Youth Aware of Mental Health (YAM) Program With Texas Adolescents:

Depression, Anxiety, and Substance Use Outcomes

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ABSTRACT

Objective: To determine the state of mental health problems among a general youth population and assess whether the Youth Aware of Mental Health (YAM) intervention can improve symptoms of depression and anxiety.

Methods: We implemented YAM with a cluster quasi-experimental study design from August 2017 through June 2019 in 29 middle schools and high schools in North Texas. Students completed the Quick Inventory of Depressive Symptomatology, Adolescent version; the Generalized Anxiety Disorder Screener; and additional substance use questionnaires before YAM delivery and 3–6 months after implementation. Multilevel models, with students nested within schools, were used to model difference scores of depression and anxiety, controlling for various student-level and school-level characteristics. Missing data were imputed during analysis. Sensitivity analyses were performed on non-imputed data.

Results: Among 3,302 adolescents at pre-test, 27% had moderate-to-severe depression, 22% had moderate-to-severe anxiety, and 4% expressed suicidal ideation. We found that on average, compared to those who had no depression at pre-test, depression decreased at post-test by (*a*) 4.62 units ($P < .05$) for those who had severe to very severe depression at pre-test, (*b*) 2.92 units ($P < .0001$) for those who had moderate depression at pre-test, and (*c*) 1.5 units ($P < .001$) for those who had mild depression at pre-test, controlling for all other factors in the model. Similar significant decreases were observed in anxiety, controlling for student-level characteristics.

Conclusions: These findings demonstrate the effectiveness of YAM in reducing symptoms of depression and anxiety among adolescents in North Texas.

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Approximately 1 in 10 adolescents experiences major depressive disorder (MDD) before age 19 years, and 31.9% experience an anxiety disorder.[1] Incidence of these disorders increased by 37% between 2005 and 2014,[2] and outcomes (even with subclinical symptoms) are poor,[3] often contributing to quality of life impairment, increased risk of depression or anxiety in adulthood, and risky behaviors such as substance use and suicidality.[4–7] Interventions are needed not only for youth who have already been diagnosed with depression or anxiety, but also for those beginning to experience subthreshold symptoms.[8]

Schools provide an opportunity for prevention and early identification.[9–11] Mental health promotion and prevention programs have expanded beyond the reduction of psychopathology to incorporate the promotion of protective factors such as resilience,[12,13] leading to beneficial effects on important mental health outcomes, including significant decrease in depressive symptoms, fewer internalizing and externalizing symptoms, and better well-being outcomes among at-risk youth.[14–16]

One intervention is the Youth Aware of Mental Health (YAM) program. YAM is a manualized, universal intervention that uses interactive didactics and role play to increase mental health awareness about protective factors, depression and suicide, and coping skills to counter stress and crises. In a randomized control trial,[17] 3 interventions (YAM; Question, Persuade, and Refer [QPR]; and screening by professionals) or a control group were implemented among over 11,000 students in 168 schools across 10 European countries. YAM was the only program superior to the control intervention at follow-up, and YAM was associated with 59% fewer suicide attempts and 52% fewer cases of severe suicidal ideation over 1 year. A pilot feasibility study conducted in the United States[18,19] indicated that students who received YAM reported significant increases in help-seeking behaviors and mental health literacy and decreases in mental health stigma.

We report on the results of mental health outcomes from students enrolled in a research study as part of a larger YAM implementation program. The current article investigates (1) the presence and severity of depression, anxiety, suicidal thoughts, and substance use among a general population of youth and (2) changes in these self-reported domains after participating in YAM.

Clinical Points

- Depression and anxiety disorders are common among adolescents, and interventions are needed not only for those individuals already diagnosed, but also for those experiencing subthreshold symptoms.
- Youth Aware of Mental Health (YAM), a manualized universal intervention designed to increase mental health awareness about protective factors, depression and suicide, and coping skills, led to improvements in mental health symptoms of depression and anxiety.
- Schools are an ideal setting for prevention and early identification of depression and anxiety symptoms, and universal mental health literacy programs such as YAM may lead to additional benefits for mental health beyond just improved understanding about mental health care.

METHODS

Study Design and Participants

This report examines the uncontrolled, within-subjects pre- and post-evaluation of YAM in Texas schools as part of a larger implementation project (J.L.H., J.R.A., F. Kahalnik, MPH, MSSW, et al; unpublished data). A cluster quasi-experimental study design was implemented from August 2017 through June 2019 in 29 North Texas middle schools and high schools. The University of Texas Southwestern Medical Center Institutional Review Board approved the study.

All students who participated in YAM at their middle or high school (grades 6–12) were invited to participate in the study. Youth who provided written informed assent and whose parents provided written informed consent were enrolled in the study.

The Program

YAM (www.y-a-m.org) was designed to promote knowledge of mental health and healthy decisions among adolescents with content that addresses common suicide risk and protective factors, such as depression, stress, and social support.[20] YAM also promotes the development of skills, knowledge, and emotional awareness needed to face stressful life events associated with suicidal thoughts and behaviors. YAM consists of five 45- to 60-minute sessions, delivered in a regular classroom period over 3 weeks. The 5 sessions comprised an opening interactive session on mental health, 3 experiential role-play and discussion sessions, and an interactive wrap-up session. YAM is delivered by a certified YAM instructor and helper, neither of whom is the students' regular classroom teacher.[20,21]

Data Collection

All measures were completed 1–2 weeks prior to YAM delivery and at a follow-up assessment that occurred 3–6 months after the intervention. Follow-up assessment occurred at the 3-month time point for most youth; however, some students completed the follow-up measures later due to summer break. Because measures were completed during standard class periods, which varied in length, sample sizes of final measures varied due to incomplete measures.

Table 1. Student-Level Demographics Characteristics at Baseline (n = 3,302)[a]

Variable	Value
Sex	
Female	2,031 (61.51)
Male	1,250 (37.86)
Other	21 (0.64)
Race	
White	1,387 (42.43)
African American	350 (10.71)
Asian	500 (15.30)
Native Hawaiian or other Pacific Islander	8 (0.24)
American Indian or Alaska Native	53 (1.62)
More than one race	327 (10.00)
Other, declined to state, or unknown	644 (19.70)
Ethnicity	
Hispanic	1,031 (31.65)
Non-Hispanic	2,123 (65.16)
Unknown	104 (3.19)
Grade	
6th, 7th, or 8th	85 (2.57)
9th	1,580 (47.85)
10th	915 (27.71)
11th	510 (15.45)
12th	212 (6.42)
Age, mean (SD), y	15.23 (1.15)

[a]Values are shown as n (%) unless otherwise noted. Thirty-three youth did not report race, and therefore results are based on data from 3,269 youth; 44 youth did not report ethnicity, and therefore results are based on data from 3,258 youth.

Measures

Student-level sociodemographic factors included sex (male/female/other), race (White, Black, Asian, American Indian or Alaska Native, multirace, and other), Hispanic (yes/no/unknown), and grade.

School-level factors included location (urban/suburban/rural) and type (public/private/charter).

Depression symptoms. The Quick Inventory of Depressive Symptomatology, Adolescent version (QIDS-A), self-report is a 17-item measure of depression severity that includes the 9 criterion symptoms for MDD.[22] The scale was developed from the QIDS,[23] with the addition an irritability item. Items are scored on a 4-point Likert scale, ranging from 0 to 3 (total score range, 0–27). Totals scores of ≤ 5 indicate no depression; 6–10 indicates mild depression; 11–15 indicates moderate depression; 16–20 indicates severe depression; and ≥ 21 indicates very severe depression. For purposes of this report, severe and very severe categories were combined as "severe to very severe" depression (≥ 16). The QIDS-A self-report has demonstrated acceptable psychometric properties.[22]

Anxiety symptoms. The Generalized Anxiety Disorder Screener (GAD-7) is a 7-item self-report measure that assesses symptoms of generalized anxiety disorder (GAD) during the past 2 weeks.[24] Items are scored on a 4-point Likert scale with values ranging from 0 to 3 (total score range, 0–21). Totals scores of ≤ 4 indicate no anxiety; 5–9 indicates mild anxiety; 10–14 indicates moderate anxiety; and ≥15 indicates severe anxiety. The GAD-7 has demonstrated good reliability and validity in adolescents and adults[25] and has

Table 2. Student-Level Descriptive Statistics Related to Depression and Anxiety at Pre- and Post-Intervention (n = 3,302)

Variable (continuous)	Pre-intervention, mean (SE)	Post-intervention, mean (SE)	Difference score, mean (SE)	*P* value
Depressive severity (QIDS-A score)	7.90 (0.08)	6.96 (0.11)	−0.94 (0.10)	< .0001
Anxiety symptoms (GAD-7 score)	5.98 (0.09)	5.41 (0.10)	−0.58 (0.09)	< .0001

Abbreviations: GAD-7 = 7-item Generalized Anxiety Disorder Screener; QIDS-A = Quick Inventory of Depressive Symptomatology, Adolescent version.

Table 3. Cross-Classification of Levels of Depression and Anxiety Severity Pre- Versus Post- Intervention (n = 3,302)[a]

	Depression Severity Pre-Test				
Depression[b]	None (n = 1,182)	Mild (n = 1,224)	Moderate (n = 616)	Severe (n = 260)	*P* value*
Depression severity post-test					< .00001
No depression (n = 1,485)	932	475	69	9	
Mild (n = 1,108)	228	577	260	43	
Moderate (n = 524)	17	158	236	113	
Severe (n = 165)	5	14	51	95	
	Anxiety Severity Pre-Test				
Anxiety[c]	No Anxiety (n = 1,606)	Mild (n = 941)	Moderate (n = 466)	Severe (n = 270)	*P* value*
Anxiety severity post-test					< .00001
No anxiety (n = 1,925)	1,338	476	89	22	
Mild (n = 868)	240	366	199	63	
Moderate (n = 365)	22	90	139	114	
Severe (n = 125)	6	9	39	71	

[a]Values shown as n unless otherwise noted.
[b]Severity based on QIDS-A: no depression: ≤ 5; mild: 6–10; moderate: 11–15; severe: ≥ 16.
[c]Severity based on GAD-7: no anxiety: ≤ 4; mild: 5–9; moderate: 10–14; severe: ≥ 15.
**P* value based on generalized McNemar test.
Abbreviations: GAD-7 = 7-item Generalized Anxiety Disorder Screener; QIDS-A = Quick Inventory of Depressive Symptomatology, Adolescent version.

acceptable sensitivity and specificity in adolescents with GAD.[26]

Suicidal ideation. Item 13 (scored on a 4-point Likert scale) from the QIDS-A was used to assess suicidal ideation. Response options include the following: 0 = "I do not think of suicide or my own death"; 1 = "I feel that life is empty or wonder if it's worth living"; 2 = "I think of suicide or my own death several times a week for several minutes"; 3 = "I think of suicide or my own death several times a day, or I have made plans or tried to commit suicide."

Alcohol and substance use. To examine alcohol and substance use, students were asked whether they had used alcohol/substances in the past 30 days, as well as how often they had 4 or more drinks in a single day. These items were scored on a 7-point scale: 0 = never; 1 = once a month or less; 2 = 2 to 4 times a month; 3 = 2 to 3 times a week; 4 = 4 or more times a week; 5 = everyday; 6 = several times a day.

Statistical Data Analyses

We described the sample at baseline using descriptive statistics (percentages for categorical variables and means and standard deviations for continuous variables). Generalized McNemar tests were conducted to test for difference among levels of categorical variables pre- to post-intervention.

We considered the difference between post- and pre-intervention QIDS-A scores as the primary outcome and used multilevel modeling to allow for the nesting of students within schools to estimate adjusted program effects. To this end, an unconditional means model expressed the student-level outcome Y_{ij} by combining two linked models: one at the student level (level 1) and another at the school level (level 2). The model at level 1 expressed a student's outcome as the sum of the intercept for the student's school and a random error term associated with each student. At level 2, the school intercept was expressed as a sum of the grand mean and sequences of random deviations from such mean. Combined together, this multilevel model became

$$Y_{ij} = \gamma_{00} + u_{0j} + e_{ij}$$

in which Y_{ij} denotes the difference in QIDS-A score from pre- to post-intervention for the i^{th} student at the j^{th} school; γ_{00} is the mean QIDS-A difference score of the school; u_{0j} is the random intercept for the j^{th} school, assumed to be normally distributed with mean zero and variance σ_u^2; and e_{ij} is random error assumed to be normally distributed with mean zero and variance σ^2. Using this as a starting point, models were progressively built by first including school-level factors (Model 2, Table 4) and then additionally student-level factors (Model 3, Table 4) to estimate program effect. Specifically,

Model 2 was as follows:

$$Y_{ij} = \gamma_{00} + \gamma_{01}L_{1j} + \gamma_{02}L_{2j} + \gamma_{03}T_{1j} + \gamma_{04}T_{2j} + u_{0j} + e_{ij};$$

controlling for school location and type.

Model 3 was as follows:

$$Y_{ij} = \gamma_{00} + \gamma_{01}L_{1j} + \gamma_{02}L_{2j} + \gamma_{03}T_{1j} + \gamma_{04}T_{2j} + \gamma_{05}G_{1j} + \gamma_{06}G_{2j} + \gamma_{07}R_{1j} + \cdots + + \gamma_{0,12}R_{6j} + \gamma_{0,13}H_{1j} + \gamma_{0,14}H_{2j} + \gamma_{0,15}Gr_{1j} + \cdots + + \gamma_{0,18}Gr_{4j} + u_{0j} + e_{ij};$$

Table 4. Fixed Effects for the Hierarchical Linear Mixed-Effects Models for QIDS-A Difference Scores (No. of schools = 29, student n = 3,302)[a]

Parameter	Model 1 (unconditional)	Model 2 (adding school-level factors)	Model 3 (adding school-level and student-level factors)	Final Model: Model 4 (student-level factors only)
Regression Coefficients (fixed effects)				
Intercept γ_{00} (SE)	−0.88 (0.09)**	−0.92 (0.11)***	−0.38 (0.33)	−0.39 (0.34)
Individual-Level Factors				
Depressive level at baseline				
Mild vs None			−1.14 (0.19)**	−1.11 (0.19)**
Moderate vs None			−2.56 (0.23)***	−2.53 (0.23)***
Severe to Very severe vs None			−4.25 (0.51)*	−4.23 (0.51)*
Sex				
Female vs male			0.24 (0.15)	0.24 (0.15)
Others vs male			0.15 (0.87)	0.09 (0.85)
Race				
Black vs White			−0.04 (0.45)	0.03 (0.44)
Asian vs White			−0.05 (0.25)	0.01 (0.23)
Native Hawaiian or other Pacific Islander vs White			−0.04 (2.01)	0.01 (2.02)
American Indian or Alaska Native vs White			0.30 (0.60)	0.34 (0.60)
More than one race vs White			0.19 (0.55)	0.22 (0.54)
Other/declined to state/unknown vs White			0.08 (0.43)	0.16 (0.41)
Ethnicity				
Non-Hispanic vs Hispanic			0.30 (0.26)	0.25 (0.26)
Unknown vs Hispanic			0.29 (0.39)	0.25 (0.39)
Grade				
6th/7th/8th vs 12th			0.67 (0.64)	0.40 (0.50)
9th grade vs 12th			0.37 (0.39)	0.34 (0.36)
10th vs 12th			0.43 (0.39)	0.41 (0.37)
11th vs 12th			0.39 (0.45)	0.39 (0.45)
School-Level Factors				
School location				
Rural vs urban		−0.12 (0.28)	−0.30 (0.36)	
Suburban vs urban		0.13 (0.22)	−0.02 (0.23)	
School type				
Private vs public		0.21 (0.34)	−0.29 (0.37)	
Charter vs public		−0.01 (0.19)	0.14 (0.23)	
Model Summary				
AIC	17,859.53	17,861.15	17,060.94	17,062.94

[a]REML estimation with unstructured covariance with QIDS-A difference score as the outcome; values shown as estimate (SE) unless otherwise noted. Model 1: unconditional model with random intercept; Model 2: school-level predictors added to Model 1 (with random intercept); Model 3: full model, student-level predictors added to Model 2 (with random intercept); Model 4: final model, adjusted according to post-estimation results, dropping school-level predictors (with random intercept).
*$P < .05$. **$P < .001$. ***$P < .0001$.
Abbreviations: AIC = Akaike Information Criterion; QIDS-A = Quick Inventory of Depressive Symptomatology, Adolescent version; REML = restricted maximum likelihood.

controlling additionally for baseline QIDS-A score, sex, race, ethnicity (Hispanic vs non-Hispanic), grade, and school location and type.

Estimates of mean change in Model 3 were stratified on baseline QIDS-A score because students with a higher score at baseline could have had a ceiling effect on possible change compared to those with a lower score. We note that in all models, γ_{00} is the parameter of interest. A significant estimate of the intercept (γ_{00}) for any given model indicated program effectiveness, controlling for all other factors in the model. The Akaike Information Criterion (AIC) was used to compare models.

Multiple imputation was used to reduce selection bias from missing data. Analysis of missing values indicated substantial proportions of missing data for the primary outcomes. The pattern of missingness was not monotone. Missing values were imputed 50 times in 10 iterations using fully conditional specification. Statistical analyses were performed separately on each imputed data set, and the results were then pooled using Rubin's rules.[27] Significance across multiple imputed data sets was determined using a similar technique.

A sensitivity analysis was performed on the non-imputed data set. Corresponding results can be found in Supplementary Tables 1–4.

The process above was repeated to model the difference between post- and pre-intervention GAD-7 scores as the outcome, controlling for baseline GAD-7 score. SAS version 9.4 was used for all analyses, and the threshold for significance was set at $P < .05$.

RESULTS

Demographic and Mental Health Characteristics of the Sample

Altogether, 3,311 youth were enrolled in the study, while 3,302 were included in the analyses (9 were excluded

Table 5. Fixed Effects for the Hierarchical Linear Mixed-Effects Models for GAD-7 Difference Scores[a]

Parameter	Model 1 (unconditional)	Model 2 (adding school-level factors)	Model 3 (adding school-level and student-level factors)	Final Model: Model 4 (student-level factors only)
Regression Coefficients (fixed effects)				
Intercept γ_{00} (SE)	−0.58 (0.09)***	−0.56 (0.12)***	0.27 (0.44)	0.23 (0.44)
Individual-Level Factors				
Anxiety level at baseline				
Mild vs None			−1.64 (0.19)***	−1.64 (0.19)***
Moderate vs None			−3.18 (0.26)***	−3.17 (0.26)***
Severe to Very severe vs None			−5.42 (0.36)***	−5.42 (0.36)***
Sex				
Female vs male			0.34 (0.18)	0.35 (0.18)*
Others vs male			0.92 (0.90)	0.93 (0.90)
Race				
Black vs White			−0.33 (0.28)	−0.34 (0.28)
Asian vs White			0.12 (0.24)	0.14 (0.24)
Native Hawaiian or other Pacific Islander vs White			−1.22 (1.61)	−1.23 (1.61)
American Indian or Alaska Native vs White			0.29 (0.62)	0.26 (0.62)
More than one race vs White			0.20 (0.29)	0.21 (0.29)
Other/declined to state/unknown vs White			0.23 (0.30)	0.21 (0.29)
Ethnicity				
Non-Hispanic vs Hispanic			0.25 (0.26)	0.26 (0.26)
Unknown vs Hispanic			0.25 (0.50)	0.25 (0.49)
Grade				
6th/7th/8th vs 12th			0.22 (0.77)	0.03 (0.61)
9th grade vs 12th			0.15 (0.42)	0.03 (0.39)
10th vs 12th			0.36 (0.41)	0.29 (0.39)
11th vs 12th			0.15 (0.39)	0.16 (0.39)
School-Level Factors				
School location				
Rural vs urban		−0.04 (0.33)	−0.23 (0.44)	
Suburban vs urban		−0.01 (0.20)	−0.17 (0.26)	
School type				
Private vs public		0.49 (0.32)	−0.03 (0.37)	
Charter vs public		−0.29 (0.23)	−0.23 (0.32)	
Model Summary				
AIC	18,463.17	18,460.50	17,484.47	17,483.86

[a]REML estimation with unstructured covariance with GAD-7 difference score as the outcome; values shown as estimate (SE) unless otherwise noted. Model 1: unconditional model with random intercept; Model 2: school-level predictors added to Model 1 (with random intercept); Model 3: full model, student-level predictors added to Model 2 (with random intercept); Model 4: final model, adjusted according to post-estimation results, dropping school-level predictors (with random intercept). No. of schools = 29, student n = 3,302.

*P < .05. ***P < .0001.

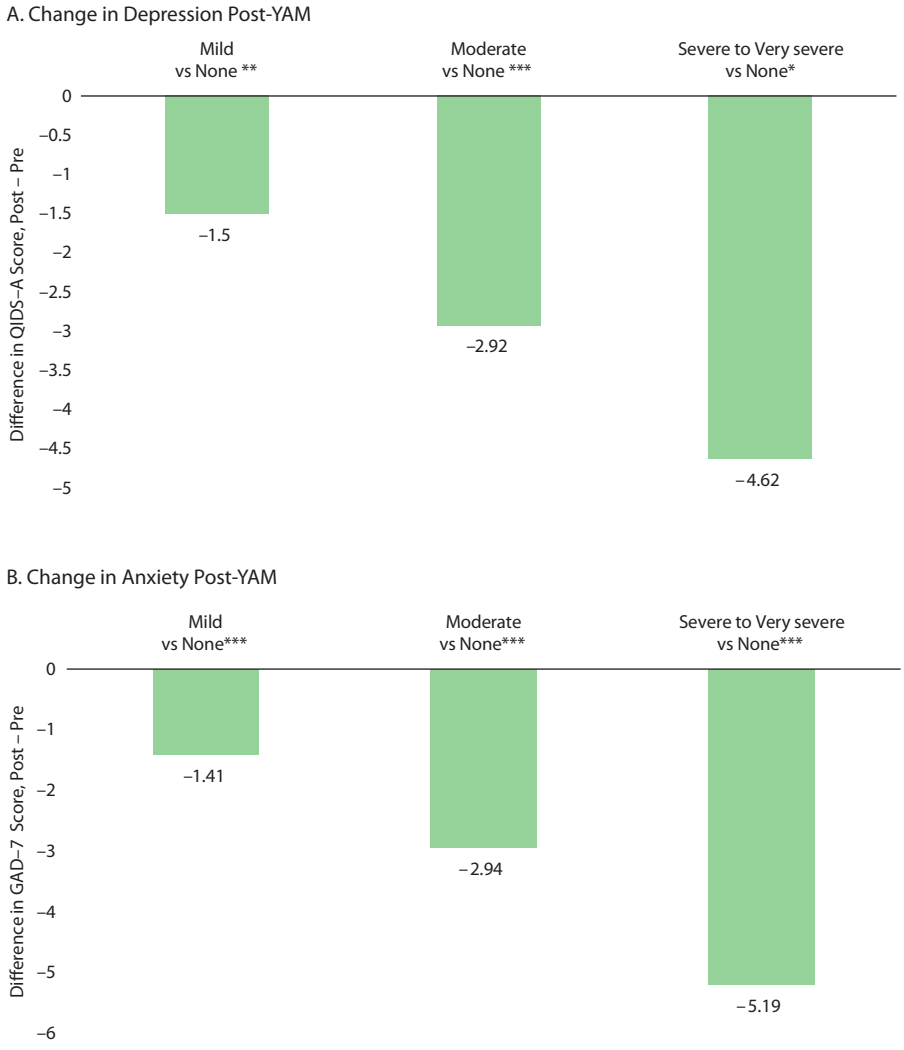
Abbreviations: AIC = Akaike Information Criterion, GAD-7 = 7-item Generalized Anxiety Disorder Screener, REML = restricted maximum likelihood.

due to incomplete baseline assessment or demographic information). Table 1 provides demographic characteristics of the sample. Most students were in high school, with a mean ± SD age of 15.23 ± 1.15 years, and 61.51% (n = 2,031) were female. The majority of students identified as non-Hispanic (65.16%; n = 2,123), with racial breakdowns being 42.4% White, 10.7% African American, 15.3% Asian, 10% more than one race, and 19.7% other or declined to state. Approximately two-thirds of the sample (n = 2,228, 67.5%) also completed the measures at follow-up. While there were statistical differences in some demographic characteristics between those who completed the follow-up assessment and those who did not (notably, sex, grade, and age), there were no statistical differences between the two groups on depression or anxiety severity at baseline.

Among the full sample, the mean ± SE QIDS-A score was 7.9 ± 0.08 pre-YAM and the mean GAD-7 score was 5.98 ± 0.09. Approximately 4.3% reported frequently thinking about suicide and/or having made a plan. An additional 13.8% reported feeling that life is empty and/or wondering if life is worth living based on the QIDS-A suicidal ideation item. Nearly 14% (424 of 3,003) reported having consumed alcohol, with 0.47% (14 of 3,003) reporting having consumed alcohol at least 2–3 times per week during the past month; 9 (0.30%) of 3,003 (0.47%) had binge drinking episodes (≥ 4 drinks in a single day). Seven percent (n = 220 of 2,996) reported having marijuana within the last 30 days, and 1.7% (51 of 2,998) reported using other drugs. Approximately 2% (n = 59) and 0.27% reported having used marijuana or other drugs (respectively) at least 2–3 times per week during the past month.

Students who reported having suicidal thoughts at pre-test reported a decrease in these thoughts at post-test. Of

Figure 1. Changes in (A) Depression Score and (B) Anxiety Score at Post-YAM for Mild, Moderate, and Severe to Very Severe Categories[a]



[a]Compared to no depression or no anxiety, respectively, controlling for factors in the final model. Depression severity is based on QIDS-A total score: no depression: ≤ 5; mild: 6–10; moderate: 11–15; severe to very severe: ≥ 16. Anxiety severity is based on GAD-7 total score: no anxiety: ≤ 4; mild: 5–9; moderate: 10–14; severe to very severe: ≥ 15.
*$P < .05$. **$P < .001$. ***$P < .0001$ (based on mixed-effects model).
Abbreviations: GAD-7 = 7-item Generalized Anxiety Disorder Screener; QIDS-A = Quick Inventory of Depressive Symptoms, Adolescent version; YAM = Youth Aware of Mental Health intervention.

the 175 students who reported experiencing mild suicidal thoughts at pre-test, over half (92) reported no suicidal thoughts at post-test, while 75 (42.86%) stated that they had no change in severity of suicidal thoughts and only 8 (4.57%) acknowledged moderate suicidal thoughts. No student initially experiencing mild suicidal thoughts reported having severe suicidal thoughts post-test.

School Characteristics

Of the 29 schools, 68.97% (20) were urban, 17.24% (5) were suburban, and 13.79% (4) were rural. Half of the schools were public (51.72%, 15 schools), followed by charter (34.48%, 10) and private (13.79%, 4 schools).

Program Effect on Depression and Anxiety

At follow-up, the mean QIDS-A score was 6.96 ± 0.11 and the mean GAD-7 score was 5.41 ± 0.10. McNemar tests indicated significant decreases in both depression and anxiety scores post-YAM (Table 2). Of the 260 severely depressed at pre-YAM, 95 (36.5%) remained depressed at post-YAM, 113 (43%) dropped to moderate depression, and 52 (20%) dropped to none/mild depression (Table 3). Similar drops were observed for anxiety (Table 3).

The primary outcome was the difference in depression, measured by the QIDS-A score, at post-test from pre-test, based on 3,302 students from 29 schools. An unconditional model (Model 1 in Table 4) for difference scores as the

outcome was fit with random intercepts only, allowing schools to vary randomly. The estimated intercept of −0.88 implied that, on average, school-level QIDS scores decreased by 0.88 units at post-test for the overall sample, and this was statistically significant ($P < .001$). Estimated variance for the residual (estimate = 13.28, SE = 0.50, $P < .0001$) indicated that there was significant variation among students within schools. However, schools did not differ significantly from one another (0.12, SE = 0.11, $P = .14$). Model 2 built on Model 1 by including school-level factors such as school location (urban, suburban, rural) and type (public, charter, private). The resulting estimated intercept of −0.92 implied that, on average, school-level QIDS scores decreased by 0.92 units at post-test, and this was statistically significant ($P < .0001$) after controlling for school-level factors. Model 3 built further on this by adding student-level factors such as sex, race/ethnicity, grade, and students' depression severity at pre-test. Given that the school-level variables did not play any significant role in predicting the outcome (seen in Models 2 and 3, Table 4), we dropped them from the model and kept only student-level factors in our final model (Model 4, Table 4). Controlling for all other factors in the model, we found that on, average, compared to those who had no depression at pre-test, depression decreased at post-test by (*a*) 4.62 units ($P < .05$) for those who had severe to very severe depression at pre-test; (*b*) 2.92 units ($P < .0001$) for those who had moderate depression at pre-test; and (*c*) 1.5 units ($P < .001$) for those who had mild depression at pre-test (Table 4, Figure 1A).

Regarding model fit, we considered the AIC statistic as a marker. While Model 3 had the lowest value of AIC, Model 4 was the most parsimonious with an equally close AIC, making it the final model of choice.

Similar significant decreases were observed in anxiety, controlling for student-level characteristics (Table 5, Figure 1B). Specifically, controlling for all other factors in the model, we found that, on average, compared to those who had no anxiety at pre-test, anxiety decreased at post-test by (*a*) 5.19 units ($P < .0001$) for those who had severe to very severe anxiety at pre-test; (*b*) 2.94 units ($P < .0001$) for those who had moderate anxiety at pre-test; and (*c*) 1.4 units ($P < .0001$) for those who had mild anxiety at pre-test.

Sensitivity Analysis

As a sensitivity analysis, the mixed effects modeling was repeated on a separate, non-imputed dataset from which adolescents with incomplete data on difference scores in QIDS-A/GAD-7 were excluded. Similar results were observed as in the primary analysis. All other analyses were replicated on the non-imputed dataset and results were closely similar (Supplementary Tables 1–4).

DISCUSSION

In the current sample, 27% and 22.5% of students reported moderate-to-severe symptoms of depression anxiety, respectively. Only 4% of students reported significant suicidal thoughts, although 14% reported thinking life is empty and/or wondering if life is worth living. Use of alcohol, marijuana, and other drugs was quite low, with 86%, 93%, and 98% of students, respectively, stating they had not used over the past 30 days. There were higher rates of depression in this sample compared to the US adolescent population rates (≈ 11%–16%); however, our sample had lower rates of anxiety than those seen in US adolescents (≈ 32%).[1,28] Rates of alcohol and substance use were also lower in this sample compared to US population rates, which show that 4.5% of American youth had a substance use disorder in the past year.[28]

The underlying mechanisms of YAM have yet to be explored fully, but it is clear that youth participating in the program have experienced improvements in mental health. The current implementation findings highlight the improvement of depression and anxiety symptoms at post-test. With regard to depression severity, youth with severe to very severe depression at pre-test were estimated to experience a drop of 4.6 points at post-YAM compared to those who did not have depression prior to YAM. This means that those in early stages of severe depression (QIDS-A total scores of 16–21) can be expected to cross over to moderate depression on completion of YAM. Similar drops are expected in other depression categories, moving youth from one category to a lower category of severity on completion of YAM. Similar movements were observed for anxiety across all severity categories.

This study has limitations. First, because this was an implementation project, there is no control group; as such, findings could be related to other factors (eg, timing of school year, differences in student stress). Second, from the larger implementation study (J.L.H., J.R.A., F. Kahalnik, MPH, MSSW, et al; unpublished data), many students who were offered the opportunity to participate in this research study did not, due to lack of parent consent; youth who did not participate may have presented with symptoms at pre- or post-test different from those of youth who participated. Additionally, many students were lost to follow-up, mostly due to logistical reasons, such as the beginning of summer vacation before post-YAM measures could be administered, making it difficult to know if those lost may have had different outcomes. Youth who were lost to follow-up did not have significantly different mental health symptoms compared to those who completed the follow-up. Finally, the results are based on self-report. Although the instruments are validated rating scales with acceptable reliability and validity and are widely used, it is possible the results would be different if ratings were completed by parents, teachers, or clinicians.

Despite these limitations, YAM is a promising intervention and is feasible and acceptable in schools. As adolescent mental health problems become more prevalent, implementing prevention programs such as YAM in schools will be important.

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Supplementary material: Available at PSYCHIATRIST.COM.

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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Childhood and Adolescent Mental Health section. Please contact Karen D. Wagner, MD, PhD, at kwagner@psychiatrist.com.

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Supplementary Material

Article Title: Youth Aware of Mental Health (YAM) Program With Texas Adolescents: Depression, Anxiety, and Substance Use Outcomes

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List of Supplementary Material for the article

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Disclaimer

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Supplementary Table 1. Student-level descriptive statistics related to Depression and Anxiety at pre- and post-intervention using original, non-imputed dataset

Variables	Pre	Post	Difference Score	
CONTINUOUS	**Mean (Standard Error)**	**Mean (Standard Error)**	**Mean (Standard Error)**	**p-value**
Depressive Severity (QIDS-A)	7.90 (0.10)	6.80 (0.13)	-0.89 (0.10)	<0.0001
Anxiety Symptoms (GAD-7)	5.99 (0.09)	5.27 (0.12)	-0.49 (0.09)	<0.0001

Abbreviations: GAD-7=Generalized Anxiety Disorder Screener; QIDS-A=Quick Inventory of Depressive Symptomatology, Adolescent version

Supplementary Table 2. Cross-classification of levels of depression/anxiety severity pre- versus post- intervention using original, non-imputed dataset

DEPRESSION SEVERITY						
		Depression Severity Pre-Test[a]				
		No Depression (n= 547)	Mild (n= 531)	Moderate (n= 269)	Severe (n= 98)	p-value*
Depression Severity Post-test	No Depression (n=691)	455	198	31	7	< 0.00001
	Mild (n = 451)	82	252	101	16	
	Moderate (n = 217)	5	71	107	34	
	Severe (n = 86)	5	10	30	41	
ANXIETY SEVERITY						
		Anxiety Severity Pre-Test[b]				
		No Anxiety (n= 904)	Mild (n= 500)	Moderate (n= 253)	Severe (n= 131)	p-value*
Anxiety Severity Post-test	No Anxiety (n = 1089)	772	251	49	17	< 0.00001
	Mild (n = 420)	114	188	94	24	
	Moderate (n = 193)	12	53	79	49	
	Severe (n = 86)	6	8	31	41	

[a] Severity based on QIDS-A. No Depression: ≤5; Mild: 6-10; Moderate: 11-15; Severe: ≥16

[b] Severity based on GAD-7. No Anxiety: ≤4; Mild: 5-9; Moderate: 10-14; Severe: ≥15

* p-value based on generalized McNemar test

Abbreviations: GAD-7=Generalized Anxiety Disorder Screener; QIDS-A=Quick Inventory of Depressive Symptomatology, Adolescent version

Supplementary Table 3. Fixed effects for the Hierarchical Linear Mixed Effects Models for QIDS difference scores (school n=29, student n=1445)

Parameters	Model 1 (unconditional)	Model 2 (Adding school-level factors)	Model 3 (Adding school-level and student-level factors)	**Final Model**: Model 4 (Student-level factors only)
Regression coefficients (fixed effects)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept γ_{00} (SE)	-0.89 (0.12)***	-0.86 (0.22)**	-1.15 (0.56)	-1.16 (0.56)*
Individual-level factors				
Depressive level at baseline				
Mild vs None			-0.84 (0.21)**	-0.80 (0.21)**
Moderate vs None			-2.38 (0.26)***	-2.34 (0.26)***
Severe to Very severe vs None			-4.93 (0.38)***	-4.90 (0.38)***
Gender				
Female vs male			0.64 (0.19)**	0.64 (0.19)**
Others vs male			0.04 (0.93)	-0.01 (0.93)
Race				
Black vs White			-0.07 (0.33)	0.06 (0.33)

Asian vs White			-0.38 (0.30)	-0.25 (0.30)
Native Hawaiian or Other Pacific Islander vs White			-0.31 (1.74)	-0.26 (1.74)
American Indian or Alaska Native vs White			-0.03 (0.69)	-0.02 (0.69)
More than one race vs White			0.09 (0.38)	0.14 (0.38)
Other, Decline to state, Unknown vs White			0.12 (0.34)	0.25 (0.33)
Hispanic				
Non-Hispanic vs Hispanic			0.69 (0.31) *	0.56 (0.30)
Unknown vs Hispanic			0.93 (0.57)	0.82(0.56)
Grade				
6th, 7th, 8th grade vs 12^{th} grade			1.32 (0.92)	0.65 (0.72)
9th grade vs 12^{th} grade			0.70 (0.52)	0.52 (0.48)
10^{th} vs 12^{th} grade			0.90 (0.51)	0.77 (0.50)
11^{th} vs 12^{th} grade			0.24 (0.50)	0.22 (0.50)
School-level factors				
School Location				
Rural vs urban		-0.20 (0.48)	-0.72 (0.58)	
Suburban vs urban		-0.02 (0.37)	-0.35 (0.34)	
School Type				

Private vs Public		-0.05(0.48)	-0.50 (0.47)	
Charter vs Public		-0.02 (0.34)	0.12 (0.39)	
Variance components (random effects)				
Residual	13.28 (0.50)***	13.28 (0.50)***	11.63 (0.44)***	11.67 (0.44)***
Intercept	0.12 (0.11)	0.19 (0.15)	0.13 (0.12)	0.12 (0.12)
Model summary				
AIC	7853.3	7853.6	7616.7	7622.8

* p<0.05; ** p<0.001; *** p<0.0001

REML estimation with unstructured covariance with QIDS difference score as the outcome. Model 1: unconditional model with random intercept; Model 2: school-level predictors added to Model 1 (with random intercept); Model 3: full model, student-level predictors added to Model 2 (with random intercept); Model 4: final model, adjusted according to post-estimation results, dropping school-level predictors (with random intercept).

Supplementary Table 4. Fixed effects for the Hierarchical Linear Mixed Effects Models for GAD difference scores (school n=29, student n=1788)

Parameters	Model 1 (unconditional)	Model 2 (Adding school-level factors)	Model 3 (Adding school-level and student-level factors)	**Final Model** Model 4 (Adding student-level factors only)
Regression coefficients (fixed effects)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept γ_{00} (SE)	-0.49 (0.11) **	-0.30 (0.16)	-0.29(0.52)	-0.39 (0.51)
Individual-level factors				
Anxiety level at baseline				
Mild vs None			-1.65 (0.21)***	-1.64 (0.21)***
Moderate vs None			-3.13 (0.27)***	-3.11 (0.27)***
Severe to Very severe vs None			-5.87 (0.35)***	-5.86 (0.35)***
Gender				
Female vs male			0.74 (0.19)**	0.73 (0.19)**
Others vs male			1.14 (0.93)	1.12 (0.93)
Race				

Black vs White			-0.63 (0.32)	-0.63 (0.31)*
Asian vs White			0.29 (0.29)	0.33 (0.29)
Native Hawaiian or Other Pacific Islander vs White			-1.26 (1.86)	-1.33 (1.86)
American Indian or Alaska Native vs White			0.43 (0.68)	0.41 (0.68)
More than one race vs White			0.47 (0.36)	0.49 (0.35)
Other, Decline to state, Unknown vs White			0.44 (0.33)	0.43 (0.33)
Hispanic				
Non-Hispanic vs Hispanic			0.49 (0.30)	0.51 (0.29)
Unknown vs Hispanic			0.62 (0.55)	0.63 (0.55)
Grade				
6th, 7th, 8th grade vs 12^{th} grade			0.69 (0.94)	0.26 (0.75)
9th grade vs 12^{th} grade			0.51 (0.48)	0.23 (0.43)
10^{th} vs 12^{th} grade			0.83 (0.48)	0.67 (0.46)

11th vs 12th grade			0.32 (0.43)	0.34 (0.43)
School-level factors				
School Location				
Rural vs urban		-0.24 (0.35)	-0.51 (0.54)	
Suburban vs urban		-0.24 (0.26)	-0.34 (0.40)	
School Type				
Private vs Public		0.32 (0.43)	-0.22 (0.52)	
Charter vs Public		-0.56 (0.26)*	-0.47 (0.42)	
Variance components (random effects)				
Residual	16.06(0.54)***	16.07 (0.54)***	13.36 (0.45)***	13.36 (0.45)***
Intercept	0.05 (0.09)	0.02 (0.08)	0.25 (0.17)	0.21 (0.14)
Model summary				
AIC	10048.9	10045.5	9680.7	9683.3

* p<0.05; ** p<0.001; *** p<0.0001

REML estimation with unstructured covariance with GAD difference score as the outcome. Model 1: unconditional model with random intercept; Model 2: school-level predictors added to Model 1 (with random intercept); Model 3: full model, student-level predictors added to Model 2 (with random intercept); Model 4:

final model, adjusted according to post-estimation results, dropping school-level predictors (with random intercept).