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Journal

Journal of the American Academy of Child & Adolescent Psychiatry, 55(5)

ISSN

0890-8567

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Publication Date

2016-05-01

DOI

10.1016/j.jaac.2016.02.008

Peer reviewed

Point Prevalence of Co-Occurring Behavioral Health Conditions and Associated Chronic Disease Burden Among Adolescents

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Objective: To examine the point prevalence of behavioral health conditions (BHCs) and co-occurring chronic medical conditions among adolescents in an integrated health system.

Method: The sample consisted of adolescents in an integrated health care system diagnosed with at least 1 of the 5 most prevalent BHCs in 2014 (n = 30,643), and patients without a BHC matched on age, sex, and medical home facility (n = 30,643). Electronic health record data was used to identify all adolescents aged 11 to 18 years with at least 1 BHC diagnosis on their diagnosis list, which included current and pre-existing diagnoses from an outpatient (including psychiatry and chemical dependency specialty treatment), inpatient, or emergency department visit at a Kaiser Permanente Northern California (KPNC) facility between January 1, 2014, and December 31, 2014. The odds of having general medical conditions and specific chronic diseases were compared between adolescents with and without BHCs.

Results: Among adolescents with at least 1 BHC in 2014, the 5 most common BHCs were: depressive disorders (42%), anxiety disorders (40%), attention-deficit/hyperactivity disorders (ADHDs; 37%), substance use disorders (SUDs; 10%), and bipolar spectrum disorders (8%). Overall, patients with a BHC did not have higher odds of any medical comorbidity compared with non-BHC patients. However, compared to individuals without BHCs, adolescents with depression (odds ratio [OR] = 1.16, 95% CI = 1.08–1.26), anxiety (OR = 1.30, 95% CI = 1.20–1.41), and substance use (OR = 1.25, 95% CI = 1.05–1.49) disorders had significantly higher odds of any medical comorbidities; individuals with ADHD and bipolar disorder did not differ from patients without BHCs.

Conclusion: BHCs were common and were associated with a disproportionately higher burden of chronic medical disease among adolescents in a large, private health care delivery system. As comorbidity can lead to elevated symptom burden, functional impairment, and treatment complexity, the study findings call for implementation of effective collaborative models of care for these patients.

Key words: behavioral health disorders, co-occurring conditions, chronic conditions, mental health disorders, adolescents

J Am Acad Child Adolesc Psychiatry 2016;55(5):408–414.

Behavioral health conditions (BHCs), including both mental health and substance use disorders (SUDs), are highly prevalent among adolescents.[1] These disorders often result in considerable distress for adolescent patients and their families, and, particularly if left untreated, are associated with negative outcomes.[2,3] Research on adults has found that there is significant comorbidity between BHCs and many chronic medical conditions, and that this co-occurrence can complicate treatment for all of the conditions.[4-8] The pediatric literature on the co-occurrence of mental health, substance use, and medical conditions is less robust, but has begun to document comorbidity between BHCs and some common chronic medical conditions.[9-11]

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Supplemental material cited in this article is available online.

A recent national population survey found that among 18-year-olds, 31.9% reported having an anxiety disorder, 14.3% a mood disorder, 19.6% a behavioral disorder, including attention-deficit/hyperactivity disorder (ADHD), and 11.4% a SUD at some point in their lives.[12] High rates of mental health and SUD comorbidity have also been documented, particularly in clinical samples.[10,13-15] ADHD has been found to co-occur frequently with a number of other mental health conditions, including anxiety[16,17] and SUDs.[18] Furthermore, studies have found high rates of SUDs among adolescents with ADHD.[19-21] Mood disorders have also been found to be significantly associated with SUDs, including alcohol, marijuana, tobacco, and polysubstance use.[22,23]

Despite the high prevalence of BHCs among adolescents, many go unidentified and untreated. The Affordable Care Act and federal and state mental health and addiction treatment parity laws all contain provisions aimed at increasing access to treatment for BHCs. An important first step for health systems is to measure the prevalence of BHCs, and of common BHCs' comorbidity with other BHCs and common chronic medical conditions. This study addresses a critical gap in the literature and provides important

information for policymakers and program planners by examining the point prevalence and comorbidities of BHCs in a large health care system. Studies have found higher rates of comorbid medical conditions among adolescents with BHCs; a recent national survey found that more than one-third of respondents reported at least 1 mental disorder and 1 physical disorder.[11] Asthma, diabetes, heart disease, infectious diseases, and digestive disorders have all been found to be associated with an increased prevalence of BHCs at some point in their lives.[11,24] Comorbidity between BHCs and medical conditions can also complicate treatment regimens,[25] increase health care use and costs,[26] and compromise health outcomes,[9,27] which supports the need for a better understanding of the prevalence of these comorbidities.

This study contributes to the literature by examining the point prevalence of BHCs among adolescent members of a large integrated health system. We compare the burden of medical comorbidity and common chronic diseases among those adolescent health plan members with a behavioral health condition to matched members without. This study provides the opportunity to examine behavioral and medical condition comorbidity in a health system population compared to the clinical and national survey populations more frequently studied.

METHOD

Setting. Kaiser Permanente of Northern California (KPNC) is a nonprofit, integrated health care delivery system providing comprehensive health services to more than 3.8 million members, 45% of the commercially insured population in the region. Outpatient behavioral health services are provided internally rather than contracted to outside vendors.

Study Patients. Electronic health record data was used to identify all adolescents who were aged 11 to 18 years, had a visit to a KPNC facility in 2014, and had at least 1 BHC on their diagnosis list in 2014. The BHCs examined included both mental health and SUDs, specifically the following: depressive disorders, bipolar spectrum disorders, anxiety disorders, ADHDs, autism spectrum disorders, personality disorders, SUDs, dementia, schizophrenia spectrum disorders, disruptive behavioral disorders, and other psychoses (see Supplement 1, available online, for relevant *International Classification of Diseases–9th Revision* [*ICD-9*] codes). These categories were selected based on collaborations with the National Institute of Mental Health's Mental Health Research Network[28] and KPNC's Regional Mental Health Leadership and were used in our prior work.[8] The first mention for each BHC during the study period was included, so BHCs were not mutually exclusive. Patients insured by Medicare or Medicaid were excluded from the study.

The analytical sample included adolescents aged 11 to 18 years with at least 1 of the 5 most prevalent BHCs, which were determined to be depressive disorders, anxiety disorders, ADHDs, SUDs, and bipolar spectrum disorders. Each patient with a BHC was matched to a patient without a BHC on sex, age, and medical facility, the latter accounting for any potential differences in services offered, or types of conditions by geographic region. The final analytical sample consisted of 61,286 individuals: 30,643 individuals with at least 1 of the top 5 BHCs, including 13,602 patients with depressive disorders, 12,554 with anxiety disorders, 11,888 with ADHDs, 2,984 with SUDs, 2,505 with bipolar spectrum disorders, and 30,643 patients without BHCs. Institutional review board approval was obtained from the Kaiser Research Foundation Institute for this retrospective, database-only study.

Measures

Patient Characteristics. Sex, age, and race/ethnicity were pulled from the electronic health records. Race/ethnicity was collapsed into 5 categories: white, African American, Hispanic, Asian, and other. All psychiatric and medical comorbidities were determined based on diagnoses noted in the electronic health records during patient visits made over the course of the study period, which included current and pre-existing diagnoses.

Psychiatric Conditions. Depressive disorders, bipolar spectrum disorders, anxiety disorders, ADHDs, autism spectrum disorders, personality disorders, SUDs, dementia, schizophrenia spectrum disorders, and other psychoses were examined. The *ICD-9* codes for these conditions can be found in Supplement 1, available online.

Medical Conditions. All *ICD-9* main categories were examined to determine medical comorbidities; however, only the most prevalent categories were selected and used for the final analyses, which included the following: infectious and parasitic diseases (*ICD-9* CM codes: 001–139 inclusive), neoplasms (*ICD-9* CM codes: 140–239 inclusive), endocrine, nutritional and metabolic diseases, and immunity disorders (*ICD-9* CM codes: 240–279 inclusive), diseases of the blood and blood-forming organs (*ICD-9* CM codes: 280–289 inclusive), diseases of the nervous system and sense organs (*ICD-9* CM codes: 320–389 inclusive), diseases of the circulatory system (*ICD-9* CM codes: 390–459 inclusive), diseases of the respiratory system (*ICD-9* CM codes: 460–519 inclusive), diseases of the digestive system (*ICD-9* CM codes: 520–579 inclusive), diseases of the genitourinary system (*ICD-9* CM codes: 580–629 inclusive), diseases of the skin and subcutaneous tissue (*ICD-9* CM codes: 680–709 inclusive), diseases of the musculoskeletal system and connective tissue (*ICD-9* CM codes: 710–739 inclusive), injury and poisoning (*ICD-9* CM codes: 800–999 inclusive), and symptoms, signs, and ill-defined conditions (*ICD-9* CM codes: 780–799 inclusive). An indicator was created for any medical comorbidity.

Chronic Medical Conditions. We developed a list of 7 chronic conditions based on the extant literature on chronic pediatric diseases and in consultation with clinical experts in the health system.[25,29] These conditions included the following: asthma (*ICD-9* CM code: 493), arthritis (*ICD-9* CM codes: 710–719 inclusive), rhinitis (*ICD-9* CM code: 477), sinusitis (*ICD-9* CM codes: 461 or 473), diabetes mellitus (*ICD-9* CM code: 250), irritable bowel disorder/inflammatory bowel disease (*ICD-9* CM code: 546.1 or 555.9 or 560.89), and migraine (*ICD-9* CM code: 346).

Data Analysis

All analyses were performed using SAS software, version 9.3 (SAS Institute Inc., Cary, NC); statistical significance was defined at $p < .01$. All BHC study patients were aged 11 to 18 years, had a visit to a KPNC facility in 2014, and had at least 1 of the top 5 BHCs on their diagnosis list in 2014, which contained new diagnoses and pre-existing conditions. We then extracted a similar sample of patients aged 11 to 18 years with a visit to a KPNC facility in 2014 who did not have a BHC diagnosis on their record during that time period. Patients were matched on a 1–1 basis based on age, gender, and medical home facility, resulting in unique matched pairs of individuals.

Frequencies were used to describe patient characteristics and psychiatric comorbidities across each of the 5 BHCs. Conditional logistic regression models were used to examine the odds of medical

comorbidities and chronic medical conditions between the patients with and without BHCs; models were run separately for each condition (i.e., depressive, anxiety, ADHD, substance use, and bipolar spectrum disorders). As we were examining 13 medical condition categories, the discrete Bonferroni-Holm multiplicity adjustment was implemented.[30] Using this technique, all p values were multiplied by 13, and only those resulting values that were 0.01 or less were considered significant. The same adjustment was conducted for the chronic condition analyses.

RESULTS

Of the sample, 52% were female, and the average age was 15 years. In all, 43% were white, 8% African American, 13% Asian, 29% Hispanic, and 6% other (not shown). As patients were matched on age and gender, there were no differences across these measures between the BHC patients and matched controls. More patients without BHCs were Asian (17.0% vs. 8.2%; $p < .001$), and fewer were white (36.9% vs. 49.7%; $p < .001$) compared with patients with BHCs; all other race/ethnicity categories were similar (Table 1).

Depressive disorders, anxiety disorders, ADHDs, SUDs, and bipolar spectrum disorders were the 5 most common BHCs among adolescents in 2014. Among patients with at least 1 of these conditions, 38.1% had multiple BHCs. Individuals with bipolar disorder had the most psychiatric comorbidity, with 84.3% of patients with bipolar disorder having at least 1 additional psychiatric comorbidity, whereas 62.6% of those with anxiety, 59.5% of those with depression, 58.2% of those with substance use, and 40.1% of those with ADHD had at least 1 additional psychiatric comorbidity (Table 2).

Overall, patients with a BHC did not have higher odds of having any medical comorbidity compared with non-BHC patients. However, adolescents with depression (odds ratio [OR] = 1.16, 95% CI = 1.08–1.26), anxiety (OR = 1.30, 95% CI = 1.20–1.41), and substance use (OR = 1.25, 95% CI = 1.05–1.49) had higher odds of medical comorbidity compared with matched controls. Adolescents with ADHD and bipolar disorder did not differ from patients without a BHC in the odds of having any medical condition; however, they did have higher odds across most of the individual medical comorbidities examined. Patients with BHC disorders had higher odds of medical comorbidity across the majority of the medical comorbidity groups examined compared with patients without BHCs, with the exception of neoplasms among those with SUDs, ADHD, and bipolar disorders; diseases of nervous system and senses among those with SUDs; and diseases of the skin and subcutaneous tissues among those with ADHD or SUDs. Patients with ADHD also did not differ in the odds of infectious and parasitic diseases, disease of the skin and subcutaneous tissues, and odds of any medical condition compared with controls (Table 3).

Findings were similar with respect to the burden of chronic conditions; statistics for all comparisons are provided in Table 4. Overall, patients with BHCs had significantly higher odds of each chronic condition examined. The odds of asthma, rhinitis, and migraine were significantly

TABLE 1 Patient Demographics for the 5 Most Prevalent Behavioral Health Conditions

	Depression Spectrum		Anxiety Spectrum		ADHD	
	BHC (n = 13,602)	Non-BHC (n = 13,602)	BHC (n = 12,554)	Non-BHC (n = 12,554)	BHC (n = 11,888)	Non-BHC (n = 11,888)
Female, %	67.7	67.7	64.4	64.4	30.1	30.1
Ethnicity, %						
Asian	9.4	17.5	8.6	16.6	6.4	16.9
African American	7.9	8.4	6.4	8.4	9.9	8.1
Hispanic	30.5	30.8	28.3	30.3	22.6	30.3
White	47.0	36.4	52.1	37.5	56.0	38.0
Other	5.1	7.0***	4.6	7.2***	5.1	6.6***
Age, mean (SD)	15.3 (1.8)	15.4 (1.7)	15.2 (1.9)	15.3 (1.9)	14.5 (2.0)	14.5 (2.0)
	Substance Use		**Bipolar Spectrum**		**Total Sample**	
	BHC (n = 2,984)	Non-BHC (n = 2,984)	BHC (n = 2,505)	Non-BHC (n = 2,505)	BHC (n = 30,643)	Non-BHC (n = 30,643)
Female, %	42.4	42.4	56.7	56.7	52.2	52.2
Ethnicity, %						
Asian	7.1	16.8	5.6	16.8	8.2	17.0
African American	10.0	8.5	10.0	8.7	8.4	8.5
Hispanic	35.8	30.2	25.9	31.1	28.5	30.6
White	42.7	38.0	54.3	36.7	49.7	36.9
Other	4.4	7.6***	4.2	6.6***	5.2	6.9***
Age, mean (SD)	16.1 (1.5)	16.2 (1.4)	15.3 (1.9)	15.3 (1.9)	15.0 (1.9)	15.1 (2.0)

Note: ADHD = attention-deficit/hyperactivity disorder; BHC = behavioral health condition.
***p < .001.

TABLE 2 Co-Occurring Psychiatric Comorbidities Among Each of the 5 Most Prevalent Behavioral Health Conditions (BHCs) for BHC Patients

	Depression Spectrum n = 13,602	Anxiety Spectrum n = 12,554	ADHD n = 11,888	Substance Use n = 2,984	Bipolar Spectrum n = 2,505	Total BHC Cohort n = 30,643
Depression, %	—	46.0	18.8	39.2	51.6	44.4
Anxiety, %	42.5	—	19.4	28.6	40.1	41.0
Substance use, %	8.6	6.8	4.2	—	17.3	9.7
Bipolar spectrum, %	9.5	8.8	7.2	14.5	—	8.2
ADHD, %	16.4	18.4	—	16.5	34.0	38.8
Dementia, %	0.1	0.1	0.1	0.2	0.2	0.1
Other psychoses, %	4.4	5.6	2.4	6.8	12.7	3.4
Schizophrenia spectrum, %	0.5	0.4	0.2	1.5	2.2	0.4
Personality disorder, %	1.0	1.0	0.5	2.0	3.8	0.6
DBD, %	7.7	6.9	10.6	13.4	23.3	7.1
Autism, %	1.6	3.1	4.3	0.8	6.1	2.8
Psychiatric comorbidities[a]						
≥1 comorbidities	59.5	62.6	40.1	58.2	84.3	38.1[a]
≥2 comorbidities	21.5	22.6	17.7	36.1	59.4	12.4
≥3 comorbidities	7.6	7.8	6.3	18.0	31.3	4.0

Note: Diagnoses are not mutually exclusive and therefore comparisons between BHC groups cannot be made. Numbers given immediately below each of the five BHCs and the total BHC cohort reflect number of BHC patients. ADHD = attention-deficit/hyperactivity disorder; DBD = disruptive behavioral disorder.
[a]Among all patients with at least 1 of the top 5 BHCs, 38.1% had 1 or more psychiatric comorbidities.

higher for patients with BHCs compared with matched controls across all BHCs examined. Of note, patients with anxiety had almost 5 times the odds of having irritable bowel syndrome/disorders compared with matched controls (OR = 4.96, 95% CI = 3.55–6.93), whereas patients with SUDs had noticeably higher odds of asthma compared with matched controls (OR = 2.43, 95% CI = 2.07–2.84), and patients with bipolar disorder had noticeably higher odds of diabetes, irritable bowel, and migraine compared with matched controls (Table 4).

DISCUSSION

Clinically identified behavioral health conditions are common among adolescents in this health system, with 15% having at least 1 behavioral health diagnosis. Among adolescents with 1 of the top 5 most prevalent BHC diagnoses, 38% had at least 1 other BHC, and 12% had at least 2 other BHCs. These findings, based on clinical diagnoses, are significantly higher than survey results found by Merikangas *et al.*[12] in the US Comorbidity Survey–Adolescent Supplement study of 18-year-olds, which reported that 25% of adolescents had 2 or more co-occurring psychiatric disorders. This difference is likely the result of our study sample being a younger clinical population as opposed to a slightly older, general population sample, and the fact that adolescents in this study may have had more opportunity for contact with the health care system, during which they received these diagnoses, including many that were given in specialty mental health and substance abuse treatment. There was substantial psychiatric comorbidity across each of the 5 most common BHCs; however, depression and/or anxiety disorders were the most prevalent comorbidities across all BHCs. Rates of psychiatric comorbidity ranged from 40.1% among adolescents with ADHD to 84.3% among those with bipolar disorder, rates that are significantly higher than has been seen among adults with BHCs in this health system.[8]

Overall, patients with a BHC were not more likely to have a medical comorbidity compared with their peers without BHCs. However, of the 13 categories of medical conditions examined, we did find significantly higher odds across the majority of the conditions examined within each BHC compared with matched controls. We found significantly higher rates of several common chronic medical conditions among those with BHCs compared to those without, including asthma, diabetes, rhinitis, sinusitis, irritable bowel, and migraine. This finding is consistent with other studies that have found high rates of medical and psychiatric comorbidity among children and adolescents.[9,16,24,25] We found a particularly strong association between irritable bowel syndrome and anxiety, which is not surprising, as anxiety and stress are thought to exacerbate the symptoms of irritable bowel syndrome.[31] Similarly, migraine has been found to be related to a number of psychiatric comorbidities,[32,33] which could represent some shared vulnerability or emotional distress resulting from dealing with the chronic pain of migraine. However, based on this study, it is difficult to know for certain whether there is a bidirectional relationship between BHCs and co-occurring medical conditions, or whether the conditions are related to some shared vulnerability or physiological mechanism.

A limitation of this study is that it examined only the behavioral health conditions documented during health system visits during or prior to the study period, thus

TABLE 3 Odds of Medical Comorbidity Among Behavioral Health Condition (BHC) Patients Versus Controls

	Depression Spectrum (n = 13,602)		Anxiety Spectrum (n = 12,554)		ADHD (n = 11,888)	
Diseases/Conditions	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Infectious and parasitic	1.34***	1.24–1.44	1.38***	1.28–1.49	1.04	0.96–1.13
Neoplasms	1.20	1.03–1.39	1.37***	1.17–1.61	1.17	0.98–1.40
Endocrine, nutritional, and metabolic and immunity disorders	2.54***	2.31–2.80	2.70***	2.44–2.99	2.00***	1.76–2.27
Blood and blood-forming organs	2.27***	1.92–2.69	2.42***	2.02–2.91	1.83***	1.43–2.34
Nervous system and sense organs	1.23***	1.17–1.30	1.37***	1.30–1.45	1.08**	1.02–1.15
Circulatory system	2.95***	2.48–3.50	3.41***	2.86–4.05	1.88***	1.54–2.28
Respiratory system	1.63***	1.55–1.72	1.72***	1.63–1.81	1.34***	1.27–1.42
Digestive system	2.09***	1.93–2.26	2.67***	2.46–2.91	1.46***	1.33–1.61
Genitourinary system	1.90***	1.77–2.05	1.89***	1.75–2.05	1.54***	1.38–1.72
Skin and subcutaneous tissues	1.11***	1.05–1.17	1.20***	1.13–1.27	1.07	1.00–1.14
Musculoskeletal system and connective tissue	1.31***	1.23–1.38	1.39***	1.31–1.47	1.16***	1.09–1.24
Injury and poisoning	1.52***	1.44–1.61	1.46***	1.38–1.55	1.25***	1.18–1.32
Symptoms, signs, and ill-defined conditions	2.84***	2.69–3.00	3.29***	3.10–3.49	1.77***	1.67–1.88
Any medical comorbidities	1.16***	1.08–1.26	1.30***	1.20–1.41	0.87	0.81–0.94
	Substance Use (n = 2,984)		**Bipolar Spectrum (n = 2,505)**		**Total Sample (n = 30,643)**	
Diseases/Conditions	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Infectious and parasitic	1.47***	1.26–1.72	1.54***	1.30–1.83	1.24***	1.18–1.31
Neoplasms	1.11	0.78–1.58	1.39	0.90–1.84	1.20***	1.08–1.34
Endocrine, nutritional, and metabolic and immunity disorders	3.11***	2.53–3.82	5.33***	4.19–6.79	2.31***	2.16–2.48
Blood and blood-forming organs	4.61***	3.09–6.88	5.81***	3.61–9.38	2.14***	1.89–2.43
Nervous system and sense organs	0.96	0.85–1.08	1.48***	1.30–1.68	1.18***	1.14–1.22
Circulatory system	3.56***	2.64–4.81	3.52***	2.50–4.98	2.48***	2.21–2.78
Respiratory system	1.84***	1.64–2.06	1.74***	1.54–1.97	1.49***	1.44–1.54
Digestive system	2.24***	1.90–2.64	3.22***	2.67–3.90	1.97***	1.86–2.08
Genitourinary system	2.00***	1.68–2.39	2.38***	1.98–2.85	1.73***	1.63–1.82
Skin and subcutaneous tissues	1.10	0.98–1.24	1.31***	1.15–1.49	1.10***	1.06–1.14
Musculoskeletal system and connective tissue	1.38***	1.21–1.56	1.39***	1.21–1.59	1.27***	1.22–1.32
Injury and poisoning	2.46***	2.19–2.77	1.91***	1.68–2.17	1.36***	1.32–1.41
Symptoms, signs, and ill-defined conditions	3.87***	3.42–4.39	3.51***	3.06–4.02	2.45***	2.36–2.54
Any medical comorbidities	1.25**	1.05–1.49	1.21	1.00–1.45	1.02	0.97–1.07

Note: ADHD = attention-deficit/hyperactivity disorder; OR = odds ratio.
**p < .01; ***p < .001.

relying on accurate and systematic documentation of BHCs. Earlier studies have found that health care providers may be hesitant to formally diagnose children and adolescents with psychiatric disorders for fear of stigmatization.[34,35] We found a high point prevalence of BHC diagnoses, which may be due to pediatric clinicians becoming more comfortable and less hesitant about diagnosing children and adolescents with mental health disorders. Pediatric clinicians not well trained in assessment of behavioral health conditions might be inclined to overdiagnose patients presenting with emotional distress. However, it is well known that many patients, both pediatric and adult, never seek care for behavioral conditions, and thus these conditions are never diagnosed,[36,37] so the BHC point prevalence that we found may actually underestimate the true point prevalence of BHCs among adolescents in this population. Moreover, in previous studies in this health system that examined primary care provider behaviors and attitudes toward identifying adolescent behavioral health conditions, we have found primary care providers in particular to be cautious about diagnosing psychiatric and SUDs in adolescents.[38] Use of natural language processing techniques to examine clinical notes that might capture current BHCs not assigned formal diagnoses would be useful in future health care studies. Another limitation of the study is that we did not examine the temporality of the diagnoses; thus we cannot determine which conditions occurred first or speculate as to which might have contributed to the development of others.

TABLE 4 Odds of Chronic Conditions Among the 5 Most Prevalent Behavioral Health Condition (BHC) Patients Versus Controls

	Depression Spectrum (n = 13,602)		Anxiety Spectrum (n = 12,554)		ADHD (n = 11,888)	
	OR	95% CI	OR	95% CI	OR	95% CI
Asthma	1.94**	1.81–2.09	2.03**	1.89–2.19	1.65**	1.53–1.78
Arthritis	1.23**	1.13–1.33	1.20**	1.10–1.31	1.12	1.02–1.23
Rhinitis	1.44**	1.32–1.57	1.69**	1.56–1.86	1.32**	1.20–1.46
Sinusitis	1.35**	1.19–1.53	1.60**	1.41–1.82	1.23	1.06–1.43
Diabetes mellitus	1.92**	1.41–2.62	1.47	1.06–2.05	1.23	0.82–1.78
Irritable bowel	3.53**	2.53–4.93	4.96**	3.55–6.93	1.23	0.80–1.89
Migraine	2.48**	2.16–2.84	2.87**	2.49–3.30	2.20**	1.83–2.64
	Substance Use (n = 2,984)		**Bipolar Spectrum (n = 2,505)**		**Total Sample (n = 30,643)**	
	OR	95% CI	OR	95% CI	OR	95% CI
Asthma	2.43***	2.07–2.84	2.34***	1.99–2.76	1.81***	1.72–1.90
Arthritis	1.17	0.97–1.41	1.10	0.90–1.34	1.17***	1.11–1.24
Rhinitis	1.30**	1.07–1.57	1.45***	1.18–1.79	1.41***	1.33–1.50
Sinusitis	1.70***	1.27–2.28	1.36	1.02–1.81	1.37***	1.26–1.49
Diabetes mellitus	1.19	0.63–2.25	3.66***	1.87–7.17	1.54***	1.25–1.92
Irritable bowel	2.68**	1.38–5.19	3.79***	1.71–8.41	2.97***	2.35–3.75
Migraine	2.20***	1.61–2.99	3.77***	2.62–5.43	2.29***	2.08–2.52

Note: ADHD = attention-deficit/hyperactivity disorder; OR = odds ratio.
**p < .01; ***p < .001.

The chronology of the development of co-occurring behavioral health and medical conditions will be important to assess. A single mention of a BHC diagnosis was adequate to classify them as having that condition, which may overestimate the point prevalence of severe conditions. However, this methodology has been used in prior studies, and we do not anticipate it to be an issue.[39-43] Finally, patients with Medicare or Medicaid were not included in the study, as these populations are known to have higher rates of BHCs, and we wished to prevent bias between patients with versus without BHCs.

This study found strikingly high levels of psychiatric comorbidity among adolescent health system members, as well as significantly higher levels of medical conditions among these individuals when compared with their peers without BHCs. This suggests a large population of vulnerable adolescents with significant levels of co- and multimorbid health conditions, which can complicate treatment and compromise health and well-being. Our findings contribute to the growing body of literature on pediatric comorbidity, and can help to raise awareness among clinicians and health policymakers of the need for effective identification of comorbidities, as well as the need for more coordinated and integrated approaches to pediatric medical and behavioral health care. There is a growing body of literature suggesting that screening, brief intervention, and referral to treatment (SBIRT) can be an effective approach to integrating the identification and brief treatment into pediatric primary care settings.[44-46] Similarly, a recent systematic meta-analysis found significantly better outcomes across studies for adolescents treated for mental health problems using an integrated medical–behavioral health approach.[47] Such approaches are also consistent with the patient-centered medical home model, which uses a team-based approach to care and frequently integrates behavioral health services into primary care.[48] Considering the high behavioral health and medical comorbidity found in this and other studies, future research and program evaluation should focus on establishing the effectiveness, cost-effectiveness, and feasibility of such integrated models of care. It is likely that the high prevalence of BHCs and high rate of comorbidity found affect services use, especially behavioral health services; future studies should also examine health services use and functioning among adolescent patients with BHCs, especially those with co-occurring medical problems. &

Accepted February 25, 2016.

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This study was supported by the Sidney R. Garfield Memorial Fund.

The authors thank Agatha Hinman, BA, of Kaiser Permanente Division of Research, for editorial assistance.

Disclosure: Drs. Weisner and Sterling and Ms. Kline-Simon report no biomedical financial interests or potential conflicts of interest.

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0890-8567/$36.00/©2016 American Academy of Child and Adolescent Psychiatry

http://dx.doi.org/10.1016/j.jaac.2016.02.008

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