

# Comparison of PHQ-9 and PHQ-2 as Screening Tools for Depression and School Related Stress in Inner City Adolescents

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Paridhi Anand<sup>1</sup> , Navpreet Bhurji<sup>1</sup>,  
Nadia Williams<sup>1</sup>, and Ninad Desai<sup>1</sup>

## Abstract

**Background:** Major depressive disorder is associated with significant morbidity and mortality in adolescents. Suicide is one of the leading causes of mortality between 15 and 19 years. Both AAP and USPSTF recommend routine depression screening of adolescents. Patient Health Questionnaire-2 (PHQ-2) and Patient Health Questionnaire-9 (PHQ-9) are widely used in primary care practice, however, PHQ-2 does not screen for suicidality. School-related factors are known to affect adolescent mental health. **Purpose:** To compare PHQ-2 and PHQ-9 for depression screening in adolescents, with respect to age, gender, chronic illness over the course of 9 months. **Methods:** As a QI initiative, we compared screening results in our inner-city pediatric practice using PHQ-2 and PHQ-9 from Jun'18 to Feb'19. EMR of 2364 patients 12 to 21 years were reviewed. We considered the PHQ-2 score of  $\geq 2$  and PHQ-9 of  $\geq 10$  as positive. Pre-existing chronic medical and mental illnesses were noted. **Results:** Of these 61.5% of patients were females, 95% were Black/Hispanic, and 96% were insured by Medicaid. About 10.6% of PHQ-9 tests were positive whereas 7.4% PHQ2 were positive. Logistic regression was performed to ascertain the effects of age, gender, and chronic illness. Females were more likely to have a positive screen, as were patients with chronic illness. Age had no effect on the outcome. The screening yield for both tests was comparable in the summer months. PHQ9 yield increased while schools were in session while PHQ 2 remained stable. **Conclusion:** PHQ9 is superior as a screening test compared to PHQ2. Repeat screening should be targeted toward patients with chronic medical conditions and/or mental health diagnoses. PHQ9 may be better at screening for school-related stress.

## Keywords

adolescent, depression, screening, primary care

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Depression in adolescents is a common occurrence with 14.4% of all 12- to 17-year-olds meeting criteria for Major Depressive Disorder (MDD).<sup>1</sup> MDD is associated with significant morbidity in adolescents. Depressed adolescents are at a higher risk of poor performance at school and of using drugs and alcohol.<sup>2</sup> Suicide is the second leading cause of death among adolescents in the USA per the National Vital Statistics Report from 2018.<sup>3</sup> Mental disorders are found to contribute between 47% and 74% of suicide risk and criteria for depression were found in 50% to 65% of suicide cases.<sup>4</sup> The economic burden of mental health crises leading to emergency room visits and inpatient hospitalizations is immense<sup>5</sup> which supports the need for early identification and treatment of mental illness. However, there is evidence to suggest that only 50% of

adolescents with depression are diagnosed before reaching adulthood.<sup>6</sup> Even though depression screening is readily accepted by both primary care providers (PCP), parents, and patients,<sup>7</sup> as many as 2 in 3 youth with depression are not identified by their PCP.<sup>8</sup> Two important findings have driven interventions to improve recognition of depression in the primary care setting as a public health suicide prevention strategy. First, patients dying by suicide visit PCPs

<sup>1</sup>NYC Health+Hospitals/Kings County, Brooklyn, NY, USA

### Corresponding Author:

Paridhi Anand, NYC Health+Hospitals/Kings County, 451 Clarkson Avenue, Brooklyn, NY 11203, USA.  
Email: paridhi.anand@nychhc.org



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<b>PHQ-2</b>				
Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
	_____ +	_____ +	_____ +	_____
	= Total Score _____			

**Figure 1.** Patient Health Questionnaire-2 (PHQ-2).

Information from Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care* 2003;41:1284-92.

more than twice as often as mental health clinicians. A review of specific clinical scenarios estimated that 45% of those dying by suicide saw their PCP in the month before their death. Second, despite an increase in the number of psychiatrists, PCPs provide a bulk of mental health care. This is evidenced by the fact that 27.4% of physician office visits for children and 47.9% for adolescents, resulting in a mental disorder diagnosis were to a school-related and PCPs (internists, pediatricians, and family physicians) write 62% of all antidepressant prescriptions, compared to 38% by mental health clinicians in the USA.<sup>9,10</sup>

The American Academy of Pediatrics (AAP), the United States Preventive Services Task Force (USPSTF), and Guidelines for Adolescent Depression in Primary Care (GLAD-PC) recommend routine screening of adolescents in the primary care setting.<sup>11,12</sup> Patient Health Questionnaire-2 (PHQ-2) and Patient Health Questionnaire-9 (PHQ-9) are 2 validated tools for screening adolescents for depression.<sup>13,14</sup> PHQ-2 is a 2-question screen widely used for adult patients (Figure 1). The PHQ-2 is up to 97% sensitive and 67% specific in adults, with a 38% positive predictive value and 93% negative predictive value<sup>15</sup> and 74% sensitivity and 75% specificity in adolescents. A positive PHQ-2 score should trigger the administration of the PHQ-9 (Figure 2) which is a 9-question screen addressing all symptoms related to MDD per the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). PHQ-9 has demonstrated 61% sensitivity and 94% specificity for mood disorders in adults, and 89.5% sensitivity and 77.5% specificity in adolescents.<sup>16</sup> It can also be used to measure the severity of symptoms<sup>17</sup> and trends in a patients' response to treatment.<sup>18</sup> Additionally, PHQ-9 screens for suicidality while PHQ-2 does not. Considering the high rates of suicidal ideation and attempts in youth and that not all suicide is related to MDD, a screening tool with a specific question for suicide is meaningful for providers working with adolescents.

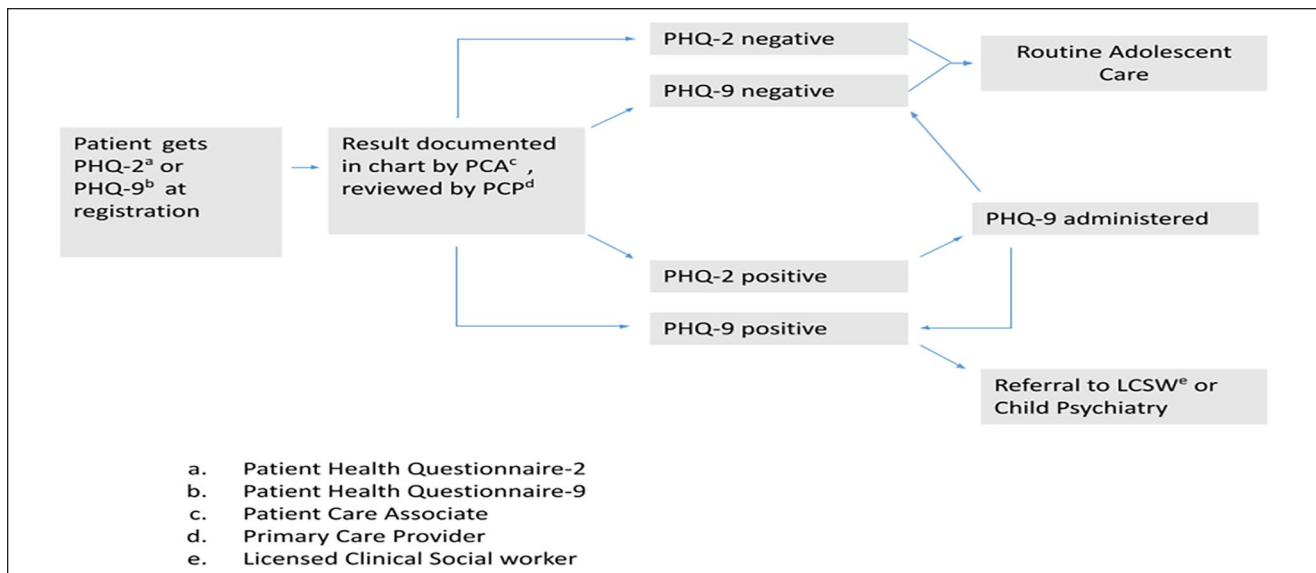
We implemented the use of both PHQ-9 and PHQ-2 to screen for adolescent depression in our pediatric practice (Figure 3) Guidelines for Adolescent Depression in Primary Care or GLAD-PC recommend that patients who screen positive should be assessed for depressive symptoms via direct interview of both the adolescent and their family on the basis of criteria listed in either the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) or the International Classification of Diseases (ICD).<sup>19,20</sup> For mild depression, the PCP should provide support in the form of psychoeducation and counseling with close follow up. For moderate to severe depression, it is recommended to obtain consultation by a mental health specialist. Our practice follows a Collaborative Care model for the delivery of mental health services with an embedded therapist who provides initial assessment and psychotherapy. A child psychiatrist is also part of the team and an interdisciplinary team meeting to discuss management plans for patients occurs regularly.

Our study retrospectively analyzed the screening results of both tests for the study population and looked at the effect of age and gender on the screening result. The screening scores within subsets of patients with a history of specific chronic medical conditions and psychosocial risk factors were further analyzed. The screening yield was analyzed every month.

## Methods

IRB approval exemption was sought and obtained. This study was conducted in the pediatric clinic of a large publicly funded hospital in inner-city Brooklyn. This clinic provides integrated mental health care to over 5000 adolescent patients annually. Prior to the implementation of validated depression screening in this setting, 13 pediatric providers were educated on the use and benefits of both PHQ-2 and PHQ-9. The choice of screening test was based on clinician





**Figure 3.** Workflow for adolescent depression screening.

**Table 1.** Demographic Information.

	Total n=2364	PHQ 9 n=1513	PHQ 2 n=851	P-value
Gender, n (%)				
Male	910 (38.5)	614 (40.6)	299 (35.1)	.01
Female	1454 (61.5)	899 (59.4)	552 (64.9)	.01
Age, median (range)	16 (12-21)	16 (12-21)	17 (12-21)	.06
Race/ethnicity, n (%)				
Black	2230 (94.3)	1417 (93.6)	813 (95.5)	.06
Hispanic	52 (2.2)	32 (2.1)	20 (2.4)	.71
Arab	20 (0.8)	14 (0.9)	6 (0.7)	.57
Asian	13 (0.5)	6 (0.4)	7 (0.8)	.18
Other/not specified	49 (2.1)	44 (2.9)	5 (0.6)	.00

using Microsoft Excel for each month of the study period. We further analyzed the odds of receiving a positive screening result, after administration of PHQ-2 and PHQ-9 via SPSS. A logistic regression analysis was performed to ascertain the effects of predictor variables age, gender, CHC, and PSS on the outcome variable of depression screen score via SPSS. A chi-square test of independence was performed to examine the relation between race/ethnicity and outcome of depression screen.

## Results

PHQ-2 or PHQ-9 questionnaires were administered in 2364 separate patient visits, which therefore met the criteria for this retrospective chart review.

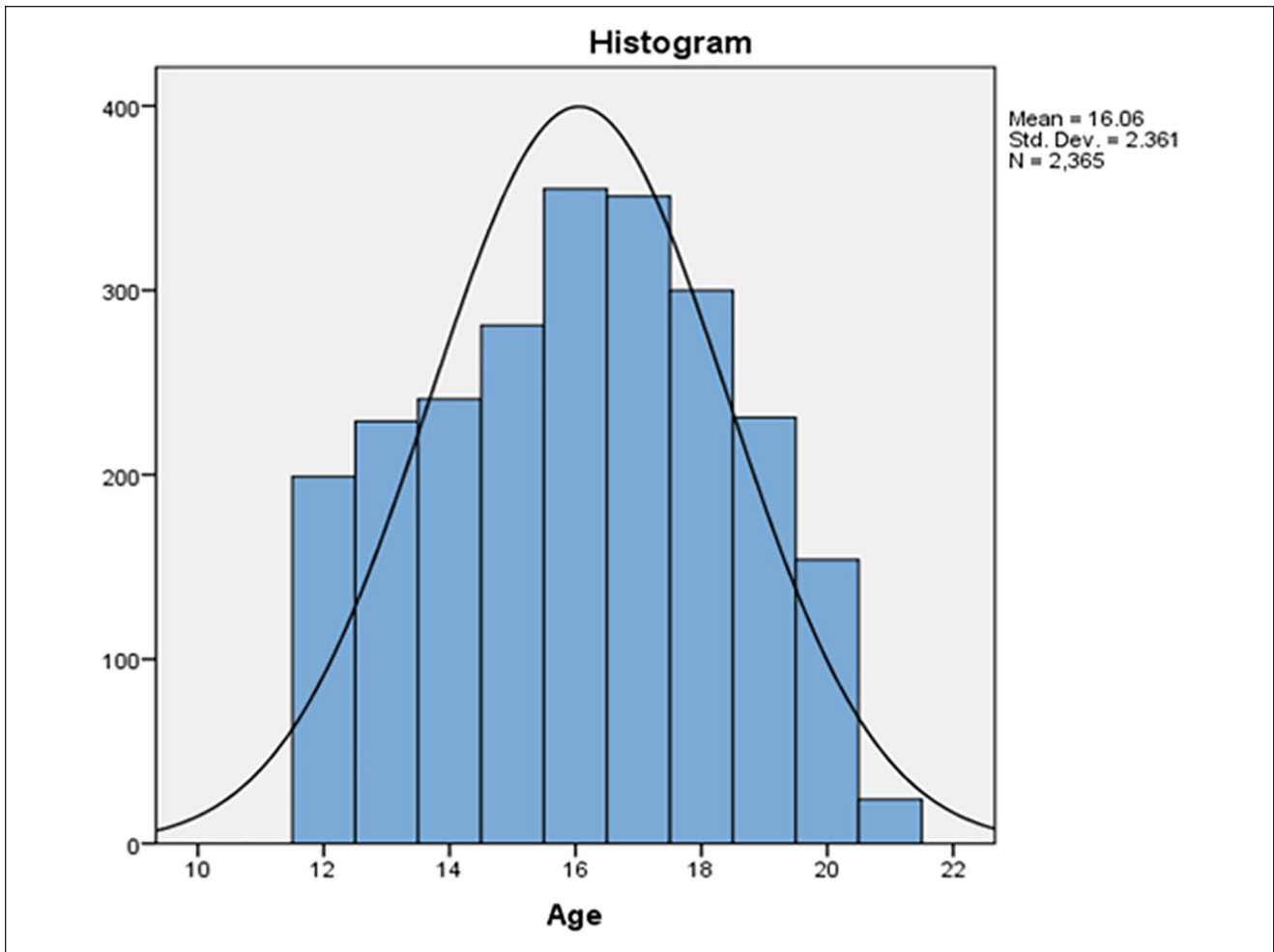
Table 1 and Figure 4 show the demographic information of all patients and for the groups which received PHQ-2 and PHQ-9. Patients ranged in age from 12 to 21 years, with a median age of 16. About 910 (38.5%) were male while

1454 (61.5%) were female. About 2230 (94.3%) identified as Black, 52 (2.2%) as Hispanic, 20 (0.8%) as Arab, 13 (0.5%) as Asian and 49 (2.1%) had no specific race/ethnicity listed in their chart. About 2269 (95.6%) had Medicaid listed as their primary insurance.

Of these 1513 (64%) patients received a PHQ-9 as a screening tool while 851 (36%) received PHQ-2. Overall, 224 (9.5%) patients scored positive on any screening test. Within the group that received PHQ-9, 161 (10.6%) scored positive. Within the group that received PHQ-2 63 (7.4%) scored positive.

Table 2 compares the positive screens obtained on both tests and shows that the odds of getting a positive screen on PHQ-9 was 1.4 times higher than on PHQ-2.

A logistic regression analysis was performed to ascertain the effects of predictor variables age, gender, CHC, and PSS on the screening result and a chi-square test of independence was performed to examine the relation between race/ethnicity and outcome of depression screen (Table 3).



**Figure 4.** Age versus frequency histogram of the study population.

**Table 2.** Comparison of Positive Screen Results for PHQ-2 and PHQ-9.

	% (n)	OR (95%CI)	P-value
Total positive screen total n = 2364	9.4 (224)		
PHQ-2 positive screen total n = 851	7.4 (63)		
PHQ-9 positive screen total n = 1513	10.6 (161)		
PHQ-2 versus PHQ-9 (1)		1.44 (1.1, 2.02) <sup>a</sup>	.022

<sup>a</sup>Odds ratio with 95% confidence interval in parenthesis.

The logistic regression model was statistically significant  $\chi^2(4)=46.969$ ,  $P<.0005$ . Females were 1.5 times more likely to have a positive screen than males. Patients with pre-existing chronic health conditions were 1.5 times more likely to screen positive while those with psychosocial stressors (PSS) were 2.1 times more likely to screen positive. An increase in age was not associated with having a positive screen. The relation between race/ethnicity and depression screen outcome was not statistically significant  $\chi^2(4, N=2364)=1.4739$ ,  $P>.05$ .

The screening yield for the 2 tests was comparable in the first 3 months of the testing period, after which the yield for PHQ-2 remained stable while the yield for PHQ-9 increased (Figure 5).

## Discussion

Screening adolescents for depression is a meaningful practice for PCPs and is considered the standard of care. Many depression screening tools are available, each with its

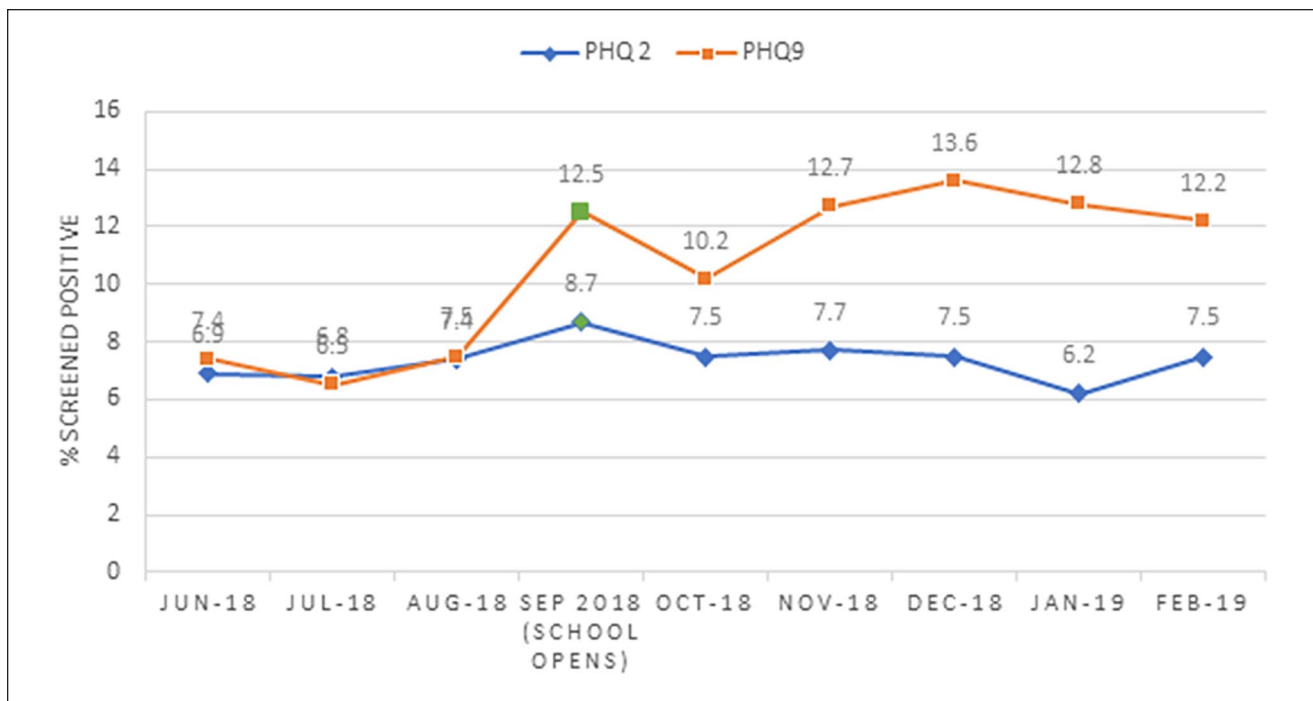
**Table 3.** Relationship of Age, Gender, Race/Ethnicity, Chronic Health Conditions, and Psychosocial Stressors With the Outcome of Depression Screening Test.

	Test	Result	P-value
Age (years)	LRA <sup>a</sup>	1.023 <sup>c</sup>	.448
Gender (female)	LRA <sup>a</sup>	0.664 <sup>c</sup>	.007
Race/ethnicity	Chi Sq <sup>b</sup>	1.47	.831
Chronic health conditions (present)	LRA <sup>a</sup>	0.648 <sup>c</sup>	.003
Psychosocial stressors (present)	LRA <sup>a</sup>	0.467 <sup>c</sup>	.000

<sup>a</sup>Logistic regression, variable(s) entered on step 1: age, gender, chronic health conditions, psychosocial stressors.

<sup>b</sup>Chi-square test of independence for screening test outcome positive versus negative for race/ethnicity Black, Hispanic, Asian, Arab, and other/not specified.

<sup>c</sup>Exp(B) output on logistic regression analysis via SPSS.

**Figure 5.** Changes in screening yield over time showing how percentage of positive screening result changed for PHQ2 and PHQ9 for each month of study period.

strengths and challenges. PHQ-2 and PHQ-9 are 2 of the most widely used screening tools for depression and have been validated for use in adolescents. PHQ-2 is attractive for its brevity and ease of administration, particularly for busy primary care clinics. However, it does not screen for suicidality which is one of the leading causes of mortality among adolescents.

Our study shows that PHQ-9 had a better yield compared to PHQ-2. During the course of our study, the odds of screening positive on PHQ-9 was 1.4 times higher than on PHQ-2. Adolescent depression often presents with somatic complaints like fatigue and with functional impairment

like poor school performance or impaired interpersonal relationships.<sup>21</sup> Such symptoms are entirely missed by PHQ-2 while PHQ-9 screens for fatigue, appetite, sleep, and lack of concentration which is a possible explanation for the difference in screening yield.

We found that during the months when school was not in session, the screening yield of the 2 tests was comparable. However, during the months when public school was open, PHQ-9 average scores increased significantly while average PHQ-2 scores remained stable. This difference could be explained by the presence of depression symptoms like sleep disturbances and poor concentration that may only

become apparent while an adolescent is in school. This again suggests that these particular symptoms of depression are missed by the PHQ-2 screening.

Universal annual screening is recommended by AAP with repeat screening for those with psychosocial issues. We did find that screening yield was significantly higher for patients with PSS. Additionally, the presence of commonly occurring chronic health problems also increased the likelihood of a positive screen. Targeted screening should be performed for youth with these risk factors in addition to annual universal screening.

During our literature search we found articles that analyzed improvement of their screening practice for adolescent depression without mention of a specific tool,<sup>22</sup> need for screening in patients with chronic health conditions.<sup>23</sup> The importance of depression screening in adolescents going to school,<sup>24</sup> and studies that compared PHQ-2 versus PHQ-9.<sup>25</sup> However, we did not find any studies that tracked screening results over time, along with comparing the demographics and other factors mentioned in our study.

The data from our study is easily adaptable to different practice settings. Given that PHQ-2 takes less time to administer than PHQ-9, busy primary care practices may choose to administer PHQ-9 only for patients with chronic health conditions or psychosocial stressors. PHQ-9 may also be a better choice during months when schools are in session at the location of the practice. There are limited costs involved in implementing this practice as the manner in which the patient is triaged, screened, and evaluated by the provider would remain the same.

A significant strength of our study is the size of the study population. Another strength of this study is that our analysis included chronic health conditions and psychosocial stressors. CHC are associated with a higher risk for depression and they are prevalent in adolescents. For example, obesity is prevalent in 20.6% of 12- to 19-year-olds<sup>26</sup> in the USA and 1 in 5 adolescents have prediabetes.<sup>27</sup> It was also a strength of this study that our analysis included PSS which are linked to suicide risk.<sup>28,29</sup> Finally, being able to analyze data for 9 months provides our study with the ability to compare results between seasons, particularly with the beginning of the school season, and with winter months.

As our study was retrospective, only charted data could be analyzed. There may be selection bias as our demographic focuses on predominantly African American and Caribbean American patients. This may limit the generalizability to populations made up of predominantly Caucasian, Asian, or other populations. Given that our practice functions in a publicly funded hospital in inner-city Brooklyn, this may also skew the results of our study as there is evidence to show that depression is more prevalent in lower socioeconomic status populations.<sup>30</sup> However, while it may increase the prevalence of depression in the study population it should not affect which screening test has better yield.

A confounding factor is that any ongoing intervention for chronic medical conditions or psychosocial stressors was not assessed which could alter the relationship between the screening result and documented history. Patients undergoing treatment or other therapeutic interventions may screen negative while still having the presence of documentation of such diagnoses in their electronic medical record.

Information about enrollment in or attendance to a school was not part of the study, hence link to school related stress is inferential. Factors like seasonal variation in mood and other symptoms of depression may confound the findings. Lastly, the link between school attendance and positive screens could be affected by patients 19 to 21 years who may not be in school, therefore it may be imperative to look at other causes for this link.

## Conclusions

Our study demonstrates that PHQ-9 is a superior screening tool for adolescents when compared to PHQ-2. This study may help practices like ours to choose a screening tool for adolescent depression. It should be noted that patients with chronic health conditions and psychosocial stressors are at higher risk of screening positive and should receive follow-up depression screening in addition to annual universal screening. PHQ-9 may be a better tool for screening for school-related stress or the presence of depression during school attendance in school-going adolescents. There are many opportunities for further research in this area; comparing PHQ-9 with other screening tools, looking at screening yields over multiple school years, comparing screening in different school settings and different demographic groups.

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## ORCID iD

Paridhi Anand  <https://orcid.org/0000-0003-3369-6713>

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