9%; PAC – Low: *n* = 681, 24.9%, Moderate: 1826, 66.7%, High: *n* = 232, 8.5%), χ2 (2, *n* = 4294) = 22.91, *p* < 0.001. Significant results were not identified among men, all non-white races, or all other sexual orientations.

Depressive Symptoms

Continuous Variable

Independent samples *t*-tests were used to compare depressive symptoms as a continuous variable in students self-selecting PAC (M = 6.32, *SD* = 4.37) compared to GHW classes (M = 6.69, *SD* = 4.36). Depressive symptoms were significantly higher among those self-selecting GHW classes compared to PAC; *t* (6516) = -3.208, *p* = 0.001. For men, levels of depressive symptoms were significantly higher among those self-selecting GHW classes (M = 6.06, SD = 4.36) compared to those selecting PAC (M = 5.61, *SD* = 4.17); *t* (2490) = -2.406, *p* = 0.016. For all non-white races, levels of depressive symptoms were significantly higher among those self-selecting GHW classes (M = 7.17, SD = 4.36) compared to those self-selecting PAC (M = 6.54, SD = 4.33); *t* (1754) = -2.768, *p* = 0.006. For heterosexual participants, levels of depressive symptoms were significantly higher among those self-selecting GHW classes (M = 6.34, *SD* = 4.20) compared to those self-selecting PAC (M = 5.89, *SD* = 4.15); *t* (5482) = -3.876, *p* < 0.001. Among women, non-Hispanic white participants, and all other sexual orientations, levels of depressive symptoms did not significantly differ between those self-selecting GHW and PAC (Table 3).

Table 3

T-Test Results on Continuous Depressive Symptom Differences by Class Selection

	PAC		GHW					
Demographics	M	SD	M	SD	*df*	*t*	*p*	Cohen's *D*
Total sample	6.32	4.37	6.69	4.36	6516	-3.208	.001	.08
Gender Identity								
Men	5.61	4.17	6.06	4.36	2490	-2.406	.016	.11
Women	6.75	4.35	6.91	4.32	3757	-1.132	.258	.04

Race/Ethnicity								
Non-Hispanic white	6.24	4.40	6.49	4.34	4628	-1.881	.060	.06
All other races	6.54	4.33	7.17	4.36	1754	-2.768	.006	.15
Sexual Orientation								
Heterosexual	5.89	4.15	6.34	4.20	5482	-3.876	<.001	.11
All other orientations	8.84	4.81	8.87	4.77	889	-0.089	.929	.01

Dichotomized Depression Variable

Chi-Squared tests were used to compare depressive symptoms, as dichotomized into subclinical and clinical depressive symptoms, in students self-selecting PAC compared to GHW classes. There was a significant relationship between depressive symptoms and class selection, such that those self-selecting GHW classes (N = 912, 37.1%) were more likely to be experiencing a clinical level of depressive symptoms than those self-selecting PAC (N = 1380, 34%), $\chi 2$ (1, N = 6518) = 6.22, p = 0.013. The findings were similar among men (GHW: N = 239, 32.2%; PAC: N = 487, 27.8%), $\chi 2$ (1, N = 2492) = 4.72, p = 0.034, any non-white races (GHW: N = 275, 42.6%; PAC: N = 393, 35.4%), $\chi 2$ (1, N = 1756) = 9.13, p = 0.003, and Heterosexual participants (GHW: N = 712, 34%; PAC: N = 1008, 29.7%), $\chi 2$ (1, N = 5484) = 10,82, p < 0.001. This relationship was not significant among women, non-Hispanic white participants, or all other sexual orientations.

DISCUSSION

This study sought to determine whether levels of perceived stress and depressive symptoms differed between college students self-selecting a physical activity-based or lecture-based class to satisfy a general education requirement. It also explored whether levels of perceived stress and depressive symptoms differed by gender, race/ethnicity, and sexual orientation in self-selected classes of GHW and PACs. Findings indicate that those who self-selected the GHW class were experiencing higher levels of both perceived stress and depressive symptoms at the beginning of the semester in which they were taking the class. Upon further inspection, findings appeared to differ by gender, race/ethnicity, and sexual orientation.

Self-Selection and Mental Health

The finding that people who self-selected GHW classes had higher levels of both depressive symptoms and perceived stress demonstrates a clear self-selection bias, such that those with higher levels of both are more inclined to select a lecture-based class over a PA-based class to satisfy a general education requirement aimed at improving the health

and wellness of students. This is particularly problematic because of the wide array of health benefits, both physically and mentally, that PA provides for people. Those who potentially have the most to gain from PA self-select courses end up limiting PA behaviors, reinforcing a cycle of inactivity. Difficulties in engaging in positive health behaviors are very common across a range of mental disorders and issues, including both high stress and depression (Sahranç, 2011; Trew, 2011). The mechanisms possibly driving this phenomenon are well established, a range of which may be occurring in this selection bias. Those with higher perceived stress and depressive symptoms may feel less physically capable of partaking in physical activity, may lack the motivation to participate (Firth et al., 2016), or may experience low self-efficacy regarding PA participation (Elliott et al., 2024; Muris, 2002), particularly in front of the large groups of people typical of college PA classes. Specific to depressive symptomology, students exhibiting more depressive symptoms may lack enjoyment that can typically be drawn from activities like PA (Leventhal, 2012), or may even have negative past experiences with physical activity that dissuade them from participation.

Gender Differences

Our results also suggest that gender differences influence mental health outcomes by class selection. Men who self-selected GHW classes had a higher level of depressive symptoms, but not of perceived stress compared to men who self-selected PAC classes. Meanwhile women who self-selected GHW classes had higher levels of perceived stress but not depressive symptoms compared to women who self-selected activity classes. Previous research has shown that men with higher levels of depressive symptoms may select lecture-based classes due to a greater perceived pressure to perform (Lilleaas, 2007) in PACs, which they may feel unfit to match due to low self-efficacy associated with depressive symptoms (Muris, 2002). Among women, exercise is commonly used as a stress management technique (Elliott et al., 2021), which may help to explain the differences observed in perceived stress by class selection. The effect this has on class selection may be exacerbated by the higher baseline levels of perceived stress reported by women in college (Graves et al., 2021).

Minority Group Implications

Further, race/ethnicity differences were evident. Among non-Hispanic White students, a difference only existed in levels of perceived stress, and not depressive symptoms. The opposite was the case among all non-White races, such that levels of depressive symptoms differed by class selection, while no difference was observed for perceived stress. Specific to racial/ethnic minority groups, lower baseline self-efficacy relating to PA (Elliott et al., 2024) may explain the lack of difference in perceived stress by class selection, as these individuals may not enroll in PACs due to their low self-efficacy. Sexual orientation differences also existed, such that both perceived stress and depressive symptoms significantly differed by class selection among heterosexual participants, but not for sexual minority students. Sexual orientation differences in class selection may be explained in part by lower PA enjoyment typically reported by sexual minorities (Peterson & Bopp, 2024). Overall minority differences may potentially be associated with more systemic stressors being prevalent among both racial minority and sexual minority groups (Hoy-Ellis, 2023; Wei et al., 2010), such as increased perceived discrimination. The inefficacy of PA to lower stress levels may point to other intervention types being more appropriate.

The overall findings shed light on previous research that showed optional for-credit physical activity classes did not encourage physically inactive students due to their amotivation (Kim & Cardinal, 2019). High perceived stress

and depressive symptoms may help to explain this research, as it may be the presence of these aspects of mental distress which deter those students from choosing to engage in a class that would increase their PA levels, and in turn reduce their perceived stress and depressive symptoms. Further, the aforementioned lack of enjoyment in PA that is prevalent within depression may play a role, as enjoyment, a form of intrinsic motivation, is the strongest motivator (Deci & Ryan, 2012).

Another possible mechanism occurring in relation to these findings is a lack of knowledge of the mental health benefits of physical activity. The physical benefits are certainly well researched, and widely known among the population, but research indicates that many college students are still unaware of the mental health benefits of physical activity, particularly among men (Doyle et al., 2019). Further research showed that people entering a recreational PA class had higher stress than those entering a for-credit PA class (Cooper & Wojcik, 2018), indicating people self-selecting recreational classes are more aware of stress reduction benefits, and more motivated by said benefits. College students are also most frequently motivated by the physical health benefits (Kim & Cardinal, 2017). Therefore, for-credit PACs, like the ones in this study, should emphasize the mental health benefits PA can provide to encourage further participation among those who need it most. Beyond this, classes could shift their focus away from psychomotor skill learning and more towards teaching mental skills and stress reduction, possibly a more appropriate strategy for this age range (Cai, 2000). While this may help encourage further PA beyond the class, it does not improve our understanding of initial selection bias keeping students with high perceived stress and depressive symptoms out of PA classes.

Course Design Implications

Two possible avenues for U.S. colleges to take to address the problem are suggested. First, colleges may put more focus on promoting the mental health benefits of physical activity. This may be done through reframing PA classes away from being sport/movement focused, and more towards being for stress management or mood boosting, using student testimonials to highlight the positive experiences of past students, and providing the scientific evidence that those in PA classes report lower perceived stress and depressive symptoms. Alternatively, a move may be made to mandate a PAR within general education requirements necessary for graduation. Research suggests that PARs help previously unmotivated students to reach weekly guidelines, and that exposure to a PAR leads to increased motivation to exercise (Kim & Cardinal, 2019). It may also be important for PAR classes to include some lecture-based components to match the academic perceptions students have of lectures.

Limitations

This study comes with limitations. Firstly, self-report measures were used to obtain all data. While the stress and depression measures are both validated and widely used inventories, issues of social desirability, misinterpretation of questions, and answers being based on recall all pose potential issues. Secondly, the sample was not sufficient to gain any valuable insight into sexual minority groups, as it was predominantly heterosexual, limiting generalizability to sexual minority students. The same can be said for the student population this sample was drawn from: the experiences of college students at a large Northeastern university may not mirror those of others of a similar age in the U.S. or across the globe, which may form the basis of future research. Many of the discussed mechanisms potentially behind the differences seen in this study apply very closely to the symptomology of anxiety disorders, considering their close

proximity to both stress and depression. Future research should explore how the rates of anxiety being experienced by students differ by class selection to understand the full range of mental distress being experienced. Finally, future research should assess the longitudinal impacts of class selection on perceived stress and depressive symptoms by comparing the rate of change across a period of time.

CONCLUSIONS

To conclude, this study explored whether levels of perceived stress and depressive symptoms differed between college students self-selecting a lecture-based or a PA-based class as part of their general education requirements. Findings show that levels of both perceived stress and depressive symptoms are significantly higher among those self-selecting lecture-based classes compared to those selecting PA-based classes. Further, there are demographic differences within both gender and race/ethnicity. These findings contribute to the understanding of how those experiencing MH difficulties self-select certain general education course requirements that may inhibit their engagement in healthy behaviors, as well as the dialogue around PARs in higher education.

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