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The Effect of Comorbid Anxiety and Depressive Disorders on Health Care Utilization and Costs among Adolescents with Asthma

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Abstract

Objective—To assess whether youth with asthma and comorbid anxiety and depressive disorders have higher health care utilization and costs than youth with asthma alone.

Methods—A telephone survey was conducted among 767 adolescents (aged 11 to 17 years) with asthma. Diagnostic and Statistical Manual – 4th Version (DSM-IV) anxiety and depressive disorders were assessed via the Diagnostic Interview Schedule for Children. Health care utilization and costs in the 12 months pre- and 6 months post- interview were obtained from computerized health plan records. Multivariate analyses were used to determine the impact of comorbid depression and anxiety on medical utilization and costs.

Results—Unadjusted analyses showed that compared to youth with asthma alone, youth with comorbid anxiety/depressive disorders had more primary care visits, emergency department visits, outpatient mental health specialty visits, other outpatient visits, and pharmacy fills. After controlling for asthma severity and covariates, total health care costs were approximately 51% higher for youth with depression with or without an anxiety order but not for youth with an anxiety disorder alone. Most of the increase in health care costs was attributable to non-asthma and non-mental health related increases in primary care and laboratory/radiology expenditures.

Conclusions—Youth with asthma and comorbid depressive disorders have significantly higher health care utilization and costs. Most of these costs are due to increases in non-mental health and non-asthma expenses. Further study is warranted to evaluate whether improved mental health treatment and resulting increases in mental health costs would be balanced by savings in medical costs.

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Introduction

Asthma is one of the most common chronic medical conditions and is associated with significant morbidity and functional impairment.¹ Studies have shown that youth with asthma have higher health care utilization and costs than youth without asthma,^{2,3} but that there is variation by comorbidity status. For example, youth with asthma and comorbid allergic rhinitis have been shown to have higher health care utilization and costs than those with asthma alone.⁴

Youth with asthma are also at increased risk for comorbid anxiety and depressive disorders.^{5–11} Comorbid anxiety and depressive disorders are associated with increased symptom burden and functional impairment even after controlling for asthma disease severity.^{12–14} Similarly, in adult diabetes research an increase in functional impairment and symptom burden is seen with comorbid depression.¹⁵ After controlling for severity of diabetes and medical comorbidities, adults with comorbid depression also have higher health care utilization and costs than those with diabetes alone.^{16,17} Similar patterns have been identified in patients with other chronic illnesses such as congestive heart failure.¹⁸ Data regarding health utilization among individuals with asthma are limited. Two small studies among adults with asthma suggest that comorbid psychiatric disorders associated with increased primary care visits and medication use¹⁹ and emergency room visits.²⁰

Less is known about the impact of comorbid anxiety and depressive disorders on costs and health care utilization among youth with chronic diseases. In one study of younger inner city children seen at an asthma clinic, youth with at least one anxiety or depressive disorder had a trend towards higher health service utilization and were significantly more likely to have had an emergency room visit than youth without a disorder.⁶ Although studies have shown that asthma and psychiatric disorders are independently associated with increased health care utilization and costs,²¹ no studies have been conducted examining health care costs for youth with asthma and internalizing disorder comorbidity. If youth with comorbid anxiety and depressive disorders are shown to have higher utilization and costs it may incentivize health care systems to develop case management or combined mental health and asthma treatment interventions to improve outcomes. The purpose of this study is to determine whether youth with asthma and comorbid DSM-IV anxiety and depressive disorders have higher health care utilization and costs when compared with youth with asthma alone.

Research Design and Methods

The Stress and Asthma Research (STAR) study was developed by a multidisciplinary team at the University of Washington and the Center for Health Studies at Group Health Cooperative (GHC). GHC is a nonprofit staff model health maintenance organization with 25 GHC-owned primary care clinics in Washington State and 75 external clinics that have contracts to care for GHC patients. All study procedures were approved by the GHC Institutional Review Board.

Eligibility Criteria

Potential study subjects were youth (11–17 years of age) with asthma who were enrolled in a GHC insurance plan for at least 6 months (95% of youth had been enrolled for a year or more). To be invited to participate in the study, youth had to meet at least one of the following criteria based on review of electronic medical records in the prior year:

- a. hospitalization with an asthma diagnosis and ≥ 1 asthma prescription
- b. ≥ 1 emergency room or urgent care visit for asthma and ≥ 1 asthma prescription
- c. ≥ 2 office visits for asthma and ≥ 1 asthma prescription

- d. only 1 asthma visit but ≥ 2 asthma prescriptions filled on different days
- e. ≥ 4 prescriptions for asthma medication
- f. ≥ 1 office visit for asthma in the past year and another in the past 18 months and ≥ 1 asthma prescription in the last year

These criteria were developed to identify youth with active asthma based on criteria used to identify youth who would benefit from case management in the Pediatric Asthma Care Patient Outcomes Research Team II Study.²² All interviews were conducted in English.

Study Sample

Of the 1458 youth meeting initial study criteria, 170 were ineligible leaving an eligible sample of 1288. Reasons for ineligibility included: parent reported that youth did not have asthma (n=63), disenrolled from GHC (n=84), language ineligible (n=11), parent too ill (n=6) and other (n=6). Among the eligible sample, 833 parents gave consent for their child to participate in the study. From these, child consent and interviews were completed for 781 youth, 60.6% of eligible youth. The current analysis is based on a final sample of 767 youth (permission for the use of automated data was not obtained for 12 youth and two youth did not complete the entire psychiatric interview). Full details of the sample are published elsewhere.⁵ A HIPAA waiver was obtained to collect de-identified data on study non-participants in order to compute propensity scores and weight the study results to the original sample.

Survey Methods

All potential study participants received a letter followed by a phone call to the parent and youth to invite them to participate. Consent was obtained both from a parent and the youth prior to conducting the interview. The telephone survey included a 15 minute interview of the consenting parent and 45–75 minute youth interview.

Measures

Demographics—The parent interview included questions about the child's age, race/ethnicity, marital status of the responding parent, and the education for both the responding parent and his/her partner. The families' address and zip code were used to code the median household income based on census block group as a proxy for socioeconomic status. The zip code was also used to develop Rural and Urban Commuting Area (RUCA) codes which were used to adjust for rural/urban location (<http://www.fammed.washington.edu/wwamirhrc/rucas.html>).²³ In addition, Medicaid status was included as another measure of socio-economic status.

Mental Health Assessment

All youth completed the Diagnostic Interview Schedule for Children NIMH (DISC 4.0), a structured psychiatric interview that has been shown to be reliable and valid in the diagnosis of DSM-IV disorders in children and adolescents.²⁴ After completing training and demonstrating competence, interview staff used the computer-assisted version of the DISC to guide telephone administration of this instrument. Telephone versions of structured psychiatric interviews have been shown to have a high correlation with in-person interviews for both children and adults.^{25,26} For our analysis, youth were considered to have an anxiety (panic, generalized anxiety, separation anxiety, social phobia, agoraphobia) or depressive (major depression or dysthymia) disorder if they met DSM-IV criteria for at least one of these disorders during the prior 12-month period.

Hospital Costs and Ambulatory Care Visits

Health plan administrative data were used to identify all services provided or paid for by GHC during the 12 months prior to and the 6 months following the telephone interview. These data included outpatient services for general medical or mental health care, inpatient medical and mental health services, emergency room services, pharmacy costs, lab and radiology costs, and patient co-insurance payments. GHC's cost accounting system assigns budget-based costs rather than charges (i.e., the costs of providing the services) for health services provided at GHC facilities. Services provided outside of the GHC system are assigned the cost paid by GHC. Patient out-of-pocket costs are calculated from co-pay, co-insurance and deductible charges required by GHC and only apply to services covered by the health plan. We also calculate costs of medical specialty services (non-primary care, emergency department or mental health) delivered or paid for by GHC.

Based on ICD-9 diagnostic codes on billed services, visits were classified as being asthma-related, mental health-related or neither. Similar categories were used to classify hospital costs and prescribed medications. Categories were not mutually exclusive, so if a patient had both a mental health code and asthma code on a single visit it was counted in both categories. However, this was rare with only 5 individual visits from the entire study having overlap across categories.

Asthma Severity

As with our prior research, we used an adapted HEDIS severity measure which uses a number of criteria over a 12-month period (having ≥ 4 ambulatory visits for asthma, ≥ 1 emergency room visit, ≥ 1 hospitalization for asthma, or ≥ 1 oral steroid prescriptions) to define severity of asthma.¹²

Medical Comorbidity

We used the Pediatric Chronic Disease Scale (PCDS) to measure health-related medical comorbidity not due to asthma or mental illness. Using claims data for prescription fills, the PCDS is an algorithm that classifies children into chronic disease categories. Studies have shown²⁷ that the PCDS performs as well as the ICD-9-CM-based Ambulatory Care Groups²⁸ in predicting subsequent one-year health utilization and health care costs. For this study, we adapted the PCDS by removing medications used primarily for asthma, anxiety and depression.

Statistical Analyses

To address possible non-response bias, all analyses were conducted using propensity score response weighting. We estimated propensity response scores (probability of being a respondent) for each individual as a function of the following variables (all of these within the past year): age, gender, RUCA code, being on Medicaid, having Washington State insurance because of low income, PCDS, number of primary care visits, number of asthma-related emergency room visits and hospitalizations, oral steroid prescription, number of specialty mental health visits, any prescription for antidepressant or anti-anxiety medication, and a diagnosis of depression or anxiety. Propensity response score weights were then applied in all the analyses after being rescaled to sum to the observed sample size (i.e. the number of survey respondents) such that respondents with a low probability of response were given a higher weight in the analysis to represent the larger number of non-respondents with similar characteristics.

By cross-tabulating youth with anxiety and depressive disorders we formed 4 groups (both disorders, depression only, anxiety only, and no disorders). Chi-square statistics and F-tests

were used to determine the statistical significance of anxiety and depressive disorder group differences on demographic, clinical and severity characteristics of the youth. In the event of a significant F or chi-square test, we performed three planned follow-up tests to determine if the three groups with at least 1 anxiety/depressive disorder differed from each other. Based on these analyses, we found that the three groups did not differ on any demographic or clinical variables. For this reason, and because the sample sizes of the groups were fairly small, we present the cost and utilization results as a two group comparison between those with and without at least 1 anxiety/depressive disorder. However, to examine possible mediation and moderation of these two variables, the cost modeling treated the presence or absence of a depressive and/or an anxiety disorder as two distinct dichotomous variables.

Health care utilization was examined in the following categories: inpatient, outpatient primary care, outpatient specialty care, outpatient mental health care, emergency department, other outpatient visits (such as physical therapy), and pharmacy fills. Categories were further subdivided to reflect those costs that were attributable to asthma, mental health, and neither. Due to the skewed nature of utilization data, non-parametric Kruskal Wallis ranked statistics and median tests were used to test for significant differences in each category of utilization. Because results were very similar, we report only the Kruskal Wallis p-values.

Unadjusted raw costs were examined across the various cost categories. To determine differences between the anxiety/depressive disorder groups we performed several types of analyses (parametric F tests on the raw data, parametric F tests on log-transformed data, median tests, and Kruskal-Wallis Rank tests) all of which yielded similar results. For simplicity and consistency, we report only the Kruskal-Wallis test.

To examine the relationship between health care costs and anxiety and depressive disorder groups we utilized a two-part model, which has been shown to work well for skewed cost data.²⁹ In the first part, logistic regressions were used to obtain odds ratios (ORs) for the probability of having *any* health care costs over 18 months within a given category, adjusting for asthma severity and all variables that were statistically different between the anxiety and depressive disorder groups in the univariate analysis. Only categories with enough variation in usage could be used for these analyses. To examine for potential effect modification, all interactions between asthma severity, anxiety diagnosis, and depression diagnosis were tested. In the absence of significant effect modification, models were fitted without the interaction terms.

In the second part of the model, the cost data were log-transformed to normalize the distribution. The two dependent variables were the natural log transformed outpatient costs and total health care costs (outpatient + inpatient costs). The independent variables were depression diagnosis, anxiety diagnosis, and asthma severity level. We again tested for effect modification by asthma severity. We first tested for heteroskedasticity of the log-transformed data. Cost ratios of estimated median health care costs and their 95% confidence intervals were calculated. For the component cost categories only patients with non-zero costs in a given category were used in the corresponding analysis.

To test the role of anxiety as a mediator in the relationship between depression and cost, we fit three regression models for each of the 2 dependent variables. For partial or full mediation by depression to occur the following conditions must hold: 1) anxiety is significantly related to costs; 2) anxiety is related to depression; 3) depression is related to costs; and 4) when anxiety and depression are both in the model, the effect of anxiety on costs is significantly reduced. Sobel's test was used to quantify the degree of mediation.³⁰ Following the methods of Preacher and Hayes,³¹ we calculated the mediation model effects and the Sobel statistic and variance using a bootstrapping SPSS Macro. Five thousand samples with replacement were used. This method was chosen because it is a nonparametric approach to deriving estimates and their

confidence intervals. All mediation tests were conducted only after testing for moderation. We did not test for mediation of anxiety or depression by asthma severity, because neither anxiety nor depression was related to the severity of asthma in this sample and this relationship needs to be statistically significant in order to test for mediation.³²

Results

A total of 16.2% (n = 125) of youth with asthma met DSM-IV criteria for ≥ 1 anxiety or depressive disorders in the last 12 months with 68 (8.9%) meeting criteria for an anxiety disorder alone, 20 (2.5%) a depressive disorder alone, and 37 (4.8%) both an anxiety and depressive disorder. Compared to youth without an anxiety or depressive disorder, youth with any disorder were significantly more likely to be female, to have a parent with high school education or less, to have a parent who is not currently married, to be a Medicaid recipient, and have a higher PCDS score (Table 1). There were no differences in the modified HEDIS measure of severity between asthmatic youth with or without a disorder. There were also no significant differences among the three groups with any anxiety or depressive disorders.

In the unadjusted analyses, youth with a disorder had significantly more total primary care visits for mental health and non-asthma non-mental health reasons (Table 2). The youth with anxiety/depressive disorders had significantly more specialty outpatient mental health and ‘other’ outpatient visits, but significantly less specialty visits for asthma than youth without a disorder. Youth with a disorder had more emergency department (ER) visits due to mental health and other non-asthma related causes. Youth with any disorder also had significantly more pharmacy fills than those without a disorder; however, this increased utilization was not attributable to asthma medications.

Because youth were sampled based on health care utilization, all youth in the sample had at least some costs during the study period. Most of these costs were in the outpatient setting. Only 5.6% of youth with an anxiety or depressive disorder and 3.4% of youth without a disorder had any inpatient costs (Table 3). Two youth with an anxiety or depressive disorder and four without had inpatient costs in a mental health setting. Youth with a disorder were more likely than youth with no disorder to have any outpatient mental health costs, ER costs, and out of pocket costs.

In the first part of the model, eight cost categories had enough variation to be examined (Table 3). None of the interactions between asthma severity and depression/anxiety group approached significance and there was no evidence of an interaction between depression and anxiety (although due to the small sample sizes in some of the cells, this test was probably underpowered). Therefore, interaction terms were not included in the final models. The unadjusted analyses showed that in the outpatient mental health, ER, and patient out of pocket cost categories, having ≥ 1 anxiety/depressive disorder was significantly and independently related to the probability of having any costs. In adjusted analyses, only having any ER costs [OR = 1.92, 95% CI = 1.22 – 3.02, p = .005] and any outpatient mental health costs [OR = 2.62, 95% CI = 1.60 – 4.28, p < .001] were significantly different between the groups.

The unadjusted health cost data showed similar patterns across groups (Table 4). Youth with an anxiety/depressive disorder had significantly higher total outpatient, primary care, outpatient mental health care, ER, other outpatient, and lab and radiology costs.

In part two of the 2-part model, we performed linear regressions using only those patients who had costs in a given category. All analyses controlled for asthma severity, child gender, parental marital status, parental education, Medicaid status, and PCDS. As with part one, none of the interaction terms approached significance and were not included in the final model. We found that the adjusted cost ratio of 18-month median *total outpatient costs* were 51% greater (95%

CI – 4% to 118%) for youth with a depression diagnosis (with or without anxiety disorder), 36% higher for youth with at least 1 HEDIS asthma severity measure (95% CI – 18% to 58%), and 112% higher for youth with >2 HEDIS measures (95% CI – 69% to 166%). Due to the small proportion of youth hospitalized in this sample, the results of the regression analyses for total outpatient and total costs were very similar. Youth with an anxiety diagnosis alone did not have statistically significant higher median cost ratios than youth without an anxiety disorder in either analysis.

As can be seen in Figure 1, the total effect of having an anxiety diagnosis on total health care costs was .26 ($p = .009$). However, when the effect of anxiety is mediated by depression, then the indirect effect of anxiety is only .13 and is non-significant ($p = .25$). The Sobel test was statistically significant ($z = 2.80$, $p = .005$) indicating significant mediation by depression in the relationship between anxiety and health care costs. The relationship between anxiety and depression is strong (coefficient = .32, $p < .0001$). Very similar results were found for total outpatient costs, which also had significant mediation by depression (Sobel test $z = 3.02$, $p = .003$), and total non-asthma-related costs (Sobel test $z = 2.82$, $p = .005$). As a sensitivity analysis we looked at the mediation of depression on health care costs by anxiety, and anxiety was not a significant mediator of the relationship between depression and costs (Sobel test $z = 1.36$, $p = .17$).

Discussion

In a community-based sample of insured youth with asthma, we found that meeting DSM-IV criteria for a depressive disorder with or without an anxiety disorder, but not anxiety disorder alone, was associated with significantly increased health care utilization and health care costs compared to youth without a disorder. Although prior studies have suggested increased health care utilization for youth with asthma and comorbid anxiety or depression,⁶ this is the first study among children with asthma to examine the impact of comorbid depression and anxiety on health care costs and suggests that youth with depression have expenditures above and beyond those for asthma. These findings are consistent with findings in adults with chronic diseases and comorbid depression who have been shown to have increased use of health care services and increased health care costs.^{16–18}

A new finding of this study is that associations between increased costs and anxiety disorders are mediated by depression. Most cost studies have examined anxiety or depression as discrete entities and have not evaluated mediation. Approximately 65% of youth with depression have comorbid anxiety, and studies have shown that comorbidity is associated with higher depressive severity.^{33,34} Thus, one possible reason for increased costs in youth is that depression presence is an indicator of higher mental health symptom severity. As these data are cross-sectional and not longitudinal, we cannot determine the direction of association between anxiety and depression.

Another possible explanation is that the type of anxiety disorders may differ among youth who develop depression compared to those who do not. In our study, we found that youth with comorbid depression and anxiety were more likely to have panic disorder and generalized anxiety disorder (GAD).⁵ In contrast, youth with anxiety disorders alone were more likely to have social phobia and separation anxiety, syndromes that may make youth more reluctant to interact with providers in the medical system. Both panic and GAD have been shown to be associated with increased health care utilization and costs in adult studies,^{35,36} and have been associated with increased asthma severity in a study in youth.³⁷ The current study did not have adequate sample size to evaluate individual anxiety disorders but this is an area worthy of further evaluation. Another difference between our study and these prior studies, is the fact that our sample was recruited from an insured population-based sample rather than a clinic-

based sample^{6,19,20} and/or a high risk inner city population^{6,20}. Both of these latter two groups may be at higher risk for comorbidity and may have a higher risk for health care utilization.

Because we have previously found that youth with comorbid depression and anxiety disorders have more asthma-related symptom burden and functional impairment,^{12,38} we were surprised to find that these youth did not have higher costs related to asthma. In fact, youth with these comorbid diagnoses were less likely to have been seen in specialty settings for asthma. Instead, the increased costs are primarily attributable to non-asthma-related primary care services and increased diagnostic testing with only a small proportion of the increased utilization and costs accounted for by increased mental health care. In a prior study, we found that depressed and anxious youth with asthma were not only more likely to report symptoms related to asthma but were also more likely to report more non-specific symptoms such as headache.¹² Prior studies also suggest that otherwise healthy youth with depressive and anxiety disorders have an average of 4 visits more per year compared to those without.³⁹ It is possible that this increase in costs is due to an increase in utilization and subsequent medical testing due to increased nonspecific somatic complaints (i.e. headache, fatigue).

This study has some limitations. First, we are reliant on claims data for service utilization and cannot judge actual causes and appropriateness of service use. We also used claims data for determining the reason for a visit. If visits were not coded properly it would result in misclassification of costs. Given concerns about reimbursement for mental health, the most likely bias is for providers to not code for a mental health disorder even if they know that it is present.⁴⁰ This bias is less likely to be a concern in a capitated system, such as the one in our study, where providers are reimbursed regardless of the diagnosis. Second, these data come from youth in the Northwest who are enrolled in a staff-model non-profit health maintenance organization and may not be generalizable to other populations. Third, the response rate was 60.5% which may have introduced non-response bias. To address this possibility, all analyses were propensity weighted to more closely approximate the original study population. Finally, unlike diabetes, severity measures for asthma are based on either symptom reporting or health care utilization. We have previously shown that symptom reporting is closely associated with anxiety and depressive diagnoses,¹² and health care utilization is by definition associated with health care costs. As a result, the lack of an objective measure such as pulmonary function testing limited our ability to measure the relative contribution of asthma severity to costs and utilization when compared to anxiety and depression. We did evaluate for effect modification by the HEDIS severity measure and found that anxiety and depression were associated with increased medical costs across the asthma severity spectrum.

A main strength of this study is the ability to link to health care utilization records as well as the completeness of the cost accounting system at GHC which allows for a thorough and standardized approach to evaluating costs. Prior research on health care utilization for youth with asthma and internalizing disorders has relied on parental self-report of both asthma diagnosis and health care utilization which may be subject to recall bias.⁶ An additional strength is the independent assessment of psychiatric disorders via a standardized diagnostic interview. Prior studies examining health care utilization and costs for youth with mental health disorders have relied on physician diagnosis or parental identification.²¹ Youth detected in this manner may have more severe disease or may be more likely to seek treatment which may result in biased cost estimates.

The results of this study have important implications. Youth with asthma and comorbid anxiety and depressive disorders have increased health care utilization and health care costs which are predominantly due to increases in the use of non-asthma and non-mental health services. The apparent increase in costs in youth with comorbid anxiety and depressive disorders and asthma

is mediated by the presence of depressive disorders. Studies of adults with diabetes and depression have shown that the cost of providing more effective screening and effective treatment of depression was offset by medical cost savings.⁴¹ Future studies should examine whether outpatient medical costs in youth with asthma and comorbid depression could be decreased by improving the diagnosis and delivery of effective treatment of mental health disorders among youth with asthma.

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Figure 1.
Association between Anxiety and Health Care Costs with and without Depression in the Model

Table 1

Characteristics of Youth Stratified by Anxiety or Depressive Disorder Grouping (N = 767, unless otherwise specified)

	Both Depression and Anxiety (N = 37)	Depression Only (N = 20)	Anxiety Disorder Only (N = 68)	No Disorder (N = 642)	Test Statistic X²(3) or F (3,763)
	N (%) or M ± SD	N (%) or M ± SD	N (%) or M ± SD	N (%) or M ± SD	
Female Gender	26 (70.3)	12 (60.0)	42 (61.8)	276 (43.0)	19.42***
Age	14.6 ± 2.0	14.4 ± 1.6	13.9 ± 2.1	14.0 ± 1.9	1.63
Parental Education - at least some college (N = 757)	29 (78.4)	18 (90.0)	58 (87.9)	592 (93.2)	12.19**
Caucasian Parent (N = 754)	29 (80.6)	16 (80.0)	46 (69.7)	514 (80.6)	5.10
Non-Hispanic Ethnicity (N 753)	33 (89.2)	19 (95.0)	62 (93.9)	605 (95.9)	3.88
Married Parent (N = 756)	21 (58.3)	16 (80.0)	33 (50.0)	481 (75.7)	24.44***
GEO Median Income (N = 742)	46543 ± 16567	48905 ± 14708	47084 ± 19449	51091 ± 16806	1.81
Medicaid Recipient	8 (21.6)	1 (5.0)	17 (24.6)	79 (12.3)	11.30**
Years since diagnosis of Asthma (N = 753)	6.8 ± 4.8	6.7 ± 4.0	6.1 ± 4.2	7.4 ± 4.3	1.95
Pediatric Chronic Disease Score (PCDS)	1089.8 ± 1167.3	805.1 ± 1064.4	629.4 ± 701.2	580.5 ± 962.5	3.66*
Modified HEDIS Asthma Score					
Low	23 (63.9)	13 (65.0)	47 (68.1)	454 (70.6)	5.38 df=6
Intermediate	8 (22.2)	7 (35.0)	17 (24.6)	139 (21.6)	
High	5 (13.9)	0 (0.0)	5 (7.2)	50 (7.8)	

*
p < .05**
p < .01;***
p < .001

Table 2**Health Care Utilization for Youth with and without any Anxiety/Depressive Disorder**

	No Disorder (N = 642)	≥ 1 Anxiety / Depressive Disorder (N = 125)	Kruskal Wallis Test
	Mean (95% CI) Median	Mean (95% CI) Median	P value
Inpatient Total	0.05 (0.02 – 0.07) 0	0.06 (0.02 – 0.11) 0	0.14
Asthma-related	0.02 (0.01 – 0.03) 0	0.02 (0.00 – 0.05) 0	0.44
Physical	0.02 (0.01 – 0.04) 0	0.03 (0.00 – 0.06) 0	0.24
Mental Health	0.01 (0.00 – 0.01) 0	0.01 (0.00 – 0.03) 0	0.40
Outpatient Primary Care Total	5.4 (5.1 – 5.8) 4	7.0 (6.1 – 7.9) 6	<0.001
Mental Health	0.06 (0.04 – 0.09) 0	0.4 (0.17 – 0.63) 0	< 0.001
Asthma	1.1 (1.0 – 1.2) 1	1.2 (0.9 – 1.4) 1	0.66
Non-Asthma or Mental Health	4.3 (4.0 – 4.6) 3	5.4 (4.6 – 6.2) 5	0.002
Outpatient Specialty Care Total	1.9 (1.7 – 2.1) 1	1.9 (1.4 – 2.3) 1	0.90
Asthma	0.4 (0.3 – 0.5) 0	0.2 (0.1 – 0.3) 0	0.01
Non-Asthma	1.5 (1.3 – 1.6) 1	1.7 (1.2 – 2.1) 1	0.43
Specialty Outpatient Mental Health Visits	1.1 (0.7 – 1.4) 0	2.7 (1.2 – 4.1) 0	<0.001
Other Outpatient Specialty Visits	0.8 (0.6 – 1.0) 0	1.9 (1.0 – 2.7) 0	0.03
Emergency Room Visits Total*	0.6 (0.5 – 0.7) 0	1.3 (0.8 – 1.7) 0	<0.001
Mental Health	0.01 (0.00 – 0.02) 0	0.05 (0.00 – 0.11) 0	.03
Asthma	0.12 (0.1 – 0.2) 0	0.17 (0.1 – 0.2) 0	0.15
Non-Asthma or Mental Health	0.44 (0.3 – 0.5) 0	1.04 (0.6 – 1.4) 0	<0.001
Number of Prescriptions	18.8 (17.0 – 20.7) 14	21.5 (18.7 – 24.3) 17	0.003
Asthma	9.2 (8.6 – 9.8) 7	8.8 (7.3 – 10.2) 6	0.51
Non-Asthma	9.6 (8.0 – 11.2) 5	12.7 (10.5 – 15.0) 9	<0.001

* Includes urgent care

Table 3

Number and Percent of Youth with Any Costs in Each Category, Unadjusted and Adjusted Tests for Anxiety / Depression Group Differences

	Total Number	No Disorder (N = 642)	≥ 1 Anxiety/ Depressive Disorder (N = 125)	Fisher's Exact p value for group differences	Adjusted* Odds Ratio For Group Differences OR (95% CI)
	N (%)	N (%)	N (%)	p	
Total Inpatient	29 (3.8)	22 (3.4)	7 (5.6)	.30	1.78 (0.66 – 4.77)
Physical	25 (3.2)	18 (2.8)	7 (5.6)	.16	
Mental Health	6 (0.8)	4 (0.6)	2 (1.6)	.25	
Total Outpatient	767 (100)	642 (100)	125 (100)	1.00	
Primary Care	752 (97.9)	630 (98.0)	122 (98.4)	1.00	1.18 (0.25 – 5.46)
Specialty Care	503 (65.5)	423 (65.9)	80 (64.5)	.76	0.83 (0.53 – 1.24)
Outpatient MH	112 (14.6)	79 (12.3)	33 (26.6)	< .001	2.62 (1.60 – 4.28)
Other Outpatient	306 (39.8)	248 (38.6)	58 (46.4)	.11	1.30 (0.86 – 1.97)
ER	195 (25.4)	147 (22.9)	48 (38.7)	< .001	1.92 (1.22 – 3.02)
Pharmacy	765 (99.6)	640 (99.7)	125 (100)	1.00	
Lab/Radiology	545 (70.4)	450 (70.0)	95 (76.0)	.20	1.19 (0.74 – 1.94)
Total GHC Costs	767 (100)	643 (100)	125 (100)	1.00	
Asthma	760 (98.9)	635 (98.8)	125 (100)	.37	
Non-Asthma	758 (98.7)	634 (98.8)	124 (99.2)	1.00	
Patient Out of Pocket Costs	669 (87.1)	569 (88.6)	100 (80.6)	.02	0.68 (0.33 – 1.41)

* Adjusted for asthma severity, sex, parental education, parental marital status, Medicaid status, and PCDS.

Table 4
Unadjusted Costs for Youth with and without Anxiety/Depressive Disorders

	No Disorder (N = 642)	≥ 1 Anxiety / Depressive Disorder (N = 125)	Kruskal Wallis Test
	Mean (95% CI) Median	Mean (95% CI) Median	
Inpatient Total	466.6 (141.6 – 791.6) 0	359.9 (87.8 – 632.0) 0	.15
Physical	443.8 (119.8 – 767.9) 0	275.0 (48.5 – 501.4) 0	.14
Mental Health	22.8 (-1.4 – 46.9) 0	84.9 (-48.0 – 217.9) 0	.40
Outpatient Total	3180.4 (2709.4 – 3651.5) 1972.4	3887.9 (3219.2 – 4556.6) 2828.5	< .001
Primary Care	718.2 (665.6 – 770.9) 576.1	884.9 (742.1 – 1027.7) 701.1	.003
Specialty Care	346.0 (309.5 – 382.4) 218.1	330.6 (253.6 – 407.6) 197.8	.93
Outpatient MH	129.2 (92.8 – 165.6) 0	353.7 (191.5 – 516.0) 0	< .001
ER *	272.0 (181.4 – 362.6) 0	482.9 (281.4 – 684.4) 0	< .001
Pharmacy	1057.6 (719.0 – 1396.1) 538.6	870.4 (721.4 – 1019.4) 694.3	.03
Lab and Radiology	158.7 (136.9 – 180.5) 58.1	216.4 (170.4 – 262.4) 138.1	.001
Other Outpatient	498.7 (299.2 – 698.2) 0	748.9 (355.4 – 1142.0) 2.4	.03
Total GHC Costs (Inpatient + Outpatient)	3647.0 (3039.3 – 4254.8) 2056.2	4247.8 (3472.2 – 5023.4) 2991.0	< .001
Asthma	1067.6 (820.9 – 1314.4) 497.3	916.9 (617.9 – 1215.8) 434.9	.56
Non-Asthma	2579.4 (2058.3 – 3100.4) 1267.1	3330.9 (2631.8 – 4030.1) 2135.6	< .001
Patient Out of Pocket	360.3 (325.9 – 394.8) 236.5	379.3 (301.2 – 457.5) 239.4	.92

* Includes urgent care