



## The Psychometric Properties of PHQ-4 Depression and Anxiety Screening Scale Among College Students



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### ABSTRACT

Depression and anxiety are some of the most common causes of morbidity, social dysfunction, and reduced academic performance in college students. The combination of improved surveillance and access to care would result in better outreach. Brief screening tools can help reach larger populations of college students efficiently. However, reliability and validity of brief screeners for anxiety and depression have not been assessed in college students. Thus, the purpose of this study was to assess in a sample of college students the psychometric properties of PHQ-4, a brief screening tool for depression and anxiety. Undergraduate students were recruited from general education classes at a Midwestern university. Students were given a questionnaire that asked them whether they had been diagnosed by a doctor or health professional with anxiety or depression. Next, they were asked to respond to the items on the PHQ-4 scale. A total of 934 students responded to the survey (response rate = 72%). Majority of the participants were females (63%) and Whites (80%). The internal reliability of PHQ-4 was found to be high ( $\alpha = 0.81$ ). Those who were diagnosed with depression or anxiety had statistically significantly higher scores on PHQ-4 ( $p < 0.01$ ). Corrected item total correlations for PHQ-4 were between  $r = 0.66$  and  $r = 0.80$ . PHQ-4 operating characteristics were estimated and area under the curve (AUC) values were 0.835 and 0.787, respectively for anxiety and depression. The PHQ-4 is a reliable and valid tool that can serve as a mass screener for depression and anxiety in young adults. Widespread implementation of this screening tool should be explored across college campuses.

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Mental illnesses are a leading cause of disability, morbidity, and mortality. In the United States, national household studies have estimated that more than one in five individuals may have a diagnosable mental illness (Druss, Zhao, Von Esenwein, Morrato, & Marcus, 2011; Reeves et al., 2011). Among all the mental illnesses, depression and anxiety are the most common forms. The onset of mental disorders usually occurs in childhood or adolescence (Kessler et al., 2007; Kessler, Avenevoli, McLaughlin, et al., 2012; Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012).

Several national and regional studies have estimated the prevalence of the most common mental illnesses, such as depression and anxiety in adolescents and young adults (Kessler, Avenevoli, et al., 2012; Kessler, Petukhova, et al., 2012; Price, Khubchandani, McKinney, & Braun, 2013). Anxiety and depression are frequently comorbid. This comorbidity pattern very often starts in youth and peaks between the age of 14 and 24 years leading to substantial functional impairment, academic failure, suicide attempts, and risk of future mental health problems (Kessler, Avenevoli, et al., 2012; Kessler, Petukhova, et al., 2012;

Cummings, Caporino, & Kendall, 2014). Unfortunately, vast majority of youth do not get treatment on time and if they get it, either it is not adequate, good quality, or disorder specific. Additionally, even though depression and anxiety frequently occur in young individuals, treatment typically does not occur until a number of years following the symptoms (Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015; Olfson, Gameroff, Marcus, & Waslick, 2003). Among the several reasons for lack of treatment in youth (e.g., stigma and lack of parental awareness), one prominent barrier is lack of diagnosis and subsequent access to care (Samargia, Saewyc, & Elliott, 2006; Pescosolindo et al., 2008; Price, Khubchandani, et al., 2013). The combination of improved surveillance and access to care would result in better outreach to manage mental illness at an earlier age.

There have been several recommendations from professional health organizations for surveillance of depression and anxiety through mass screening in youth. However, little has been done for population based screening as professionals cite numerous barriers to screening and frequently there is a debate about the best screening tools (Dowdy, Ritchey, & Kamphaus, 2010; Zenlea, Milliren, Mednick, & Rhodes, 2014). Eventually, the goal should be to screen as many youths as possible and upon finding of positive indication for depression and anxiety, proper follow-up should be conducted for diagnosis to confirm cases (Dowdy et al., 2010; Zenlea et al., 2014). Screening tests have high sensitivity and can be used on a population basis whereas diagnostic tests

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have high specificity and should be conducted in healthcare settings with proper consideration of detailed DSM related criteria for depression and anxiety (Maurer, 2012; Dowdy et al., 2010; Zenlea et al., 2014).

To improve surveillance and screening accuracy, researchers have explored scales to assess the prevalence of mental illness. Over the past few decades, a number of clinician-rated and patient-rated instruments have been developed as screening measures for depression and anxiety (Kroenke, Spitzer, & Williams, 2001; Furukawa, Andrews, Slade, & Kessler, 2003; Julian, 2011; Kessler, Avenevoli, et al., 2012; Kessler, Petukhova, et al., 2012). Each of those scales has relative strengths and weaknesses and some of them have been more effective than others. Scales such as Patient Health Questionnaire-9 (9 items), Beck's Anxiety Inventory (21 items), and Kessler's scale for non-specific psychosocial distress (10 items) have shown strong psychometric properties (Kroenke et al., 2001; Furukawa et al., 2003; Julian, 2011). Furthermore, to enhance reliability and efficiency of screening, strategies have been utilized to explore brief versions of each of these scales. The Patient Health Questionnaire-4 (PHQ-4) is a four-item ultra-brief screening tool for both depression (PHQ-2 with 2 items) and anxiety (GAD-2 with 2 items) that has been shown to have high sensitivity and specificity in screening for depression and anxiety (Furukawa et al., 2003; Lowe, Kroenke, & Grafe, 2005; Gilbody, Richards, Brealey, & Hewitt, 2007; Kroenke, Spitzer, Williams, & Löwe, 2009). However, PHQ-4 and its components have been commonly tested on clinic-based or general adult populations. Additionally, there is a paucity of research on the PHQ-4 as an instrument for mass screenings of depression and anxiety in young adults (Furukawa et al., 2003; Lowe et al., 2005; Gilbody et al., 2007; Kroenke et al., 2009). Therefore, the purpose of this study was to explore the validity and reliability of the PHQ-4 in a large college student population.

## METHODS

### Sample Population

Undergraduate students were recruited from a large Midwestern university. The total undergraduate student population at this university was 16,652. An a-priori power analysis was conducted to determine the sample size and we found that at 99% confidence level and 5% margin of error, a total of 639 students would be needed to make inferences to the total population. A total of 1200 questionnaires were distributed to ensure at least 50% response rate in 20 different general education classes. There were no exclusions based on age, gender, race/ethnicity, and year of undergraduate study.

### Procedures

IRB approval for the study was obtained from the university attended by student subjects. In fall 2014, faculty members from all colleges in a large Midwestern university were contacted and requested to help in data collection for this study. Faculty members used a convenience sample of general education classes or classes that contained students broadly representative of the undergraduate students in the University. All students present on the days the questionnaires were distributed were asked to complete the anonymous questionnaire during that class period.

### Instrument and Measures

A four-page booklet style questionnaire with multiple items on lifestyle, medical history, social history, and demographics was created. On the first page of the questionnaire, two questions about a history of depression and anxiety were included. Participants were asked: "Have you been diagnosed with depression in the past 12 months by a doctor or health professional?" and "Have you been diagnosed with anxiety in the past 12 months by a doctor or health professional?" The response

options were 'yes' or 'no'. These 2 questions confirmed the healthcare professional diagnosed prevalence of depression and anxiety in the study population.

Questions about lifestyle and social history were included on the second and third pages of the questionnaire. To ensure enough space between questions on depression and anxiety diagnosed by a healthcare professional and PHQ-4 screening items, the PHQ-4 items were included on the last page of the questionnaire. The first two items (PHQ-2) were for depression screening and were worded as: "Over the last 2 weeks, how often have you been bothered by: Feeling down, depressed, or hopeless?" and "Over the last 2 weeks, how often have you been bothered by: Little interest or pleasure in doing things?". The next two items (GAD-2) were for anxiety screening and were worded as follows: "Over the last 2 weeks, how often have you been bothered by: Feeling nervous, anxious, or on edge?" and "Over the last 2 weeks, how often have you been bothered by: Not being able to stop or control worrying?". The response options were: not at all (score = 0), several days (score = 1), more than half the days (score = 2), and nearly every day (score = 3). PHQ-2, GAD-2, and PHQ-4 scores were computed by adding scores on individual items (Furukawa et al., 2003; Lowe et al., 2005; Gilbody et al., 2007; Kroenke et al., 2009). The 4 items on PHQ-4 were used as screening tools for depression and anxiety. Scales and questionnaire items used in the study are freely available in the public domain and do not require permission for use.

### Data Analysis

Survey data were entered into the computer using the SPSS for Windows statistical package 23.0 (SPSS, Chicago, Illinois). Descriptive statistics (frequencies, range of scores, means, and standard deviations) were used to describe the students in terms of their demographic and background characteristics and responses to the questions from depression and anxiety screening scale.

## RESULTS

### Demographic Characteristics

A total of 934 students responded to the survey (response rate = 72%). Majority of the participants were females (63%), Whites (80%), enrolled full-time (95%), and in the 1st or 2nd year of undergraduate studies

**Table 1**  
Background and Demographic Characteristics of Participants.

Variable	n (%)
Gender	
Male	333 (37)
Female	568 (63)
Race	
White	750 (80)
Non-Whites	184 (20)
Year in college	
1st year undergraduate	148 (16)
2nd year undergraduate	407 (44)
3rd year undergraduate	216 (23)
4th year undergraduate	93 (10)
5th year undergraduate	33 (4)
Employed (currently working for pay)	473 (51)
Full time	100 (11)
Part time	373 (40)
Enrollment status	
Full time	888 (95)
Part time	46 (4)
Housing location	
On campus	410 (44)
Off-campus	524 (56)
	Mean ( $\pm$ SD)
Age (in years)	20.32 (2.72)
Body mass index	24.66 (5.04)

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