

Depressive Symptoms and Academic Performance of North Carolina College Students

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BACKGROUND Depression negatively affects cognitive functioning and, consequently, academic performance. Studies of this association have yielded conflicting results and have not fully considered other factors that may play a role in academic performance. This study examines the relation between depression and academic performance in students at a large urban university in North Carolina.

METHODS We analyzed data from student responses to the 2008 cross-sectional National College Health Assessment to create categories of depressive symptomatology. E-mail invitations to participate in the assessment were sent to 8,000 students at the university in an effort to obtain at least 900 responses, the minimum number considered valid for a campus of its size. We analyzed the responses of the 1,280 undergraduates who completed the survey. Logistic regression analyses were performed to examine associations between depressive symptoms and academic performance in this group.

RESULTS Students in the second, third, and fourth quartiles of depressive symptomatology had increased, though statistically non-significant, odds of having a lower cumulative grade average, even after adjustment for age, sex, year in school, race/ethnicity, substance use, and level of credit-card debt. This difference was most pronounced among students in the second quartile of depressive symptomatology.

LIMITATIONS This cross-sectional study did not allow for evaluation of causality. In addition, the self-report nature of this questionnaire could have led to some inaccuracy in reporting.

CONCLUSIONS Students reporting even a small number of depressive symptoms may be at increased risk for academic problems.

Findings from the Global Burden of Disease study indicate that depression is the world's leading cause of disability [1]. Data from the National Health and Nutrition Examination Survey 2005-2006 revealed that, in any 2-week period, 5.4% of Americans 12 years of age or older were depressed [2]. In the year 2000, depression costs in the United States (including direct medical costs, suicide-related mortality costs, and workplace costs relating to diminished productivity) totaled more than \$83.1 billion [3].

The rate of depression in college students is higher than that in the general population [4]. Depression was the fourth most common health problem reported by college students on the American College Health Association (ACHA) National College Health Assessment (NCHA) in the NCHA Spring 2007 survey; 18.4% of respondents reported having experienced depression sometime within the past year [5]. Elsewhere it has been reported that students are increasingly seeking out campus services for help with depression [6].

Because depression has a negative effect on cognitive functioning, it can affect academic performance [7]. Several studies have shown a relationship between academic performance and depression in college populations [7-12], but others have not [13-14]. The relationship may not be linear; students experiencing moderate depressive symptoms do not necessarily perform worse academically than those with a mild or normal level of symptoms [9]. Many researchers have examined the association between depression and academic performance as a minor aspect

of some other issue that they have taken as their main focus of study [8, 12-14]. Consequently, these examinations have taken into account very few of the variables that are potential confounders of the relationship.

A review of the literature suggests that many factors may be associated both with depression and with academic performance. Gender is one such factor, and gender differences in depression have been studied in both adults and adolescents [15-17]. Researchers have shown that race or ethnicity [18] and use of tobacco, alcohol, or illicit drugs [19-21] are other factors associated with both depression and academic performance. Financial difficulties also are related to both depression and academic achievement [8]. To date, researchers have not fully examined the effects of variables such as age, sex, year in school, and race or ethnicity on this association, nor have they considered the potential roles of substance use and financial problems, both of which often affect college students. We know of no studies reporting the association between depression and academic performance for college students in North Carolina.

Our study takes data collected at a large urban university in North Carolina in the NCHA Spring 2008 survey

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and uses it to evaluate the association between depressive symptoms and academic performance in college students.

Materials and Methods

The NCHA solicits information on a variety of health issues and their impact on student academic performance. The survey is available to universities each fall and spring semester. In the Spring 2008 semester, 106 campuses participated in the assessment [22]. ACHA has conducted reliability and validity analyses for the items on this survey [23]. The institution in our study administers the NCHA each spring semester, employing survey sampling and administration procedures that are consistent with NCHA protocols [23]. For a university of its size, ACHA recommends a response sample of at least 900 [23]. An e-mail invitation was sent to 8,000 randomly selected students. A total of 1,535 students responded to the invitation and completed the survey, yielding nearly twice the minimum desired number of responses; this yield is consistent with that for administration of the survey at this school in previous years. Only the responses of the 1,280 undergraduates who participated are included in our analysis. The collection of NCHA data on this campus and our plans for secondary analysis of it were reviewed and approved by the university's Institutional Review Board. Participants provided informed consent prior to beginning the survey.

Variables. Selected data from the NCHA [24] were abstracted into a de-identified dataset for this secondary analysis. Control variables were selected for inclusion based on a review of the literature. Cross-sectional data of this sort permits the construction of correlational models but does not permit assessment of causality. The outcome and exposure variables described below, therefore, are classified as such for purposes of statistical modeling and hypothesis generation.

The potential confounding variables that we examined included socio-demographic variables such as age (in years), sex, race or ethnicity, year in school (year 1 through 5 or more as an undergraduate), and level of credit-card debt (none, \$1-\$1,000, or more than \$1,000). The outcome variable was cumulative grade average; this was self-reported as "mostly As," "mostly Bs," and so on; for analysis, we recoded these responses into two categories: A/B and C/D/F.

Students recorded the frequency with which they experienced depressive symptoms within the past 12 months (never, 1-2 times, 3-4 times, etc). But the main exposure variable, depressive symptom level, was constructed from a series of 6 questions regarding the frequency during the past year with which students had felt things were hopeless, had felt overwhelmed, had felt exhausted, had felt very sad, had felt so depressed that they had difficulty functioning, or had seriously contemplated suicide. This set of items demonstrated high internal consistency (Cronbach's $\alpha = 0.859$). Each of these 6 depressive symptom items had 7 response

categories ranging from "never" to "11 or more times in the past year." Each response category was assigned a value from 1 to 7, with "never" receiving a value of 1 and "11 or more times" receiving a value of 7. The values from each question were then summed to produce a depressive symptom score between 6 and 42. This approach yielded a measure that represented both the breadth and the frequency of symptoms experienced. Given the underlying imprecision in such responses and the nature of the score distribution, the scores were collapsed into quartiles for analysis.

Several potential confounder variables were recoded. Categories for year in school, race or ethnicity, substance use, and level of credit-card debt were collapsed because of the small number of responses for some categories.

Analysis. Participants with incomplete responses were included in the analyses of the variables for which they had responses. The race/ethnicity question received the lowest number of responses, with 1,196 students providing answers. All other variables had more than 1,200 responses. Frequencies and percentages were calculated for nominal and ordinal variables (sex, year in school, and race/ethnicity); mean and standard deviation were calculated for age. Bivariate analyses (χ^2 test for trend) were used to determine the relationship between cumulative grade average, depressive symptoms, and the suspected confounders (sex, year in school, race or ethnicity, each substance used, and credit-card debt).

Binary logistic regression was performed to provide a crude association between the depressive-symptom quartiles and cumulative grade average, as well as to identify other risk factors for a low cumulative grade average. Logistic regression was used to predict categorical outcome variables (a cumulative grade average of A/B or C/D/F) from exposure variables (level of depressive symptoms and the other risk factors). Crude odds ratios provided information on the association between the outcome variable and each individual exposure variable. To assess confounding, all variables were entered into the logistic regression model at the same time, and adjusted odds ratios and 95% confidence intervals were computed. Variables whose odds ratios changed by 10% or more in the multivariate model were considered to be confounders that should be considered for inclusion in subsequent multivariate analyses [25]. Finally, the Hosmer-Lemeshow test for goodness of fit was conducted to determine how well the model fit the data.

Results

One fourth of study participants (25.2%) reported a cumulative grade average of C, D, or F (Table 1). Men and non-Hispanic black students ($P < .001$, χ^2 test), as well as those with a modest (\$1-\$1,000) level of credit-card debt ($P < .003$, χ^2 test) made up a higher proportion of those with a cumulative grade average of C, D, or F than did women, students of other races or ethnicities, and those with either no credit-card debt or credit-card debt of more than \$1,000.

The constructed depressive symptomatology scale yielded a non-normal distribution. Consequently, nonparametric summary statistics are reported (eg, medians and quartiles rather than means). The quartile scores were used as cut points to condense the information into an ordinal ranking. The median depressive symptom score for all participants (shown in Table 2) was 15 (range 6, 42; interquartile range 11, 20). The median depressive symptom scores within each quartile are also noted in Table 2. Students in the first depression quartile (ie, those with the lowest level of symptoms of depression) were least likely to report having C, D, or F grades (only 23.0% of them did so), and those in the fourth quartile (those with the highest level of symptoms) were mostly likely to report C, D, or F grades (29.3% of them did so), but this trend was not statistically sig-

nificant ($P = .257$). Participants who reported ever having been diagnosed with depression constituted 12.7% of the respondents. Of those students who had been diagnosed with depression, 63.7% fell into the fourth quartile, the category with highest level of depressive symptoms, and 17.2% fell into the third quartile, which had the next-highest level of depressive symptoms.

Unadjusted odds ratios. In the unadjusted analysis, students whose depressive-symptom scores fell into the second, third, or fourth quartile had higher odds than did those in the first quartile of reporting a cumulative grade average of C, D, or F, with those in the second quartile having the highest odds of all—an odds ratio (OR) of 1.388 (95% CI, .968-1.991) (Table 3). Males were significantly more likely (OR = 1.565; 95% CI, 1.203-2.035) to report a C, D,

TABLE 1.
Cumulative Grade Averages of Students with Various Demographic and Behavioral Characteristics

Student characteristic or behavior	Cumulative grade average A/B, no. (%)	C/D/F, no. (%)	Total no.	P ^a
Sex				
Female	621 (77.7)	178 (22.3)	799	0.001
Male	301 (69.0)	135 (31.0)	436	
Year in school (undergraduate)				
1st	234 (79.3)	61 (20.7)	295	0.280
2nd	182 (73.1)	67 (26.9)	249	
3rd	281 (73.8)	100 (26.2)	381	
4th	163 (74.1)	57 (25.9)	220	
5th or higher	57 (69.5)	25 (30.5)	82	
Race/ethnicity				
White, non-Hispanic	728 (77.9)	206 (22.1)	934	<0.001
Black, non-Hispanic	81 (57.0)	61 (43.0)	142	
Hispanic or Latino	34 (79.1)	9 (20.9)	43	
Asian or Pacific Islander	34 (68.0)	16 (32.0)	50	
Other	21 (77.8)	6 (22.2)	27	
Substance use during past 30 days				
Cigarettes	146 (62.9)	86 (37.1)	232	<0.001
Cigars	45 (56.3)	35 (43.8)	80	<0.001
Smokeless tobacco	26 (60.5)	187 (39.5)	43	0.027
Alcohol	526 (71.6)	209 (28.4)	735	0.002
Marijuana	84 (61.3)	53 (38.7)	137	<0.001
Cocaine	11 (61.1)	7 (38.9)	18	0.180
Amphetamines	15 (50.0)	15 (50.0)	30	0.002
Other drugs	21 (61.8)	13 (38.2)	34	0.077
Level of credit-card debt				
None	644 (78.4)	177 (21.6)	821	<0.001
\$1-1,000	149 (65.4)	79 (34.6)	228	
> \$1,000	114 (68.3)	53 (31.7)	167	
Total	927 (74.8)	313 (25.2)	1240	

^aP value (calculated by means of χ^2 test) for association between the demographic or behavioral characteristic and cumulative-grade-average category.

TABLE 2.
Percentages of Students in Each Quartile of Depressive-Symptom Score Who Have a Cumulative Grade Average of C, D, or F or a Diagnosis of Depression

Quartile	Depressive-symptom score Median (Range)	Cumulative grade average of C/D/F ^a (%)	Ever diagnosed with depression ^b (%)
1st	8 (6-10)	23.0	6.4
2nd	12 (11-14)	26.8	12.7
3rd	17 (15-20)	23.8	17.2
4th	26 (21-42)	29.3	63.7
All participants	15 (11-20) ^c	25.7	12.7

^aP = .257

^bP < .001, using χ^2 test for trend

^cInterquartile range

or F grade average than were females. Upper classmen had higher odds of reporting C, D, or F grades than did freshmen, but the association was not statistically significant. For every 1-year increase in age, the odds of having a C, D, or F grade average remained the same (OR = 1.000; 95% CI, 0.966-1.034).

Black, non-Hispanic students were more than twice as likely as non-Hispanic white students to report having a cumulative grade average of C, D, or F (OR = 2.661; 95% CI, 1.845-3.840). The use of cigarettes, cigars, smokeless tobacco, alcohol, marijuana, and amphetamines all were associated with significantly increased odds of having a C, D, or F grade average (Table 3). Students with modest credit-card debt (\$1-\$1,000) had increased odds of having a C, D, or F grade average (OR = 1.140; 95% CI, 0.746-1.744), whereas students with more than \$1,000 of debt were significantly less likely to have a C, D, or F grade average (OR = 0.591; 95% CI, 0.410-0.852).

Confounders and adjusted odds ratios. The adjusted analysis included all of the previously identified potential confounders. With adjustment, the odds ratios showing the likelihood of having a cumulative grade average of C, D, or F increased by more than 10% for all races and ethnicities other than Hispanic or Latino and decreased by more than 10% for every type of substance use, signifying that these variables are all likely confounders of the association between depression level and cumulative grade average. After adjustment, the associations between poor grades and the use of cigarettes, smokeless tobacco, or alcohol were all attenuated to levels that were not statistically significant. The association of poor grades with Asian or Pacific Islander ethnicity reached statistical significance, and the associations of poor grades with being male, identifying as a non-Hispanic black, smoking cigars, using marijuana, using amphetamines, or having more than \$1,000 in credit-card debt all remained statistically significant (Table 3).

Compared with students whose level of depressive symptoms was in the first quartile, students in the second quartile of symptom level were nearly 50% more likely to report a cumulative grade average of C, D, or F, but this

difference was not statistically significant (adjusted OR = 1.475; 95% CI, 0.975-2.234). The adjusted odds of having poor grades were also elevated for those in the third and fourth quartiles of symptom level, but those increases were not statistically significant and were lower in magnitude than the increase for students in the second quartile.

Goodness-of-fit. The Hosmer-Lemeshow test produced a non-significant P value (P = .07). This indicates that the proposed model adequately fits the data.

Discussion

Students whose depressive-symptom score fell into the second quartile had the highest odds of reporting a cumulative grade average of C, D, or F. This result differs from the finding of Heiligenstein and colleagues [10] that those who are the most depressed are the most functionally impaired. However, it is similar to the finding of DeRoma and colleagues [9] that those experiencing a moderate level of symptoms perform worse academically than those with symptoms that are milder or more severe.

That nearly three fourths of students who fell into either the third or fourth depressive-symptom quartile had been diagnosed with depression speaks to the utility of using cumulative depressive symptoms as a sensitive proxy for depression in university-based surveys and suggests that it is likely that many of these students had been undergoing treatment for depression. Using depressive symptoms as a proxy for depression might not be as precise as using a diagnosis of depression, but doing so is more economical in community settings and can identify undiagnosed but at-risk students for further follow-up.

Students, faculty, and staff members of the student health service should be made aware that even mild symptoms of depression may be associated with lower grades. Although most faculty members see mental health problems as having an effect on academic productivity [26], they may not know just how prevalent these symptoms are and how they affect students. They should be alerted to the fact that they need to be watchful not just for students who are overtly depressed, but also for those who display

milder symptoms of depression. Because faculty members see both a student's grades and his or her behavior and demeanor in class, they may be in a better position to recognize that a student's academic performance is being impaired by depression than are other members of the campus community. Educational programs on this topic could be beneficial to faculty members and improve their interactions with students.

In some cases, subtle symptoms of depression may be difficult to detect through interpersonal means. The implementation of a program of required screening for depression can help detect potential problems and prevent students from experiencing the detrimental effects of untreated depression. Students experiencing low levels

of depressive symptoms might otherwise go undiagnosed. Academic problems resulting from undiagnosed depression can affect students for the rest of their lives.

Students need to be made aware of the nature and magnitude of the risks posed by symptoms of depression. Depression must be destigmatized so that its potential consequences can be addressed proactively. The staff of the student health service should be made fully aware of the effects of depression so that they can plan health-education activities accordingly. Such activities should focus on making students aware of the possible threats to their health and to their academic performance posed by depression. Students should also be informed that depression during the college years is more common than they might think,

TABLE 3.
Crude and Adjusted Odds of Having a Cumulative Grade Average of C, D, or F

Student characteristic or behavior	Unadjusted odds OR (95% CI)	Adjusted odds OR* (95% CI)	Change with adjustment (%)
Depressive-symptom level			
1st quartile	1.000	1.000	
2nd quartile	1.388 (0.968-1.991)	1.475 (0.975-2.234)	6.27
3rd quartile	1.044 (0.716-1.523)	1.201 (0.790-1.826)	15.04
4th quartile	1.189 (0.813-1.740)	1.324 (0.867-2.021)	11.35
Age	1.000 (0.966-1.034)	0.974 (0.929-1.022)	-2.60
Sex			
Female	1.000	1.000	
Male	1.565 (1.203-2.035)	1.646 (1.212-2.235)	5.18
Year in school (undergraduate)			
1st	1.000	1.000	
2nd	1.412 (0.949-2.101)	1.451 (0.937-2.247)	2.76
3rd	1.365 (0.950-1.962)	1.168 (0.767-1.778)	-14.43
4th	1.341 (0.888-2.027)	1.306 (0.792-2.151)	-2.61
5th or higher	1.682 (0.973-2.911)	1.502 (0.781-2.889)	-10.70
Race/ethnicity			
White, non-Hispanic	1.000	1.000	
Black, non-Hispanic	2.661 (1.845-3.840)	3.540 (2.336-5.365)	33.03
Hispanic or Latino	0.935 (0.442-1.982)	0.998 (0.453-2.195)	6.74
Asian or Pacific Islander	1.663 (0.900-3.073)	2.128 (1.093-4.142)	27.96
Other	1.399 (0.804-2.433)	1.593 (0.864-2.939)	13.87
Substances used during past 30 days			
Cigarettes	2.033 (1.499-2.757)	1.336 (0.911-1.958)	-34.28
Cigars	2.456 (1.548-3.898)	1.882 (1.094-3.235)	-23.37
Smokeless	1.997 (1.069-3.733)	1.120 (0.511-2.455)	-43.92
Alcohol	1.524 (1.164-1.995)	1.149 (0.834-1.584)	-24.61
Marijuana	2.044 (1.410-2.962)	1.586 (1.001-2.514)	-22.41
Cocaine	1.903 (0.731-4.952)	0.657 (0.203-2.127)	-65.48
Amphetamines	3.071 (1.483-6.356)	3.432 (1.456-8.086)	10.52
Other	1.870 (0.925-3.779)	1.438 (0.611-3.384)	-23.10
Level of credit-card debt			
None	1.000	1.000	
\$1-1,000	1.140 (0.746-1.744)	1.061 (0.664-1.696)	-6.93
>\$1,000	0.591 (0.410-0.852)	0.566 (0.369-0.866)	-4.42

Numbers in boldface type are statistically significant.

*Adjusted for all of these potentially confounding student characteristics and behaviors.

so that those who suffer from depression can better understand that they are not alone. With that knowledge, they may feel more comfortable seeking help, which ultimately will improve their chances of succeeding in college.

The variables that we considered likely to be confounders (because they had an adjusted odds ratio that differed by more than 10% from the unadjusted ratio)—race or ethnicity and the use of substances such as cigarettes, cigars, smokeless tobacco, alcohol, marijuana, cocaine, amphetamines, or other drugs—should be considered, and adjusted for, in future analyses. Because the proposed model adequately fit the data, it likely will be useful for future research.

Limitations. Studies that are cross-sectional in nature, as ours was, only allow assessment of correlation, not evaluation of causality. It is possible that poor academic performance leads to depressive symptoms rather than depressive symptoms leading to poor academic performance. The NCHA survey is a self-reported instrument, and respondents may not have answered every question accurately, especially given the sensitive nature of some questions. If all participants had the same likelihood of providing inaccurate responses, nondifferential misclassification could have occurred, biasing the results toward the null hypothesis. In addition, the information available was not sufficient to determine whether survey respondents were demographically representative of the student population as a whole or whether nonrespondents differed in some way from respondents. Another limitation of our study is that the depressive-symptomatology scores we constructed, although highly reliable, cannot be linked to the diagnostic criteria for clinical depression.

This data is drawn from a single, large, urban university in North Carolina. The student population there is largely reflective of the state's total population of university students. Thus our findings should be generalizable throughout the state, and to similar urban universities in other states as well; these findings should prove useful in designing programs to address the pervasive effects of depression on college campuses.

Conclusions

Students experiencing even mild symptoms of depression are likely to be at risk for lower academic performance, and several factors could play a role in this relationship. Students in North Carolina and elsewhere could benefit from knowing more about this issue and its impact. Therefore, further research is needed in this area—specifically, longitudinal studies and additional efforts to validate the association between depressive symptomatology and clinical depression. *NCMJ*

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