The Association of Adolescent Depressive Symptoms with Healthcare Utilization and Payer-Incurred Expenditures

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Abstract

Objective—Screening adolescents for depression is recommended by the U.S. Preventive Services Task Force. We sought to evaluate the impact of positive depression screens in an adolescent population on healthcare utilization and costs from a payer perspective.

Methods—We conducted depression screening among 13-17 year olds adolescents enrolled in a large integrated care system using the 2- and 9-item Patient Health Questionnaires (PHQ). Healthcare utilization and cost data were obtained from administrative records. Chi-square,

Wilcoxon rank-sum, and t-tests were used to test for statistical differences in outcomes between adolescents based on screening status.

Results—Of the 4,010 adolescents who completed depression screening, 3,707 (92.4%) screened negative (PHQ-2 < 2 or PHQ-9 < 10), 186 (3.9%) screened positive for mild depression (PHQ-9 = 10-14), and 95 (2.4%) screened positive for moderate-to-severe depression (PHQ-9 ≥ 15). In the 12-months after screening, screen-positive adolescents were more likely than screen-negative adolescents to receive any emergency department visit or inpatient hospitalization, and had significantly higher utilization of outpatient medical (mean (SD) = 8.3 (1.5) vs. 3.5 (5.1)) and mental health (3.8 (9.3) vs. 0.7 (3.5)) visits. Mean total healthcare system costs for screen-positive adolescents ($5,083 ($10,489)) were more than twice as high as those of screen-negative adolescents ($2,357 ($7,621)).

Conclusion—Adolescent depressive symptoms, even when mild, are associated with increased healthcare utilization and costs. Only a minority of the increased costs is attributable to mental health care. Implementing depression screening and evidence-based mental health services may help to better control healthcare costs among screen-positive adolescents.

Keywords

Depression; Mental Health; Adolescent Health; Costs; Economic Analysis

INTRODUCTION

In 2011, 28.5% of adolescents reported feeling sad or hopeless almost every day for two weeks or more, close to 16% of adolescents seriously considered attempting suicide, and almost 13% of adolescents made a suicide plan.[1] An estimated 14% of adolescents experience a mood disorder, such as major depressive disorder or bipolar disorder, by age 18.[2] Adolescents with major depressive disorder are more likely to smoke, to use alcohol, have anxiety or other mental disorders, and to have made a suicide attempt.[3,4] One study estimated that patients who were diagnosed with major depressive disorder as children have lifetime annual healthcare expenditures that are nearly double those of their peers.[5]

Both the U.S. Preventive Services Task Force (USPSTF, 2009) and the American Academy of Pediatrics (AAP, 2014) recommend that medical practitioners screen adolescents for depression when systems are in place to ensure accurate diagnosis, treatment, and follow-up. [6] Screening positive for depression could affect adolescent productivity and educational attainment.[7] As healthcare providers decide whether to implement broad-based depression screening in their practices, it is important to understand the effect adolescent depression has on healthcare utilization and payer's expenditures. Many studies have examined the percentage of adolescents with depression who use mental health services and have found that treatment is underutilized. Estimates of mental healthcare utilization among adolescents with depression range from 18-60%.[4,8-11]

While cost-effectiveness analyses of several adolescent depression screening and treatment interventions have been previously reported[12,13], few studies have been conducted to describe the economic healthcare cost of adolescent depression. In an analysis of data from

the 1996 U.S. Medical Expenditure Panel Survey, Guevara et al. found that children who had been diagnosed with depression, anxiety and other emotional disorders had annual healthcare expenditures of $2,237 (95% CI: $1,426, $3,050), higher than annual expenditures of children with physical disorders such as asthma or diabetes ($1,245, 95% CI: $106, $2,386), children with behavioral disorders such as ADHD ($1,167, 95% CI: $903, $1,340), and otherwise healthy children ($834, 95% CI: $11, $1,658) (all estimates in 1996 USD). [14,15] Another study of data from a large integrated healthcare system by Richardson et al. found that the payer-incurred healthcare expenditures for youth with depression and asthma were 51% higher than those for youth with asthma alone.[16]

Unfortunately, study populations for many analyses conducted to date have been limited to youth with a coded diagnosis of major depressive disorder (MDD), which does not represent the full spectrum and prevalence of clinical depression.[17] In this study, we aimed to use a reliable, validated depression screening instrument and automated utilization data from a large integrated healthcare system to evaluate the payer-incurred cost of adolescent depressive symptoms and the types of services used by adolescents with clinically significant depressive symptoms. We hypothesized that annual expenditures for adolescents who screened positive for depression would be significantly higher than those for adolescents who did not screen positive for depression and that only a small percentage of costs would be due to mental health treatment. [18-21]

METHODS

This analysis was conducted as part of the Reaching Out to Adolescents in Distress (ROAD) study. ROAD was a randomized clinical trial to evaluate a collaborative care intervention for adolescent depression in primary care settings. [21] Adolescents from nine primary care clinics in the Group Health (GH) integrated healthcare system were screened for depression. Adolescents who screened positive were invited to participate in a follow-up evaluation. All individuals who continued to screen positive were either invited to participate in the ROAD intervention study or assisted with connecting with other resources if they were found to be depressed but not eligible for intervention participation due to exclusion criteria. Those who wished to participate and met study eligibility criteria were randomized to intervention (n = 50) or usual care (n = 51). The ROAD study intervention included the provision of care managers who would assist youth in initiating and maintaining evidence based treatments, including antidepressants and brief psychotherapy delivered by the care manager in the primary care clinic. [21] This study utilizes administrative data from all participants who were screened for symptoms of MDD to assess eligibility for the ROAD study. It therefore includes the ROAD study participants as a subsample of the current study population. The Seattle Children's Hospital and GH Institutional Review Boards approved the study protocol.

Participants

Participants were recruited between April 2010 and March 2012 from the population of 13-17 year olds enrolled in any of nine urban primary care GH clinics in western Washington State. 10,955 adolescents were contacted first by mail, and subsequently by

phone, to participate in the study. Participants were excluded from the analysis if they were unable to complete survey questions due to developmental delay or being hospitalized, non-English speaking, no longer enrolled in Group Health, had a sibling who had already been invited to participate in the study, if there was no parent or guardian to consent, or due to sampling error. (Figure 1)

Screening

Depression screening was conducted using the Patient Health Questionnaire (PHQ) Depression Scales, validated self-report instruments that are extensively used to screen for depressive disorders in primary care settings.[22] Screening was conducted in two steps within the same phone call. First, adolescents completed the PHQ-2, a two-item screening tool that inquires about symptoms of depression and anhedonia over the past two weeks. [23] A PHQ-2 score of 2 or greater has a sensitivity of 100% and a specificity of 62% for detecting MDD among adolescent populations.[23] Those that scored 2 or greater then completed the remaining seven items of the full PHQ-9, a nine-item questionnaire that further identifies the presence and severity of depressive symptoms.[24] A PHQ-9 score of 10 or greater has a sensitivity of 89.5% and a specificity of 72.1% for detecting MDD among adolescents.[24] Both the PHQ-2 and the PHQ-9 were administered by phone, which has been shown to be a valid method for assessing depressive symptoms in adult and adolescent populations. [23-25]

Depressive symptom severity was categorized based on the results of the PHQ-2 and PHQ-9 screening. A PHQ-2 score < 2 or a PHQ-2 score 2 with a PHQ-9 score < 10 represented a low likelihood of MDD, a PHQ-9 score of 10-14 represented probable mild MDD and a PHQ-9 score 15 represented probable moderate-to-severe MDD.

Study Measures

Baseline demographic and health characteristics, including age, gender, public insurance coverage, race/ethnicity, body mass index (BMI) z-score, and BMI class (i.e. normal weight, overweight, or obese), were assessed from GH administrative data records and a participant survey. We also calculated each patient's Pediatric Chronic Disease Score (PCDS), a measure of chronic disease burden estimated using data on prescription drug fills from the 12 months prior to screening.[26] The PCDS was calculated both including and excluding data on antidepressant prescription drug fills.

GH is an integrated care provider which coordinates both care and coverage for its members. We collected data from GH administrative records on each patient's healthcare utilization and expenditures related to outpatient visits, inpatient visits, emergency department (ED) visits, prescription drugs, and diagnostic lab tests in the 12 months after PHQ screening. Utilization was categorized as mental health or non-mental health-related care based on GH provider specialty. GH expenditure data includes estimates of direct costs related to administering patient healthcare, overhead costs in GH clinics, and costs related to approved out of plan services paid by GH. Overhead costs consisted of costs related to facilities, payroll, and other administrative departments. Therefore, the cost analysis was conducted from the perspective of the payer, GH. All costs were incurred between February 2010 and March 2013. All costs were inflated to 2013 common dollars using the medical care

component of the U.S. Consumer Price Index. [15] Grant-funded intervention costs related to the conduct of the ROAD intervention study[21], specifically including costs related to coordinated care management and cognitive behavioral therapy sessions provided as part of the intervention, were excluded from this analysis.

Statistical Analysis

Demographic, health, utilization, and expenditure data were summarized for groups of patients defined by depression screening status. Bivariate analyses were performed using Pearson's X^2 tests to examine the differences in categorical characteristics (i.e. gender, type of insurance, race/ethnicity, and BMI class) by level of depressive symptom severity. T-tests were used to compare continuous predictors (i.e. age, PCDS, and BMI z-score) between groups. As utilization and expenditure data tend to have non-normal, skewed distributions, the nonparametric Wilcoxon-Mann-Whitney and Kruskal-Wallis tests were used to test for statistically significant differences in utilization and expenditures between groups. All statistical analyses were conducted using SAS, version 9.3 (© 2012, SAS Institute Inc., Cary, North Carolina).

RESULTS

Participants

Parental and adolescent consent was obtained for 4,010 of the 10,955 patients originally invited to participate in the study. (Figure 1) Of those for whom consent was obtained, 3,330 adolescents (83.0%) screened negative for depression using the PHQ-2 and 680 adolescents (17.0%) screened positive for depression. Of 680 adolescents that screened positive for depression on the PHQ-2, 377 (55.4%) screened negative for depression and 281 (41.3%) screened positive for depression based on a score of 10 or greater on the PHQ-9. Twenty-two adolescents (3.2%) were categorized as ineligible due to changes in the study protocol that resulted in them not completing the PHQ-9 despite have a PHQ-2 score of 2. Among the 281 adolescents who screened positive for depression on the PHQ-9, 186 (66.2%) were categorized as probable mild MDD (PHQ-9 of 10 to 14) and 95 (33.8%) were categorized as probable moderate-to-severe MDD (PHQ-9   15).

Healthcare Utilization and Payer-Incurred Expenditures

Adolescents who screened positive for any depression were significantly more likely to be female (69% vs. 49%, p < 0.01), publicly insured (13% vs. 9%, p < 0.01), and obese (14% vs. 9%, p = 0.02). Screen-positive adolescents were slightly older than their screen-negative counterparts (15.2 vs. 15.0 years old, p < 0.01). The Pediatric Chronic Disease Score, a measure of chronic disease burden, increased with increased severity of depressive symptoms (p < 0.01), indicating higher medical disease burden even when excluding antidepressant prescriptions. (Table 1)

Healthcare utilization in the study population also increased linearly along with the severity of depressive symptoms (Table 2). In the 12 months after the screening was conducted, screen-negative adolescents had the lowest levels of outpatient utilization (3.5 visits), followed by adolescents with probable mild MDD (6.5 visits) and adolescents with probable

moderate-to-severe MDD (12.0 visits) (p < 0.01). The pattern was similar for mental health visits, with screen-negative, probable mild MDD, and probable moderate-to-severe MDD adolescents having 0.7, 2.5, and 6.4 mental health visits, respectively (p < 0.01). Screen-positive adolescents were significantly more likely than screen-negative adolescents to receive hospital care; the probability of any ED utilization was 11.5%, 21.0% and 29.5% for screen-negative, probable mild MDD, and probable moderate-to-severe MDD adolescents, respectively. The probability of having any inpatient hospitalization was a respective 1.2%, 3.8%, and 8.4% among screen-negative, probable mild MDD, and probable moderate-to-severe MDD adolescents. To reduce the risk of individual identification, results are not reported for cell sizes smaller than 5 youth, including inpatient mental health and non-mental health care utilization.

Higher utilization among screen-positive adolescents translated into higher expenditures. From the payer's perspective, mean total healthcare expenditures for screen-positive (either probable mild MDD or moderate-to-severe MDD) adolescents ($5,083) were more than twice as high as those for other adolescents ($2,357). Higher expenditures were primarily driven by outpatient expenditures ($4,004 vs. $2,203), followed by inpatient ($1,079 vs. $334), ED ($634 vs. $145), pharmacy ($521 vs. $280) and diagnostic test-related expenditures ($195 vs. $108) (p < 0.01 for all comparisons). Consistent with the differences in utilization, adolescents with moderate-to-severe probable MDD had higher expenditures than those with mild probable MDD in all categories of expenditures. Total annual expenditures for mild and moderate-to-severe probable MDD adolescents were $3,505 and $8,173, respectively—49% and 247% higher than total expenditures for screen-negative adolescents. (Table 3)

Sensitivity analyses that excluded ROAD intervention youth from the analysis indicated that non-intervention youth (n = 3960) had slightly, but not significantly higher expenditures than intervention youth (n=50). (Appendix Tables 1 and 2)

DISCUSSION

We examined healthcare utilization and associated expenditures among a population of adolescents enrolled in an integrated healthcare system that were screened for depression. We found that adolescents who screened positive for depression had significantly higher utilization and expenditures than adolescents who screened negative for depression in each component of medical utilization including outpatient medical, outpatient mental health, emergency visits, pharmacy, diagnostic testing, and inpatient admissions from the perspective of the payer. Only a small percentage of the increase in utilization was specifically due to mental health care and prescription drug use. Screening positive for depression was associated with a 49% increase in expenditures for those with mild probable MDD and a 247% increase in expenditures for those with moderate-to-severe probable MDD.

We also found that mental health visits comprised less than half of all outpatient visits for screen-positive patients (Table 2). Similar findings have been observed among adult populations, in which fewer than 10% of outpatient expenditures were specifically for the

treatment of depression.[27] It is possible that some of the encounters in primary care included discussion of mental health and resulted in antidepressant prescriptions. While we could capture pharmacy charges, we are not able to ascertain primary care-based mental health counseling from current data. Adolescents who screened positive for depression had a higher Pediatric Chronic Disease Score even when antidepressant prescriptions were excluded from the pharmacy-based risk calculation algorithm. This may reflect the high rates of co-occurrence between depressive symptoms and chronic illness, which has been associated with increased healthcare utilization and medical costs in depressed adult and adolescent populations. [16,27,28] Most of the increase in costs in both adolescent and adult populations with depression and chronic diseases are due to higher utilization for somatic symptoms such as headache and fatigue. [16,27] Many studies have shown that comorbid depression also maladaptively affects self-care of chronic medical conditions (i.e. decreasing adherence to medication or cessation of smoking), which may also increase medical costs. [29,16,28] Several large randomized trials have shown that collaborative care interventions that improved depressive outcomes in adult patients with comorbid depression and medical illness were associated with total medical costs savings compared to patients treated in usual primary care. [27,30,31] The Reaching Out to Adolescents in Distress intervention demonstrated that implementing a collaborative care program to treat depression in primary care settings is feasible and could result in significant improvements in depressive symptoms. [21]

One strength of this study relative to the existing literature [14,16] is that we used the PHQ-9, as opposed to coded diagnoses of depression to identify adolescents with depressive symptoms, making this study a more comprehensive analysis of expenditures for patients who exhibit symptoms of depression, whether they have been diagnosed or not. Only 20% to 50% of adolescents with depression are accurately diagnosed by primary care physicians[32,33], therefore dependence on ICD-9 codes is likely to have missed up to half of depression cases. Also, pediatric coding practices vary widely by provider and many pediatricians are reluctant to use mental health codes for their patients[17], decreasing the reliability of analyses that use coded diagnoses to classify depressed patients. While use of ICD-9 coding would allow us to examine mental health-specific utilization in ED (e.g. suicidal ideation), relying on diagnostic codes for this purpose risks a significant under-representation of the actual reason for health care use among children.[34] Moreover, compared to other studies of healthcare utilization among adolescents with MDD[4,8-11], we assessed utilization and expenditures from administrative data as opposed to patient self-report, and analyses assessed all healthcare utilization, not just mental health disorder-specific utilization.

Given the association between positive screens for depression and increased utilization of a wide range of healthcare services, screening adolescents for depressive symptoms in the primary care setting using an easily administered instrument like the PHQ-9 may be a viable strategy for providers to identify patients who could benefit from evidence-based team approaches like ROAD or the Youth Partners-in-Care programs. [21,35] However, providers may need additional training in order to increase screening in practice.[36] Collaborative depression care programs have been shown to improve the quality of mental health care and health outcomes of patients with depression[37,38], including patients with comorbid medical conditions.[39] In the ROAD collaborative care intervention, adolescents in the intervention

arm had a 5.2 higher odds of remission of depressive symptoms compared to adolescents receiving usual care.[21] Future research should examine the impact of such collaborative care programs on healthcare utilization and expenditures.

Limitations

This analysis was subject to limitations. These data are from a single healthcare system. We were unable to assess the degree of non-response bias among those who refused to participate in the screening study. Additionally, there were significant differences between screen-positive and screen-negative populations in other baseline characteristics including weight status, gender, and chronic disease score that may have driven some of the differences in utilization and expenditure estimates. Moreover, adolescents that screened positive for depression were more likely to have public health insurance, and presumably also lower socioeconomic status, compared to those that screened negative for depression. However, healthcare utilization by children with continuous public insurance coverage is comparable to utilization by children with continuous private coverage.[40] Due to limitations of consent obtained, this is a purely descriptive study of group data; we were unable to conduct individual-level analyses that would allow us to control for differences between groups that might be contributing to cost differences. Future analyses should analyze utilization and expenditures, controlling for factors that may influence service use in pediatric populations.[41]

We calculated the PCDS for the 12 months prior to PHQ-2 screening. Our enrollment criteria did not specify that adolescents had to be enrolled for the entire 12 month period before screening, and so our PCDS estimates may be conservative. [26] Additionally, the PCDS cannot provide information about whether health conditions are chronic or acute, however the PCDS has shown to be comparable to the ICD-9-based Ambulatory Care Groups in predicting one-year health utilization and health care costs. [26]

This study cannot make determinations about the causality of the relationship between medical problems and the incidence of depressive symptoms, which can have complex bidirectional associations. Furthermore, we have limited information about co-occuring anxiety, substance abuse, poverty, and other factor that could affect a child's mental health. Future work should use more extensive questionnaires to explore these mechanisms further.

Finally, the analysis was conducted from the healthcare payer perspective. Any family-incurred expenditures related to transportation, medical supplies, or out-of-network care not approved by GHC were not captured in expenditure estimates. Moreover, any indirect costs related to parents' missed workdays or lost leisure time were not captured. Additionally, the exclusion of ROAD intervention-related costs may bias non-therapy-related cost differences toward the null. Therefore, the economic analysis may be somewhat conservative.

CONCLUSIONS

Depressive symptoms among adolescents are associated with increased healthcare utilization and expenditures, even among patients who only exhibit mild depressive symptoms. Only a small percentage of the increased healthcare utilization among adolescents who screened

positive for depression are attributable to increased mental health and prescription drug utilization. As in adult populations, adolescent depressive symptoms were found to be associated with marked increases in all components of medical utilization and costs. Screening adolescents for depressive symptoms in primary care settings and intervening to provide evidence-based health services interventions may help to decrease healthcare expenditures. Future studies are needed to better understand whether improving adolescent depression care could decrease non-mental health-related utilization.

Acknowledgments

Appendix

Table A1

Healthcare utilization for non-intervention adolescents (n = 3960), 12 months post-screening, by severity of depressive symptoms

Type of utilization[a]	Screen Negative[b] n=3,707	Screen Positive[b]			p
		Mild MDD n= 162	Moderate-to-Severe MDD n= 69	All MDD n= 231	
Outpatient Visits, mean (SD)	3.5 (5.1)	6.5 (8.6)	13.3 (17.7)	8.0 (15.2)	< 0.01[c]
Outpatient Mental Health Visits, mean (SD)	0.7 (3.5)	2.6 (6.5)	8.0 (15.2)	3.8 (9.3)	< 0.01[c]
Any Inpatient Care Utilization	1.2%	3.7%	10.1%	5.6%	< 0.01[c]
Any Inpatient Mental Health Utilization	0.2%	--[d]	--[d]	3.5%	--
Any Inpatient Medical Utilization	1.1%	--[d]	--[d]	3.5%	--
Any Emergency Department Utilization	11.5%	21.0%	29.5%	19.8%	< 0.01[c]
Any Antidepressant Prescription	5.0%	19.8%	34.8%	24.2%	< 0.01[c]

[a] All results are expressed as percentages unless otherwise indicated

[b] Probable depression severity was categorized by PHQ-2 and PHQ-9 screening results. A PHQ-2 score < 2 OR a PHQ-2 score ≥ 3 and a PHQ-9 score < 10 represented a probably non-depressed patient, a PHQ-9 score of 10-14 represented a probably mildly depressed patient, and a PHQ-9 score ≥ 15 represented a probable moderately-to-severely depressed patient

[c] Statistically significant difference between depression screen-negative, screen positive for mild MDD, and screen positive for moderate-to-severe MDD groups at p = 0.05 level or below

[d] Sample size too small (n ≤ 5) to report sub-categories

Table A2

Mean unadjusted healthcare expenditures (with standard deviations) non-intervention adolescents (n = 3960), 12 months post-screening by severity of depressive symptoms

Type of expenditures[a]	Screen Negative[b] ($) n =3,707	Screen Positive[b] ($)		p
		Mild Depression n= 162	Moderate-to-Severe Depression n= 69	All n= 231	
Outpatient	2,203 (4,531)	2778 (3703)	6760 (8714)	3968 (5949)	< 0.01[c]
Inpatient	334 (4,500)	545 (3679)	2772 (11285)	1210 (6940)	< 0.01[c]
Inpatient Mental Health Care	24 (730)	438 (3409)	536 (2781)	468 (3228)	< 0.01[c]
Inpatient Medical Care	310 (4427)	107 (1317)	2235 (9433)	743 (5336)	< 0.01[c]
Emergency Department	145 (801)	273 (888)	1483 (4390)	634 (2561)	< 0.01[c]
Pharmacy	280 (1,236)	430 (870)	765 (1405)	530 (1067)	< 0.01[c]
Diagnostic tests (laboratory and radiology)	108 (476)	169 (238)	287 (496)	204 (449)	< 0.01[c]
Total costs	**2,357 (7,621)**	**3323 (6786)**	**9532 (17076)**	**5178 (11250)**	**< 0.01[c]**

[a] All results are expressed as mean (SD) in 2013 US dollars

[b] Probable depression severity was categorized by PHQ-2 and PHQ-9 screening results. A PHQ-2 score < 2 OR a PHQ-2 score 3 and a PHQ-9 score < 10 represented a probably non-depressed patient, a PHQ-9 score of 10-14 represented a probably mildly depressed patient, and a PHQ-9 score 15 represented a probable moderately-to-severely depressed patient

[c] Statistically significant difference between depression screen-negative, screen positive for mild MDD, and screen positive for moderate-to severe MDD groups at p = 0.05 level or below

Abbreviations

GH	Group Health
MDD	Major depressive disorder
PHQ	Patient Health Questionnaire
PCDS	Pediatric Chronic Disease Score
ROAD	Reaching Out to Adolescents in Distress

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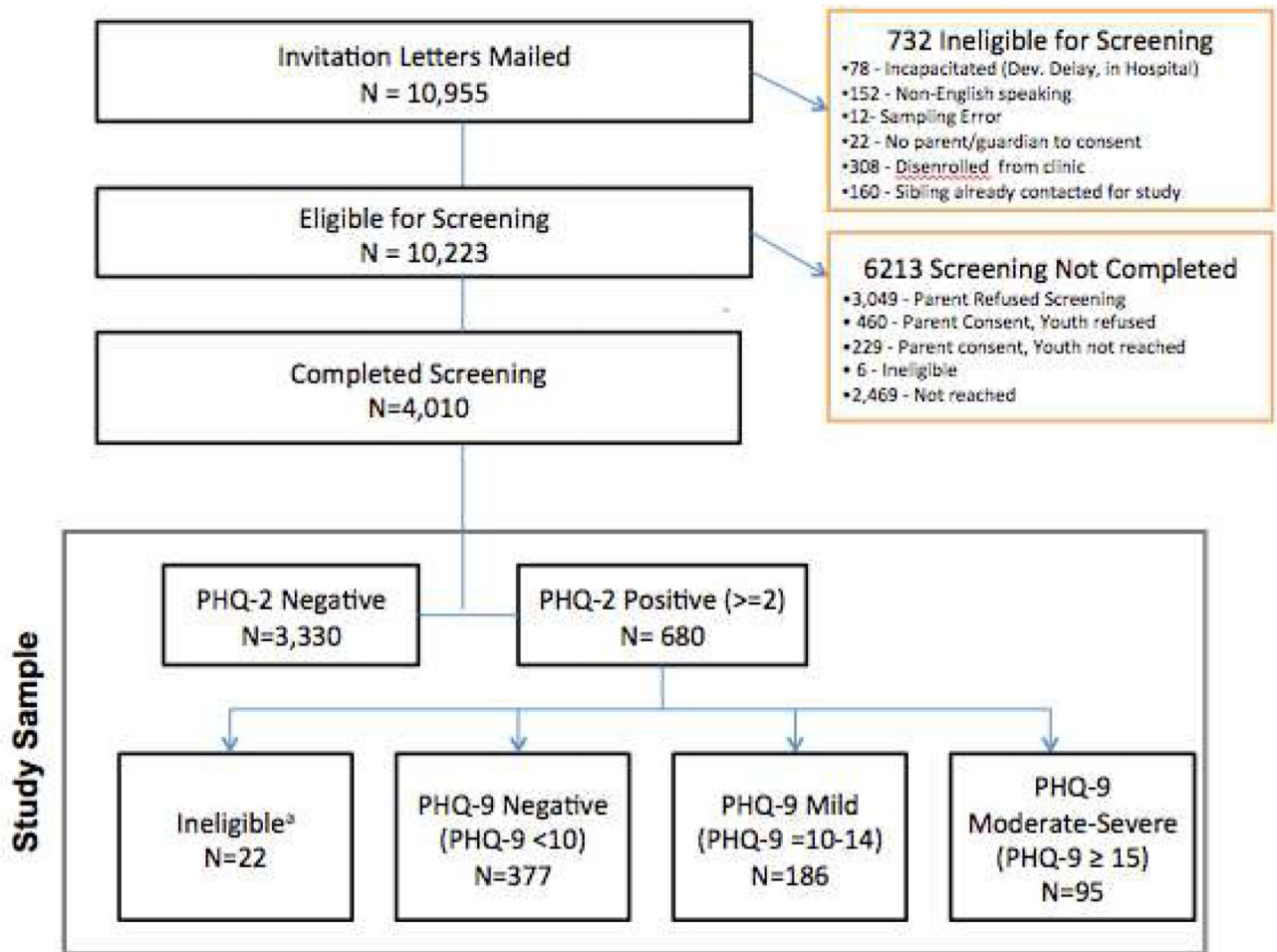
What's new on this subject: This study estimates the impact of positive adolescent depression screens, not just coded diagnoses of depression, on healthcare utilization and payer-incurred expenditures. These data inform the development of strategies to improve care for youth with depressive symptoms while minimizing costs.

a Twenty-two adolescents were categorized as ineligible due to changes in the study protocol that resulted in them not completing the PHQ-9 despite a PHQ-2 score ≥ 2.

Figure 1.
ROAD Study Sample

Table 1

Population Characteristics by Severity of Probable Major Depressive Disorder (MDD)

	Screen negative[+] n= 3707	Screen Positive[+]			p
		Mild MDD n= 186	Moderate-to-Severe MDD n= 95	All MDD n= 281	
Demographic Characteristics [a]					
Age in years, mean (SD)	15.0 (1.4)	15.3 (1.3)	15.1 (1.3)	15.2 (1.3)	0.01[c]
Female Gender	49.3%	67.2%	73.7%	69.4%	<0.01[c]
Public Insurance	8.5%	14.5%	10.5%	13.2%	0.02[c]
Race/ethnicity					0.09
White Non-Hispanic	59.5%	59.7%	67.4%	62.3%	
African-American Non-Hispanic	7.5%	8.6%	--[d]	7.5%	
Hispanic	6.7	6.5%	--[d]	6.0%	
Asian/Pacific Islander	8.3%	5.9%	--[d]	5.3%	
Other/Unknown	18.1%	19.4%	17.9%	18.9%	
Health Characteristics [§]					
Pediatric Chronic Disease Score[26]					
Total, mean (SD)	412.5 (687.7)	520.9 (655.9)	831.9 (1091.3)	626.0 (840.1)	<0.01[c]
Excluding antidepressants, mean (SD)	403.4 (673.6)	472.5 (627.8)	725.4 (902.3)	558.0 (740.3)	<0.01[c]
BMI z-score, mean (SD)	0.48 (0.98)	0.66 (1.0)	0.67 (0.99)	0.66 (1.0)	0.02[c]
Obese	9.2%	13.9%	12.6%	13.5%	0.03[c]

[b] Probable depression severity was categorized by PHQ-2 and PHQ-9 screening results. A PHQ-2 score < 2 OR a PHQ-2 score ≥ 3 and a PHQ-2 score < 10 represented a probably non-depressed patient, a PHQ-9 score of 10-14 represented a probably mildly depressed patient, and a PHQ-9 score ≥ 15 represented a probable moderately-to-severely depressed patient

[a]All results are expressed as percentages unless otherwise indicated

[c]Statistically significant difference between depression screen-negative, screen positive for mild MDD, and screen positive for moderate-to severe MDD groups at p = 0.05 level or below

[d]Sample size too small (n ≤ 5) to report sub-categories

Table 2

Healthcare utilization, 12 months post-screening, by severity of depressive symptoms

Type of utilization[a]	Screen Negative[b] n= 3,707	Screen Positive[b]			p
		Mild MDD n= 186	Moderate-to-Severe MDD n= 95	All MDD n= 281	
Outpatient Visits, mean (SD)	3.5 (5.1)	6.5 (8.2)	12.0 (15.5)	8.3 (11.5)	< 0.01[c]
Outpatient Mental Health Visits, mean (SD)	0.7 (3.5)	2.5 (6.1)	6.4 (13.3)	3.8 (9.3)	< 0.01[c]
Any Inpatient Care Utilization	1.2%	3.8%	8.4%	5.3%	< 0.01[c]
Any Inpatient Mental Health Utilization	0.2%	--[d]	--[d]	3.2%	--
Any Inpatient Medical Utilization	1.1%	--[d]	--[d]	3.2%	--
Any Emergency Department Utilization	11.5%	21.0%	29.5%	23.8%	< 0.01[c]

[a] All results are expressed as percentages unless otherwise indicated

[b] Probable depression severity was categorized by PHQ-2 and PHQ-9 screening results. A PHQ-2 score < 2 OR a PHQ-2 score < 10 represented a probably non-depressed patient, a PHQ-9 score of 10-14 represented a probably mildly depressed patient, and a PHQ-9 score 15 represented a probable moderately-to-severely depressed patient

[c] Statistically significant difference between depression screen-negative, screen positive for mild MDD, and screen positive for moderate-to severe MDD groups at p = 0.05 level or below

[d] Sample size too small (n 5) to report sub-categories

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Table 3

Mean unadjusted healthcare expenditures (with standard deviations), 12 months post-screening by severity of depressive symptoms

Type of expenditures[a]	Screen Negative[b] ($) n =3,707	Screen Positive[b] ($)		p
		Mild Depression n= 186	Moderate-to-Severe Depression n= 95	All n= 281	
Outpatient	2,203 (4,531)	2,951 (4,152)	6,067 (7,771)	4,004 (5,818)	< 0.01[c]
Inpatient	334 (4,500)	554 (3,592)	2,105 (9,701)	1,079 (6,376)	< 0.01[c]
Inpatient Mental Health Care	24 (730)	--[d]	--[d]	416 (2973)	< 0.01[c]
Inpatient Medical Care	310 (4427)	--[d]	--[d]	663 (4917)	< 0.01[c]
Emergency Department	145 (801)	411 (2,182)	1,129 (3,789)	634 (2,843)	< 0.01[c]
Pharmacy	280 (1,236)	453 (881)	654 (1,231)	521 (1,015)	< 0.01[c]
Diagnostic tests (laboratory and radiology)	108 (476)	163 (229)	257 (437)	195 (317)	< 0.01[c]
Total costs	**2,357 (7,621)**	**3,505 (6819)**	**8,173 (14,887)**	**5,083 (10,489)**	**< 0.01[c]**

[a] All results are expressed as mean (SD) in 2013 US dollars

[b] Probable depression severity was categorized by PHQ-2 and PHQ-9 screening results. A PHQ-2 score < 2 OR a PHQ-2 score ≥ 3 and a PHQ-9 score < 10 represented a probably non-depressed patient, a PHQ-9 score of 10-14 represented a probably mildly depressed patient, and a PHQ-9 score ≥ 15 represented a probable moderately-to-severely depressed patient

[c] Statistically significant difference between depression screen-negative, screen positive for mild MDD, and screen positive for moderate-to severe MDD groups at p = 0.05 level or below