Pediatric Anxiety Disorders: A Cost of Illness Analysis

Jeffrey E. Pella[1] · Eric P. Slade[2] · Paige J. Pikulski[1] · Golda S. Ginsburg[1]

Abstract

Few studies provide information about the clinical correlates of economic costs in pediatric anxiety disorders. This study uses baseline data from a randomized trial involving 209 children and adolescents with clinical anxiety to examine clinical and demographic correlates of direct and indirect costs. Measured costs included the direct costs of mental health services and the indirect costs resulting from children's missed school and parents' missed work. Validated measures of anxiety and depression severity and of internalizing and externalizing behaviors were reported by youth, their parents, and independent evaluators. Seventy-two percent of youth ($n = 150$) had positive costs. Among these youth, the mean annual total cost was $6405 ($sd$ = $11,674$), of which $5890 represented direct cost and $4658 represented indirect cost. Higher average costs were correlated with greater child anxiety and depression severity ($p < 0.001$). Most pediatric anxiety disorders result in substantial individual and family costs, and costs may increase rapidly with elevated anxiety severity and depressed mood.

Keywords Pediatric anxiety · Cost-of-illness · Anxiety disorders · Predictors of cost

Introduction

Pediatric anxiety disorders affect an estimated 32% of children and adolescents in their lifetime in the U.S. and can result in impairments across multiple domains of functioning (Merikangas et al. 2010; Swan and Kendall 2016). By expressing morbidity impacts in financial terms, cost-of-illness (COI) estimates help provide context for the burden of illness, and may be useful for characterizing the economic benefits of mental health interventions. This study provides COI estimates of pediatric anxiety disorders in a sample of children and adolescents who participated in a randomized controlled

school-based intervention study, and examined associations of anxiety-related costs with demographic and clinical characteristics.

Studies of the annual economic costs of pediatric anxiety disorders are rare, and none have been conducted using data from the United States. Bodden and colleagues conducted a cost of illness study among children ($N = 118$) 8 to 18 years old in the Netherlands, inclusive of all anxiety disorders (Bodden et al. 2008). Annual average costs per family, estimated using data from parent cost diaries, were €2748 (or approximately $3215) per family. Costs were attributable to institutional care (26%), day treatment (23%), loss of productivity for parents (23%) and absence from school (17%). Although average cost was positively related to child age, no average cost differences were found for gender, anxiety severity, or number of diagnoses (mean 2.6 diagnoses for the sample). Van Steensel and colleagues compared the cost of anxiety disorders among three groups of children in the Netherlands: children with an anxiety disorder only ($n = 34$), children with an autism spectrum disorder and comorbid anxiety disorders ($n = 73$), and children with no disorder ($n = 87$) (van Steensel et al. 2013). Using a retrospective cost questionnaire, children in the anxiety only group had costs of €860 (or $1006; 95% CI: €439 to €1336) during the prior 3 months. Costs were close to evenly split between additional health care costs (€417 per child) and non-health care costs (€423 per child). Costs due to anxiety and anxiety severity were not significantly correlated. Other correlates of costs were not examined.

✉ Jeffrey E. Pella
  Pella@uchc.edu

  Eric P. Slade
  Eslade@jhu.edu

  Paige J. Pikulski
  ppikulski@uchc.edu

  Golda S. Ginsburg
  Gginsburg@uchc.edu

[1] Department of Psychiatry, University of Connecticut School of Medicine, 65 Kane Street, West Hartford, CT 06119, USA

[2] The Johns Hopkins University School of Nursing, 525 North Wolfe Street, Baltimore, MD 21205, USA

The current study used baseline data from a randomized clinical trial to examine the cost of disorders as well as demographic and clinical characteristics predictors of the costs of pediatric anxiety (see Ginsburg et al. 2019). This study included children and adolescents from diverse socioeconomic populations (central Connecticut and urban Maryland) and validated measures of psychopathology (e.g. *Child Behavioral Checklist and Clinical Global Impression -Severity (CGI-S) Scale*). We hypothesized that higher anxiety severity, having comorbid anxiety disorders, comorbid depression and internalizing/externalizing behavioral problems would be positively related to cost.

Method

Sample

Two-hundred and nine children and adolescents between the ages of 6 and 18 years were enrolled in elementary, middle, and high schools in central Connecticut (26 schools, $n = 85$) and urban Maryland (33 schools, $n = 124$) were enrolled (See Table 2 for additional demographic information). All children met criteria for a DSM-IV primary anxiety disorder based on the Anxiety Disorders Interview Schedule for DSM-IV (Silverman and Albano 1996). Primary diagnoses included generalized anxiety disorder (GAD; 64%), social phobia (SP; 22%), and separation anxiety disorder (SAD; 14%). Sixty-nine percent ($n = 144$) had at least one comorbid psychiatric disorder, and 56% had a comorbid anxiety disorder ($n = 117$).

All study procedures were approved by participating sites' Institutional Review Boards and by school districts and principals. All participants signed informed consent and assent prior to completing any study tasks.

Measures

Service Utilization (Direct Cost) and Missed School and Work Days (Indirect Cost)

Estimates of the direct treatment costs, indirect costs and total costs (i.e., direct plus indirect) during a 12-month time period were obtained using survey information combined with external information about the average costs of mental health and medical services, daily costs of school, and the parents' hourly wage. Measures of direct anxiety-related health care delivery costs were developed using information on mental health care services use, as reported by parents using the *Child and Adolescent Services Assessment* (CASA; Ascher et al. 1996). The CASA, administered by an independent evaluator (IE) is an inventory of mental and medical services used by children, including both general medical and specialty mental health care and substance abuse treatment services in the past

3 months. Although the CASA does collect data related to school-based services, because of validity issues, these data were not included in cost estimates. Average unit costs for these services were obtained from public mental health fee schedules (Blue Cross and Blue Shield of Massachusetts 2015; Maryland Department of Health. Public Mental Health System Rates 2015), published research studies (Rosenheck et al. 2016), and from professional online sources (www.payscale.com). Direct cost estimates were calculated by multiplying the unit costs by the quantity of services used, and then were annualized by multiplying the 3-month costs by 4.

Indirect cost estimates included the value of school days missed and the value of parents' lost work time as a result of the child's anxiety-related emotional and behavioral problems. Parents indicated the number of partial and full school days that their child missed and the number of hours of paid or unpaid labor time that parents missed. Each school day missed results in opportunity costs for unused education services (Bodden et al. 2008). We consequently valued missed school using the school expenditure per pupil per school day. The cost of a school day was measured by annual school spending obtained from public reports (Connecticut State Department of Education 2015; Maryland State Department of Education 2015) divided by required school days (see Table 1). The cost of a missed work day was estimated as a parent's assumed hourly labor cost rate times 8 (hours). To assign an hourly rate, mean hourly wages by occupation were obtained from the U.S. Bureau of Labor Statistics (2015), and were adjusted for the value of benefits and payroll taxes. For parents who were not employed for pay, we constructed an imputed wage rate using mean wages by education level. All indirect cost estimates were adjusted to reflect costs over a 12-month period.

Demographics

Demographic Characteristics

The primary caregiver reported child age, gender, family income and race/ethnicity.

Anxiety Disorder Type

Anxiety disorder type was obtained from the *Anxiety Disorders Interview Schedule for DSM-IV (*ADIS; Silverman and Albano 1996). The ADIS is a semi-structured diagnostic interview administered by trained independent evaluators. Each diagnostic category with positive symptoms was assigned a Clinician Severity Rating or CSR reflecting anxiety symptom severity and impairment level (range = 0–8; a score of 4 or higher indicated a diagnosis). The ADIS has proven to be internally consistent in samples of children and adolescents with kappa coefficients ranging from 0.80 to 0.92 (Silverman et al. 2001). Inter-rater agreement on 10% of 209 tapes ($n =$

Table 1　Unit price per service in U.S. Dollars

Service	Price (US $)	Units	Data source
Direct cost			
Mental health care services			
Inpatient psychiatric unit	1150	Single visit	Rosenheck et al. 2016
Psychiatrist office visits	114 (77)	Initial visit (subsequent visits)	Maryland Department of Health.
Mental health clinic visits	194 (60)		Public Mental Health System Rates (2015)
Psychologist/other non-MD office	124 (41)		
In-home counseling/ crisis services	257	Single visit	
Crisis hotline	17	Single call	www.payscale.com
Medical care			
Inpatient medical unit in general hospital	1150	Single visit	Blue Cross and Blue Shield of Massachusetts (2015)
Emergency department	575		
Primary care office/clinic	138		
Indirect cost			
Missed school day			
Connecticut (public school)			
Special education	163	Single day	Connecticut State Department of Education (2015)
General education	86		
Maryland (public school)			
Special education	128	Single day	Maryland State Department of Education (2015)
General education	67		
Missed work day			
Parents wage	9–97	Hourly range	United States Department of Labor (2015)

21), defined as matching on the presence of a disorder and scoring within 1 point on the CSR, was 86%.

Clinical Characteristics

Clinical characteristics included anxiety severity and comorbid emotional and behavior problems. To aid interpretation of regression coefficients, all the clinical measures were normalized using z-scores.

Clinical Global Impression -Severity (CGI-S) Scale (Guy 1976) provides a global rating of anxiety severity with scores ranging from 1 (Not at all ill) to 7 (Extremely ill). CGI-S interrater agreement, defined as scoring within 1 point on the measure, was 98%.

Child Behavioral Checklist (CBCL/6–18; Achenbach and Rescorla 2001) is a widely used parent-report measure of child psychopathology. This study utilized the Externalizing (28 items; scores range 0–56) and Internalizing problems (29 items; scores range 0–58) subscales. Each item is rated on a 3-point scale from 0 (Not True) to 2 (Very True or Often True). Higher scores indicate more behavior problems. The CBCL has proven to be internally consistent in samples of children and adolescents with alphas ranging from 0.76 and 0.85 (Achenbach et al. 2003). The Cronbach's alphas for the internalizing and externalizing subscales were. 88 and. 92, respectively.

Revised Child Anxiety and Depression Scale – child version (RCADS; Chorpita et al. 2000) This study utilized the child completed RCADS MDD subscale (10 items; scores range 0–30). Higher scores reflect greater frequency of depressive symptoms. The RCADS MDD subscale has proven to be a reliable and valid measure of depression in general and clinical populations in children and adolescents with alphas ranging from 0.78 to 0.87, respectively (Chorpita et al. 2000; Chorpita et al. 2005). The Cronbach's alpha for the MDD subscale was 0.87.

Comorbid anxiety disorder was assessed using the ADIS described above.

Analyses

The annual cost estimates of pediatric anxiety disorders were examined using descriptive statistics for the entire sample and only among those with any cost.

Examination of the relationship between anxiety severity and cost was conducted first using Pearson correlation, with a test of significance for rejecting the null hypothesis that the correlation equals zero. To examine correlates of costs, a negative binomial regression model was conducted in order to examine disorder type (i.e. SAD, SP and GAD), clinical characteristics (i.e. anxiety disorder type, severity, comorbidity, CBCL internalizing and externalizing symptoms,

and RCADS MDD) and demographics (i.e., gender, age, Race, Ethnicity, and study site location) as predictors of overall cost. Negative binomial regression was selected for this analysis as it allows for over-dispersion in the empirical distribution of costs (Taouali et al. 2015). Estimated coefficients (β) in the negative binomial model can be interpreted as the percentage difference in costs associated with a one-unit increase in an independent variable of interest, holding all other covariate values constant at their sample means. In order to account for missing data, multiple imputation was conducted using SPSS. The CBCL externalizing and internalizing subscales had 7.6% and 8.1% missing data, respectively. The RCADS depression subscale had 13.9% missing data, while comorbid status had 0.0%. No demographics variables had missing data, except child ethnicity (6.7%). Cost of illness had 6.7% missing values. In estimating imputed values, all dependent and independent variables from the negative binomial regression were utilized. As a result, all 209 children and adolescents in the original sample were included. The multiple imputation procedure was used to generate 10 samples with imputations, and the regression results represent the average of these ten (Rubin 1987; Bodner 2008).

In order to test the robustness of the regression model, a sensitivity analysis was conducted which removed students who received in-home crisis services. In-home crisis services were removed, as this may not be a representative service for this population, as it is specialized and often reserved for children that may otherwise require institutionalization. Since the study recruitment specified that students were non-institutionalized and since child anxiety is rarely by itself a reason for long-term institutionalization, these students were excluded.

Results

Child and School Characteristics

Table 2 presents child and school characteristic descriptive statistics. Approximately half of the participants were male (51.2%) and had a family income under $80,000 per year (49.3%). The majority of the sample was non-Hispanic or Latino (81.3%) and the mean age was 10.89 years old (SD = 3.31). One hundred and thirty-three children had a primary diagnosis of GAD (63.6%), 47 had SP (22.5%) and 29 had SAP (13.9%). One hundred and forty-four children had a comorbid anxiety disorder diagnosis (68.9%). Twelve children from Connecticut (10%) and 6 children from Maryland (7%) schools were enrolled in special education services.

Cost of Pediatric Anxiety Disorders

The average annual costs (raw scores) of pediatric anxiety disorders (U.S. Dollars) are presented in Table 3. Among families

Table 2 Sample characteristics

Characteristics	Overall (N = 209)
Demographics	
Gender (male)	107 (51.2%)
Ethnicity (not Hispanic or Latino)	170 (81.3%)
Family income (under $80,000)	103 (49.3%)
Age, mean (SD)	10.9 (3.3)
Clinical characteristics	
Primary diagnosis	
Generalized anxiety disorder	133 (63.6%)
Social phobia	47 (22.5%)
Separation anxiety disorder	29 (13.9%)
Comorbid anxiety disorder	144 (68.9%)
Separation anxiety disorder	20 (9.6%)
Social phobia	50 (23.9%)
Generalized anxiety disorder	36 (17.2%)
CGI-S, mean (SD)	5.2 (0.8)
CBCL internalizing, mean (SD)	16.3 (10.2)
CBCL externalizing, mean (SD)	7.5 (8.1)
RCADS depression, mean (SD)	9.0 (6.0)
School characteristics	
Connecticut school district	130 (60.2%)
Maryland school district	79 (39.8%)
Connecticut special education	22 (10.2%)
Maryland special education	16 (7.4%)

with any costs (n = 150), the mean annual total cost was $6405 (sd = $11,674), direct cost was $5890 (sd = $14,690) and indirect cost was $4658 (sd = $6614). Thirty-six families (17%) used any mental health services (e.g. psychologist, psychiatrist), and among them had a mean cost of $8615 (sd = $18,633). Mental health service types with the highest frequency of use included psychologists (n = 23, 11%) and psychiatrist office visits (n = 14, 7%). Forty-two families (20%) utilized medical care as treatment for anxiety and had a mean cost of $1591 (sd = 2252). The medical care service with the highest frequency was primary care visits (n = 29; 14%). Regarding indirect costs, 60% (n = 126) of children missed partial or full school days and 18% (n = 38) of parents missed work to stay home with their children because of their child's anxiety.

Pearson Correlation

Anxiety severity and total cost estimates were significantly correlated, $r(195) = 0.202$, $p = 0.004$.

Regression Model Estimates

The results of the regression analyses are presented in Table 4. When examining clinical characteristics within the same negative

Table 3 Annual cost of pediatric anxiety disorder per child, by category (U.S. dollars, 2016)*

Category	Full sample			Children with any costs in category						
	n	mean	sd	n	%	mean	sd	min	median	max
Total cost of illness	195	4952	10,604	150	72	6405	11,674	70	3225	106,870
Direct costs	196	1923	8797	64	31	5890	14,690	70	1315	106,870
Indirect costs	186	3113	5831	125	60	4658	6614	403	2642	57,603
Mental health care services	198	1566	8531	36	17	8615	18,633	70	3390	106,174
Inpatient psychiatric unit	209	22	318	1	0	4600	0	4600	4600	4600
Psychiatrist office visits	198	106	474	14	7	1504	1067	696	1149	4315
Mental health clinic visits	198	325	3202	8	4	8048	14,749	740	3330	44,400
Psychologist/other non-MD office visits	209	544	2261	23	11	4946	5058	860	2340	17,880
Crisis hotline	198	1	9	3	1	70	0	70	70	70
In-home counseling/ crisis services	198	666	5542	5	2	26,357	25,807	1030	20,591	61,774
Medical care	196	341	1223	42	20	1591	2253	550	623	11,500
Inpatient medical unit	198	70	563	3	1	4600	0	4600	4600	4600
Emergency department visits	196	47	326	4	2	2300	0	2300	2300	2300
Primary care visits	209	89	243	29	14	645	258	550	550	1650
Child missed school days	190	2243	4938	126	60	3382	5743	403	2035	57,603
Parents missed workdays	189	856	2486	38	18	4258	4066	468	3079	20,995

*All costs pertain to the child unless otherwise indicated | the n values in this table represent the raw frequencies

binomial regression, among demographic factors, only study site location (Maryland) ($B = -0.93$ $p = 0.001$) significantly predicted higher overall cost estimates of anxiety. Among clinical characteristics, higher anxiety severity was strongly related to overall cost ($B = 0.25$ $p < 0.001$), followed by higher depression symptom severity ($B = 0.19$ $p < 0.001$). Internalizing and externalizing symptoms, according to parent report on the CBCL, and comorbidity, according to IE report on the ADIS, were not significant predictors of overall cost estimates. Using SP as a variable to indicate the effect of other disorders; SAD ($B = 0.64$ $p =$

Table 4 Negative binomial regression analysis with Anxiety severity, Demographics, Disorder Type and Clinical Characteristics predicting overall cost

	OR (B)	SE	P	CI
Demographics				
Gender (male)	0.06	0.16	0.71	−0.27 to 0.45
Ethnicity (Hispanic or Latino)	0.22	0.2	0.37	−0.24 to 0.81
Age	0.02	0.03	0.29	−0.08 to 0.05
Race (non-white)	−0.33	0.03	0.21	−1.23 to 0.01
Location (Connecticut)	−0.93	0.27	0.001	−1.62 to −0.35
Disorder type (primary disorder)				
Social phobia*				
Generalized anxiety disorder	−0.14	0.2	0.5	−0.57 to 0.28
Separation anxiety disorder	0.64	0.26	0.01	0.16 to 1.38
Clinical characteristics				
Comorbid anxiety disorder	0.09	0.2	0.66	−0.31 to 0.63
CBCL externalizing	0.05	0.1	0.63	−0.11 to 0.31
CBCL internalizing	−0.04	0.11	0.71	−0.34 to 0.10
RCADS depression	0.19	0.09	0.03	−0.01 to 0.34
CGI-S anxiety severity	0.26	0.1	0.01	0.05 to .50

*Reference disorder (Multiply imputed dataset $N = 209$)

Table 5 Negative binomial regression analysis with Anxiety severity, Demographics, Disorder Type and Clinical Characteristics predicting overall cost without crisis services

	OR (B)	SE	P	CI
Demographics				
Gender (male)	0.00	0.17	0.99	−0.34 to 0.34
Ethnicity (Hispanic or Latino)	0.18	0.26	0.49	−0.33 to 0.69
Age	0.02	0.03	0.57	−0.04 to 0.08
Race (non-white)	−0.40	0.23	0.11	−0.90 to 0.09
Location (Connecticut)	−0.76	0.27	0.005	−1.3 to −0.24
Disorder type (primary disorder)				
Social phobia*				
Generalized anxiety disorder	−0.13	0.20	0.52	−0.51 to 0.26
Separation anxiety disorder	0.17	0.26	0.52	−0.35 to 0.69
Clinical characteristics				
Comorbid anxiety disorder	0.25	0.24	0.30	−0.22 to 0.72
CBCL externalizing	−0.02	0.10	0.83	−0.21 to 0.17
CBCL internalizing	0.02	0.01	0.87	−0.18 to 0.21
RCADS depression	0.14	0.09	0.10	−0.03 to 0.31
CGI-S anxiety severity	0.16	0.11	0.14	0.06 to 0.38

*Reference disorder (Multiply imputed dataset $N = 209$)

0.001) was the strongest disorder predictor of higher costs followed by GAD ($B = -0.14$ $p = 0.50$).

Examining the same regression model while removing students who utilized in-home crisis services, showed that anxiety severity ($B = 0.16$ $p = 0.14$), depression symptoms ($B = 0.14$ $p = 0.10$) and separation anxiety disorder ($B = 0.17$ $p = 0.52$) were no longer significant predictors while location (Maryland) ($B = -0.76$ $p = 0.005$) remained a significant predictor of cost (see Table 5).

Discussion

This study reported estimated annual costs of pediatric anxiety disorders (i.e. GAD, SP and SAD) in a sample of school-age children and adolescents with clinical anxiety and examined clinical and demographic predictors of costs. Findings indicated that the annual mean cost was $4952 ($sd = $10,604$) for the entire sample regardless of service use and an annualized per person cost estimate of $6405 ($sd = $11,674$) for children and adolescents who utilized mental health and/or medical services for anxiety. These findings indicate that society and families incur a high cost as a result of pediatric anxiety disorders. In comparison, after adjusting for inflation, the cost of pediatric anxiety appears to be similar to the cost of pediatric attention deficit/hyperactivity disorder ($6726; Swensen et al. 2003) and higher than conduct disorder ($3997) and oppositional defiant disorder ($2827; Foster and Jones 2005). Therefore, the cost of pediatric anxiety among the most expensive common psychiatric conditions.

An examination of predictors of costs revealed that, relative to SP, SAD and GAD predicted an increased cost of 64% and minus 14%, respectively. Individual anxiety disorders have not been investigated as predictors of cost in child and adolescent populations. Separation anxiety may have predicted a higher cost, as it impacts not only the children but also results in impairment in parents' functioning. Within DSM-5, SAD is a specific diagnosis under the umbrella diagnostic category of anxiety disorders (American Psychiatric Association 2013). This diagnosis, specifically, is characterized by symptoms which may increase cost. For example, many parents accommodate their children's separation anxiety via not separating from their child, which may result in additional missed time in school and missed work. In contrast, children and adolescents with GAD may be more likely to suffer in silence, engage in less avoidance, and experience more personal distress (e.g., somatic complaints, fatigue).

Regarding demographic factors, living in urban Maryland, significantly predicted higher estimated cost of pediatric anxiety, while gender, age, ethnicity, and race did not. Findings in the cost-of- pediatric anxiety literature related to demographic predictors of cost are limited and mixed. For example, Bodden et al. found that no demographic factors significantly predicted cost, including gender, age and ethnicity. Van Steensel et al. found no differences in costs related to gender, however, child age was positively related to estimated costs. Thus, while the findings of this study are largely consistent with the pediatric anxiety literature, there appear to be inconsistencies. Additional research investigating demographic predictors of cost in child and adolescent populations is necessary.

Urban Maryland based children and adolescents had an increased cost estimate of 93% over those from central Connecticut. Several explanations for this may exist, for example, children in more densely populated areas are significantly more likely than children in rural areas to access mental health visits (Howell and McFeeters 2008). Mental health services are also more commonly available to students in urban school settings compared to rural settings (Lee et al. 2009). Among the families in the top 10% of total cost estimates, 65% were Urban Maryland residents. The single highest total cost estimate of $106,870, was also an Urban Maryland family. For perspective, the family with the second highest total cost estimate was $57,603. Upon additional examination, this family experienced long periods of homelessness. The child experienced severe SAD and required intensive daily in-home crisis services and attended outpatient mental health services, resulting in a high overall cost.

Within this school-based sample, only five families utilized in-home crisis services which had a mean cost of $26,357. Consequently, individuals with severe anxiety and high service use influenced mental health costs. The sensitivity analysis allowed for the examination of predictors of cost, while excluding families who utilized in-home crisis services. Upon removing students who accessed in-home crisis services, anxiety severity, depression symptoms and separation anxiety disorder were no longer statistically significant predictors of cost. Therefore, individuals with severe anxiety relying on in-home crisis services appear to be driving the relationship between these predictors and cost. Importantly, while anxiety severity, depression symptoms and separation anxiety disorder no longer significantly predicted a higher cost of pediatric anxiety, individuals who utilize in-home crisis services are not outliers, but part of the population severely impaired by their anxiety symptoms, with little access to traditional mental health services and therefore, utilizing expensive service options.

A number of youths mostly from the study's Urban Maryland site had severe anxiety and high service usage. The result of which is a skewed data distribution, reflecting low service utilization overall and high service use among those cases with severe anxiety. As expected, the overall cost estimate data distribution in this study is highly skewed (Gilleskie and Mroz 2004). Within this sample, only 31% of families utilized services for anxiety. In fact, the most accessed medical care and mental health care was the primary care physician (14% of the sample) and psychologists (11% of the sample). This finding is in accordance with the pediatric

anxiety literature, showing that the majority of school-age children and adolescents with clinical anxiety do not access services (Merikangas et al. 2011). Therefore, although early intervention and prevention may reduce anxiety symptom severity in students, for some severely disadvantaged families (e.g. homeless), access to early intervention programs may not be feasible. In order to provide services to these families, a joint approach between social and mental health services might be warranted.

Among clinical characteristics, anxiety severity and higher depression symptoms were the only significant predictors of estimated cost. Internalizing, externalizing and having a co-morbid anxiety disorder were not significant predictors of cost estimates. The literature offers limited and mixed information related to clinical factors predicting the cost of pediatric anxiety disorders. Van Steensel et al. similarly found no differences in cost for children with comorbidities and those without, and also found no differences for severity of anxiety. This is contrary to our finding including the full sample, that anxiety severity is significantly correlated with overall cost estimate when examined independently and when examined with other demographic and clinical factors. The presence of elevated anxiety and depression symptoms appears to increase the total cost estimate. For example, one standard deviation increase in anxiety (CGI-S change score of 0.8) and depression severity (RCADS change score of 6.0) increases costs by 26% ($1288) and 19% ($941), respectively. Taken together, children and adolescents who experience elevated anxiety and depression symptoms, have an increased cost estimate of 45% ($2229). Therefore, as anxiety and depression symptoms become more severe, children are experiencing more impairment and families appear to be seeking help via additional services.

Taken together, from a family and societal economic prospective, it is critical to identify children and adolescents with elevated anxiety and depression symptoms, as this combination of symptoms appears to result in an increase cost burden on families and society. Interestingly, in this study, measures collected by IEs (e.g., anxiety severity) and reported by children/ adolescents (e.g., depression symptoms) predicted higher cost. No parental report measures predicted total cost estimates. As this study was school-based, parents may have been less aware of the severity of impairment their children were experiencing. If replicated in a community-based clinic, parental report measures may have significantly predicted cost, as children may have received treatment because of parent referral, rather than a school-based personnel referral.

Although this study included cost estimates which are a combination of direct (i.e. mental health and medical services), as well as indirect (i.e. missed work and missed school days) costs, additional information is needed to gain a better and more complex understanding of costs. In order to achieve this, improvements in measurement are necessary, including collaboration between medical and mental health care providers and researchers, to longitudinally capture service use frequency, duration, and cost. Further, improved measurement of indirect cost is necessary, as this study and others include limited measurement of costs not directly associated with service use for children (e.g. missed summer camp) and parents (e.g. missed gym class).

Limitations

Whereas anxiety disorders are typically chronic illnesses, this study only investigated current costs associated with anxiety disorders at a single point in time. Additionally, all costs assigned in this project were assigned from survey data. Ideally, researchers would be able to collect records from study participants and their medical providers, which could provide a more accurate account of spending. This would also eliminate the reliance on retrospective parental report and improve the validity of the data by eliminating parental recall. Data collection was limited to a three-month retrospective parental report measure. Although this is in line with (van Steensel et al. 2013) and exceeds (Bodden et al. 2008) the current literature, additional efforts should be made in future research to examine the cost of pediatric anxiety disorders longitudinally. While the total sample size is the largest to date for a cost of pediatric anxiety disorder study, future studies should also aim to have a larger sample size in order to better capture predictors of cost. Information on use of psychotropic medications within the sample was incomplete and could not be used for this study. Although medication use information was collected as part of the larger study, inconsistencies in parental reporting regarding specific names and doses of medication resulted in poor data quality. Cost data for visits to the psychiatrist and primary care doctors reflects a substantial portion of the cost related to medication use and management. Additionally, it is worthwhile to note that although not captured and monetized in the current study, the lost time for non-employed parents may overvalue the cost of lost productivity. The data for this study was drawn from a limited number of recruited youth in a school-based study. Therefore, the results may not be representative of the population of children in the US with anxiety disorders.

Conclusion

The annual cost of illness for pediatric anxiety disorders in a large school based population was $6405. Individual clinical factors such as increased anxiety severity and depression were

associated with higher costs. Within this sample, the economic burden of pediatric anxiety was highly skewed and concentrated among children with severe anxiety and economic disadvantage, as they relied on expensive crisis services for care. For severely disadvantaged families, collaborative efforts between social and mental health services may be necessary to reduce symptom severity and lower cost. To reduce the cost burden associated with pediatric anxiety disorders, families should be encouraged to seek prevention and treatment services early, to reduce and manage their children's anxiety. Additionally, access to mental health services for pediatric anxiety should be improved by offering care in places which reduce barriers to care (e.g. school, primary care).

Compliance with Ethical Standards

Conflict of Interest   The authors declare they have no financial or non-financial conflicts of interest to report.

Ethical Approval   The study was approved by the UConn Health Institutional Review Board.

Informed Consent   written informed consent was completed with all participants prior to commencing with study procedures.

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