

The Association Between Mental Health and Acute Infectious Illness Among a National Sample of 18- to 24-Year-Old College Students

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Abstract. Poor mental health is associated with physical illness, but this association is poorly characterized among college students. **Objective and Participants:** Using American College Health Association–National College Health Assessment data, the authors characterized poor mental health (depression, anxiety, negative affect) and examined the relationship between poor mental health and acute infectious illnesses (bronchitis, ear infection, sinusitis, strep throat) among 47,202 US college students. **Methods:** The authors used frequency and cross-tabulation analyses to characterize mental health and determine univariate associations among variables. They used binary logistic regression to determine the association between poor mental health and acute infectious illness, controlling for research-derived covariates. **Results:** The prevalence of acute infectious illness ranged from 8% to 29%. The prevalence of anxiety and depression ranged from 12% to 20%, respectively. Depression, anxiety, and exhaustion were associated with acute infectious illness across all dependent measures, with odds ratios ranging from .56 to .91. **Conclusions:** Poor mental health is associated with acute infectious illness among college students.

Keywords: anxiety, college students, depression, infectious illness, negative affect

Approximately 54 million Americans suffer from poor mental health. According to recent data, depression, which is the most pervasive mental disorder, affects 12.6 million women and 6.3 million men annually.¹ Poor mental health is associated with several negative outcomes, including higher health-related costs,^{2–4} reduced productivity,^{5,6} and a greater incidence of chronic comorbidities,⁷ including cardiovascular disease^{8,9} and can-

cer.¹⁰ These outcomes underscore the impact of poor mental health over time. However, research also indicates that poor mental health is associated with acute conditions such as pain¹¹ and infectious illness.^{12,13} The relationship between poor mental health and acute infectious illness may be mediated via down-regulation of the immune system,¹⁴ which functionally lowers resistance to infectious agents.

Most researchers studying the association between poor mental health and acute infectious illness have investigated older¹³ or working-adult populations,^{2–4} although poor mental health and acute infectious illnesses are common on college campuses. Recently published data indicate that approximately 12.6% of female and 6.2% of male college students report ever having been diagnosed with depression.¹⁵ These findings are consistent with national data on adults.^{16,17}

Although it is commonly believed that college students experience higher than normal rates of infectious illness during stressful times (eg, final exams), the association between any type of mental health and any physical morbidity among college students is poorly characterized. Investigators in 2 studies of college student populations suggest that more stressful life events are associated with a greater likelihood of upper respiratory infection¹⁸ and that social networks¹⁸ or stress-reduction exercises seem to mediate this relationship.¹⁹ The findings of another study indicate that the experience of acute infectious illness is consistently associated with poor mental health.²⁰

Developing a better understanding of this relationship is important because college students are young, are at a critical developmental crossroads,¹⁹ and are forming lifelong habits.^{21,22} In addition, college students are prone to risky health behaviors, which, in general, are associated with both poor mental health¹⁷ and acute infectious illness.²³

Our purpose in this study was twofold: first, using secondary data from the American College Health Association–

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National College Health Assessment (ACHA–NCHA),²⁴ we wanted to determine the presence of clinically treated depression, self-reported depression and anxiety, and 5 indicators of negative affect in a sample of 18- to 24-year-old US college students. Second, we examined the association of clinically treated depression, self-reported depression and anxiety, and 5 indicators of negative affect, with the prevalence of 4 acute infectious illnesses: bronchitis, ear infection, sinus infection, and strep throat.

METHODS

Design and Sample

We used a retrospective design with secondary analysis of cross-sectional data. Data were from the NCHA.²⁴ During the spring 2004 semester, 50,819 US college students at 80 schools nationwide completed the NCHA. However, in our analysis, we included only students who had been randomly selected or who were in randomly selected classrooms ($N = 47,202$, 74 schools). The composite response rate was approximately 35%. Each institution provided permission for ACHA to release data, without information that would allow identification of institutions or students, to interested researchers. The first author (TA) requested and received permission to use these data. Prior to any data manipulation or analyses, we received approval for secondary research from the institutional review board of a major university in the Southwest.

Demographic characteristics of the schools included: 49 public colleges and universities, 25 private; 67 four-year and 5 two-year institutions; 9 schools with less than 2,500 students, 7 schools with 2,500–4,999, 17 schools with 5,000–9,999, 25 schools with 10,000–19,999, and 16 schools with 20,000 or more. The schools were relatively dispersed, with 13 in the Northeast, 18 in the Midwest, 17 in the South, and 24 in the West. Campus settings varied, with 17 schools located in urban areas with populations of greater than 1 million, 25 schools located in urban settings with populations of 100,000 to 1 million, 10 schools located in suburban settings, and 22 located in rural settings.

The survey method selected by each university may have affected the validity of the data (online or paper/pencil). For example, the completion rate, the care with which students answered questions, and the propensity to falsify information may have differed between forms. Thus, we used several validity screens developed for research with these data.^{25–27} First, we used the value corresponding to the mean plus 4 standard deviations as an omission criterion on 3 continuous variables: hours of alcohol consumed at last party (> 14), number of drinks consumed at last party (> 22), and number of sexual partners in past 12 months (> 13). We omitted students with values beyond 4 standard deviations on any of these variables ($n = 583$). Second, we omitted respondents with body mass index values below 15 and above 45 ($n = 290$). Last, we omitted participants aged younger than 18 ($n = 2$) and older than 24 ($n = 3,749$). The final sample consisted of 43,678 18- to 24-year-old col-

lege students. Table 1 presents demographic data for this sample.

Measures

An interdisciplinary team of college health professionals developed the NCHA and systematically evaluated it with reliability and validity analyses comparing common survey items with national studies such as the the Centers for Disease Control and Prevention's National College Health Risk Behavior Survey.^{28,29} The NCHA includes more than 300 items that assess behavioral, medical, normative, and demographic characteristics. It has been rigorously evaluated for reliability and validity.²⁹

We extracted dependent measures for this study from the NCHA; these included 4 self-reported dichotomous measures (yes or no) of past-year experience of infectious diseases (bronchitis, ear infection, sinus infection, or strep throat).²⁴ The independent measures included self-reported dichotomous measures of incidence in the previous 12 months of either depression or anxiety. In addition, we included a measure of clinically treated depression. We developed this measure using 3 items. If the respondent reported not being diagnosed with depression in the previous school year, we coded him or her as *never depressed*. If the respondent replied in the affirmative to the previous question and reported either taking medication or currently attending therapy sessions, we coded him or her as *depressed but receiving treatment*. The final group comprised respondents who were *depressed but receiving no treatment*. Last, we included 5 items that assessed negative affect experienced during the past school year. These items included feeling hopeless, overwhelmed, exhausted, very sad, or depressed to the point of functional limitation. Each item had 7 response options that ranged from *never to 11 or more times*.

We used as covariates several behavioral risk factors that are comorbid with either mental health or infectious illness. These variables included cigarette smoking (frequency in preceding 30 days), binge drinking (frequency in past 2 weeks), physical activity (frequency of vigorous or moderate activity in preceding 7 days), sleep (number of nights of restful sleep in preceding 7 days), perceived health (excellent, very good, good, fair/poor), and daily servings of fruit and vegetable intake (5 or more, 3–4, 1–2, 0). In addition, we used several categorical demographic variables as covariates, including age, sex, race, living arrangement, relationship status, hours worked per week, and hours volunteered per week.

Analysis

To characterize the presence of mental health issues, negative affect, and infectious illness in this sample, we performed a frequency analysis. We used cross-tabulation analysis with Cramer's V as an indicator of effect size to determine the association between the 3 dichotomous measures of mental health and the 4 dependent measures. Similarly, to determine the association between the 5 ordinal

TABLE 1. Participants' Demographic Characteristics

Characteristic	<i>n</i>	%
Sex		
Female	27,648	65
Male	14,861	35
Age (y)		
18	4,958	11.4
19	8,778	20.2
20	7,820	18.0
21	7,041	16.2
22	4,334	10.0
23	2,163	5.0
24	8,318	19.2
Race		
White	31,644	72.9
Black	2,402	5.5
Hispanic	1,835	4.2
Asian	4,481	10.3
American Indian	148	0.3
Multiracial	2,898	6.7
Relationship status		
Single	23,487	54.0
Married	3,746	8.6
Committed	15,728	36.2
Separated/divorced/widowed	497	1.1
Living arrangement		
Residence hall	15,661	36.0
Fraternity or sorority house	725	1.7
Other university housing	2,184	5.0
Off campus	16,642	38.3
With parents	5,992	13.8
Other	2,270	5.2
Weekly number of hours worked		
0	16,333	37.7
1–9	7,209	16.6
10–19	8,810	20.3
20–29	5,844	13.5
30–39	2,246	5.2
40	1,554	3.6
> 40	1,376	3.2
Weekly number of hours volunteered		
0	27,590	63.8
1–9	13,800	31.9
> 10	1,857	4.3

measures of negative affect and the 4 dependent measures, we used cross-tabulation analysis with Somer's *D* as an indicator of effect size.

We used a series of hierarchical binary logistic regression models to assess the impact of mental health, negative affect, comorbid behavioral risk factors, and demographic factors on each of the dependent measures. In each model, we entered the mental health and negative affect measures in one block as covariates. This allowed for the prediction of each infectious illness, controlling for the influence of the mental health variables on each other. We then similarly adjusted each model by adding behavioral risk factors in a second block and demographic variables in a third block. The latter 2 blocks controlled for the influence of behavioral

and demographic factors on the study outcomes. We considered the odds ratio for each predictor significant if $\alpha \leq .05$.

RESULTS

Table 1 presents respondents' demographic characteristics. Infectious illness rates in this sample were 8% for bronchitis, 10% for ear infection, 13% for strep throat, and 29% for sinus infection. Approximately 12% of the sample reported experiencing anxiety in the previous year, and nearly 1 in 5 reported experiencing depression. However, only 1 in 10 respondents indicated that they had been clinically diagnosed with depression. About 30% of those who had been diagnosed were currently receiving treatment, and the remaining 70% were not (see Table 2). A greater

TABLE 2. Descriptive Statistics for Dichotomous Dependent and Independent Measures

Measure	<i>n</i>	%
Dependent		
Bronchitis	3,357	8
Ear infection	4,215	10
Sinus infection	12,174	29
Strep throat	5,524	13
Independent		
Self-reported anxiety	5,132	12
Self-reported depression	8,062	19
Clinically treated depression	1,153	3
Untreated depression	2,912	7

Note. Because we rounded, percentages do not total 100.

percentage of participants indicated that they had never felt hopeless (37%) in the prior 12 months. Conversely, a majority did report feeling overwhelmed (29%) or exhausted (28%) 11 or more times during the prior 12 months. Nearly 1 in 3 (31%) indicated that they had felt very sad 1–2 times in the previous 12 months (see Table 3).

Cross-tabulation analysis indicated that in every case, a statistically significant association was evident between all independent variables and each of the 4 dependent variables. However, the effect sizes for these dichotomous measures were small, ranging from .04 to .10 for anxiety, .03 to .08 for depression, and .02 to .06 for clinically treated depression. The effect sizes for the ordinal measures were larger but still modest, ranging from .08 to .17 across all 5 independent measures.

We discuss the results of the binary logistic models by dependent variable in the following order: bronchitis, ear infection, sinus infection, and strep throat. We report only the significant predictors in the final adjusted models. Table 4 displays the results of the unadjusted and both adjusted models.

Bronchitis

Significant predictors of bronchitis included the measures of clinically treated and self-reported depression, anxiety,

and exhaustion. Relative to those with the first 3 conditions, students not experiencing clinically treated depression, self-reported depression, and anxiety were 15%, 14%, and 27% less likely to have had bronchitis, respectively. Relative to those who reported feeling exhausted 11 or more times during the previous 12 months, most groups were less likely to have had bronchitis: never exhausted (44%), 1–2 times (28%), 3–4 times (23%), and 5–6 times (17%).

Ear Infection

The significant predictors of ear infection included the measures of those clinically treated for depression, experiencing anxiety, and feeling exhausted. Relative to those with the first 2 conditions, those who did not have clinically treated depression or anxiety were 28% and 23% less likely to have had an ear infection, respectively. Relative to those who reported feeling exhausted 11 or more times during the previous 12 months, most groups were less likely to have had bronchitis: never exhausted (26%), 1–2 times (19%), and 3–4 times (17%).

Sinus Infection

Significant predictors of sinus infection included the self-reported measures of depression, anxiety, and exhaustion.

TABLE 3. Percentages for Negative Affect Measures

In the past school year, how often have you felt...	Never	1–2	3–4	5–6	7–8	9–10	11+
Hopeless	37	27	11	7	4	3	10
Overwhelmed	6	16	15	14	11	9	29
Exhausted	8	17	15	13	10	9	28
Sad	19	31	14	10	7	5	14
Functionally limited by depression	55	21	7	4	3	2	7

Note. Because we rounded, percentages do not total 100.

TABLE 4. Prediction Models for Infectious Illness

Mental health measure	Unadjusted			Adjusted ^a			Adjusted ^b		
	Wald	<i>p</i>	OR	Wald	<i>p</i>	OR	Wald	<i>p</i>	OR
<i>Bronchitis</i>									
Anxiety	83.0	.001	.58	67.7	.001	.60	57.3	.001	.63
Depression	5.2	NS	.86	4.6	NS	.87	5.7	NS	.86
Diagnosed depression									
Not depressed	25.6	.001	0.71	14.0	.001	.77	0.08	NS	.85
Being treated	0.1	NS	1.03	0.3	NS	1.06	0.08	NS	1.03
Feeling exhausted									
0 times	49.6	NS	.45	37.2	.001	.49	24.9	.001	.56
1–2 times	43.9	.001	.61	28.6	.001	.66	18.6	.001	.72
3–4 times	26.6	.001	.70	16.8	.001	.74	12.0	.001	.77
5–6 times	16.1	.001	.75	10.2	.001	.80	7.1	NS	.83
7–8 times	0.5	NS	.95	0.05	NS	.99	0.009	NS	.99
9–10 times	0.1	NS	.98	0.001	NS	1.0	0.01	NS	.99
Feeling depressed									
0 times	9.3	.002	.69	5.8	NS	.74	8.1	.004	.70
1–2 times	5.4	NS	.76	3.0	NS	.81	3.8	NS	.79
3–4 times	3.3	NS	.80	2.2	NS	.83	2.4	NS	.82
5–6 times	4.8	NS	.75	3.3	NS	.78	3.4	NS	.78
7–8 times	4.4	NS	.74	3.0	NS	.78	2.6	NS	.79
9–10 times	6.8	NS	.66	5.3	NS	.69	4.9	NS	.70
<i>Ear infection</i>									
Anxiety	24.0	.001	.75	20.4	< .001	.77	14.1	.001	.80
Depression	8.9	.003	.84	7.6	NS	.86	10.4	.001	.83
Diagnosed depression									
Not depressed	4.6	NS	.87	2.2	NS	.91	0.62	NS	.95
Being treated	0.4	NS	.93	0.23	NS	.95	0.66	NS	.91
Feeling exhausted									
0 times	39.8	.001	.54	28.2	.001	.59	17.0	.001	.66
1–2 times	21.3	.001	.74	12.2	.001	.79	5.9	NS	.85
3–4 times	10.8	.001	.81	5.7	NS	.86	3.3	NS	.89
5–6 times	11.8	.001	.81	7.8	.005	.84	5.4	NS	.86
7–8 times	1.6	NS	.92	0.56	NS	.95	0.5	NS	.95
9–10 times	0.07	NS	.98	0.003	NS	1.0	0.0	NS	1.0
<i>Sinus infection</i>									
Anxiety	105.8	.001	.66	91.84	.001	.67	67.2	.001	.71
Depression	17.2	.001	.85	15.3	.001	.86	21.4	.001	.83
Diagnosed depression									
Not depressed	18.6	.001	.82	11.8	.001	.86	2.8	NS	.93
Being treated	0.5	NS	.95	0.23	NS	.96	2.1	NS	.89
Feeling hopeless									
0 times	8.5	.004	1.20	13.3	.001	1.25	1.3	NS	1.01
1–2 times	12.4	.001	1.20	14.9	.001	1.26	3.5	NS	1.10
3–4 times	13.0	.001	1.30	15.0	.001	1.28	6.8	NS	1.19
5–6 times	8.0	.005	1.20	9.0	.003	1.23	3.6	NS	1.14
7–8 times	10.7	.001	1.30	11.2	.001	1.29	7.2	NS	1.23
9–10 times	3.5	NS	1.2	3.3	NS	1.16	0.9	NS	1.09
Feeling overwhelmed									
0 times	44.5	.001	.60	45.1	.001	.59	10.1	.001	.78
1–2 times	14.8	.001	.82	14.5	.001	.82	0.3	NS	.97
3–4 times	12.2	.001	.85	12.7	.001	.84	1.8	NS	.94
5–6 times	4.9	NS	.91	4.8	NS	.91	0.9	NS	.96
7–8 times	2.0	NS	.94	2.4	NS	.93	1.0	NS	.95
9–10 times	8.6	.003	.87	9.0	.003	.86	6.7	NS	.88
Feeling exhausted									
0 times	67.1	.001	.57	52.1	.001	.60	49.6	.001	.61
1–2 times	44.9	.001	.72	34.2	.001	.74	33.6	.001	.74
3–4 times	32.3	.001	.76	25.1	.001	.79	27.4	.001	.78

table continues

TABLE 4. (continued)

5–6 times	20.2	.001	.81	16.3	.001	.83	15.2	.001	.83
7–8 times	3.8	NS	.91	2.7	NS	.93	3.7	NS	.91
9–10 times	0.5	NS	.97	0.4	NS	.97	0.8	NS	.96
<i>Strep throat</i>									
Anxiety	39.8	.001	.72	33.0	.001	.74	25.8	.001	.77
Diagnosed depression									
Not depressed	1.1	NS	.93	1.2	NS	.94	1.9	NS	.92
Being treated	8.3	.004	.73	6.8	NS	.75	8.5	.004	.72
Feeling exhausted									
0 times	27.9	.001	.60	19.1	.001	.65	21.0	.001	.64
1–2 times	15.2	.001	.77	8.4	.004	.82	9.9	.002	.81
3–4 times	10.8	.001	.81	6.3	NS	.85	8.2	.004	.83
5–6 times	2.7	NS	.91	1.4	NS	.93	1.7	NS	.92
7–8 times	0.005	NS	1.0	0.09	NS	1.02	0.001	NS	1.0
9–10 times	1.2	NS	.93	0.88	NS	.94	1.4	NS	.93

Note. Only significant predictors are listed.

^aAdjusted for cigarette smoking, frequency of binge drinking, physical activity, sleep, perceived health, and daily servings of fruits and vegetables.

^bAdditionally adjusted for age, race, living arrangement, relationship status, hours worked per week, and hours volunteered per week.

Relative to those with depression and anxiety, students who did not have these conditions were 17% and 29% less likely to have had a sinus infection, respectively. Relative to those who reported feeling exhausted 11 or more times during the previous 12 months, most groups were less likely to have had a sinus infection: never exhausted (39%), 1–2 times (26%), 3–4 times (22%), 5–6 times (17%), and 7–8 times (9%).

Strep Throat

Significant predictors of strep throat included the self-reported measures of depression, anxiety, and exhaustion. Relative to those with depression and anxiety, students who did not have these conditions were 17% and 20% less likely to have had bronchitis, respectively. Relative to those who reported feeling exhausted 11 or more times during the previous 12 months, most groups were less likely to have had strep throat: never exhausted (36%), 1–2 times (15%), 3–4 times (11%), and 5–6 times (14%).

COMMENT

Our primary purpose in this study was to examine the association of clinically treated depression, self-reported depression and anxiety, and 5 indicators of negative affect, with the incidence of 4 acute infectious illnesses (bronchitis, ear infection, sinus infection, and strep throat) in a college student population. Results suggest that the absence of depression, anxiety, or exhaustion was consistently associated with a lower probability of infectious disease across all 4 dependent measures. The odds ratios ranged from .56 to .91. Most impressive, we found a dose-response relationship between feeling exhausted and the experience of acute infectious illness; the probability of acute infectious illness decreased in a linear fashion from the most to the least exhausted. Those who were most exhausted had the highest probability of acute infectious illness, whereas those who were least exhausted had the lowest probability.

This study had several strengths. First, to our knowledge, we are the first researchers to examine the relationship between indicators of mental health and the experience of acute infectious illness in a national sample of college students. Second, we included several variables known to affect the incidence of acute infectious illness and several demographic factors; thus, analyses enabled the identification of predictors of acute infectious illness after controlling for covariation. Last, these findings consistently suggest that anxiety, depression, and feeling overwhelmed are associated with the experience of acute infectious illness.

Study limitations also warrant mention. First, self-reported data can include errors resulting from purposeful falsification or mere carelessness. This may have been the case with some of these data; however, without the original surveys, we could not correct such errors. Second, several professionals with varying research skills collected the data using 2 different formats. Because the data were secondary, this potential error could not be eliminated; however, to reduce potential error caused by the varying skill levels, we used several techniques to omit improbable responses. Third, although causality cannot be assumed because of the nature of these data, physiological mechanisms exist by which poor mental health could affect acute infectious illness. Specifically, acute infectious illnesses are often opportunistic. For an agent to infect a host, exposure must occur and the infectious agent must survive the initial defenses of the immune system. Thus, the likelihood that exposure to an infectious agent would result in an illness is increased if immune function has been compromised by any number of factors, including poor mental health. Fourth, the sample was not purely representative because we did not use a representative sampling technique. This may have limited the generalizability of the results; however, the sheer size of the sample renders these findings powerful. Last, although we found significant associations in

many cases, the variance accounted for by the binary logistic regression models was small, as were the effect sizes in the univariate analyses. This suggests that the transmission of acute infectious illnesses is affected by many other variables that we did not measure or include in these analyses.

Applications of these findings are warranted on the basis of the nature of the significant predictors. For example, the allocation of resources to prevent and treat depression and anxiety in a college setting is appropriate, whether or not these 2 mental health disorders affect acute infectious illness. In addition, the consistent presence of feeling overwhelmed as a significant predictor across all 4 conditions warrants the provision of resources and support to help students better manage themselves and their time. Better self-management and other personal skills may reduce the perception of feeling overwhelmed and also affect the experience of acute infectious illness. Future researchers could evaluate the impact of this suggestion; for example, are students who receive training in self-management less likely to feel overwhelmed and correspondingly less likely to contract infectious illness? In addition, because depression is a pervasive issue on college campuses, it would be interesting to prospectively compare the resistance to infectious illness between students with and without depression.

NOTE

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