The Economic Impact of Bipolar Disorder in an Employed Population From an Employer Perspective

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Objective: To determine the economic impact of bipolar disorder on health benefit costs and health-related work absences from an employer perspective.

Method: Data on health benefit costs and health-related absences during 2001 and 2002 were retrieved from a database and retrospectively examined. Regression modeling measured the cost differences while controlling for potentially confounding factors. The study population consisted of employees at multiple large employers who were widely dispersed throughout the United States. These employees were grouped into 2 cohorts: (1) employees with a bipolar disorder diagnosis (primary, secondary, or tertiary ICD-9 code of 296.0x, 296.1x, 296.4x, 296.5x, 296.6x, 296.7x, or 296.8x) in 2001 and (2) employees with no bipolar disorder diagnosis during 2001 or 2002 (comparison cohort). Specific outcome measures included annual health benefit claim costs and salary-replacement payments for the following employee health benefits: health care insurance, prescription drug, sick leave, short- and long-term disability, and workers' compensation. Additional outcome measures included annual absence days due to workers' compensation, short- and long-term disability, and sick leave (separately).

Results: The analysis identified 761 employees (0.3%) with bipolar disorder and 229,145 eligible employees without bipolar disorder. Employees with bipolar disorder annually cost $6836 more than employees without bipolar disorder (p < .05) and were more costly in every health benefit cost category. Employees with bipolar disorder missed an average of 18.9 workdays annually, while employees without bipolar disorder missed 7.4 days annually (p < .05).

Conclusion: The impact of bipolar disorder can be costly in the workplace, leading to increased health benefit costs and increased absenteeism.

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Bipolar disorder is a serious mental illness affecting a great portion of the population. About 1 in 100 people in the United States has been diagnosed with bipolar disorder.[1–3] Studies also show that bipolar disorder often goes undiagnosed and is often misdiagnosed as depression.[4] In 2005, *The Journal of Clinical Psychiatry* dedicated an entire supplement, "The Burden of Bipolar Illness,"[5] to addressing this topic. The present study aims to further this body of literature by assessing the quantifiable impact of bipolar disorder among an employed population and to help clinicians understand how this impact permeates multiple facets of employment. This study measures the impact of bipolar disorder across a wider array of employee health benefit cost outcomes (health care, prescription drug, sick leave, short- and long-term disability, and workers' compensation payments) and health-related work absence outcomes (days absent due to sick leave, short- and long-term disability, and workers' compensation) than has been previously reported.

Employer Perspective

Employers pay for more than just salary for their employees in the form of paid vacations and holidays, taxes, and retirement benefits. Other contributions are "health-related," such as health care and prescription drug insurance claims costs, sick leave, short- and long-term disability salary replacement payments while employees are

absent due to illness, and workers' compensation medical claims costs and salary replacement payments.[6–9] Health-related absences also lead to additional staffing costs to the employer.[7] Direct productivity losses (both reduced output while an employee is at work and reduced output due to absences) can also be health-related and very costly.[10,11] These costs are substantial and can be significantly impacted by specific illnesses among employees.[3,4,11,12] To assess the impact of bipolar disorder from an employer's perspective, a wide array of health-related outcomes must be quantified.

Review of Literature and Contextual Discussion

Several studies have examined the economic impact of bipolar disorder on health care and drug costs, highlighting the importance of detection, treatment, and the particular impact of the depressive symptoms associated with the illness.[3,4,12–20] Employees have reported that the manic or depressive symptoms of the condition disrupted their work experience significantly in concert with other social functioning.[19,20] Bipolar disorder has also been reported as the most expensive behavioral health disorder for patients when measured in out-of-pocket expenditures.[2] Bipolar disorder patients make more frequent use of health care resources, resulting in higher total health care costs. These patients generate more health care encounters than age- and sex-matched nonbipolar patients, including inpatient and outpatient hospital services, office visits, emergency room visits, dispensing, central nervous system/non–central nervous system issues, laboratory tests, and other services.[1]

Using limited elements of direct cost data (i.e., not including certain significant types of employee health benefit costs), these previous studies estimated that the economic impact of bipolar disorder was substantial. In one instance, bipolar disorder patients accounted for 12.4% of the behavioral health care carve-out expenses, even though neither outpatient pharmacy claims nor general health care expenses were included,[2] while in another, bipolar disorder claimants of employment age (18–64 years) were more than 4 times as expensive as persons without bipolar disorder.[1]

Few studies have addressed the impact of bipolar disorder on some types of work absence. In one study, employees with bipolar disorder had $1063 higher annual short-term disability payments (p < .0001) and 33 more hours of annual absence (p = .0009) than employees without bipolar disorder.[3] Using self-report data, one study showed that persons with bipolar disorder also report more difficulty with work.[13]

The present study adds to the body of literature by quantifying the bipolar disorder impact for more health-related employee benefit cost and work absence outcomes than prior studies. In addition, this study uses regression methods that are more appropriate for analyzing cost data.

This study also identifies and adjusts for a greater number of potentially confounding differences between employees with bipolar disorder and employees without bipolar disorder in order to obtain a more accurate quantification. Furthermore, the present study also extends the current literature by providing detail on potential areas of incremental health care costs by comparing 17 broad and 261 specific categories of comorbidities. Finally, the present analysis enhances the current literature by stratifying bipolar disorder patients by bipolar disorder–specific cost levels to examine the variation in cost severity existing within a population of employees with bipolar disorder.

METHOD

Data Source

A retrospective database was used to analyze the impact of bipolar disorder. The employee data included in this bipolar disorder research project were retrieved from the Human Capital Management Services Research Reference Database (HCMS RRDb). These employee data come from multiple large employers that are widely dispersed throughout the United States and represent the retail, service, manufacturing, and financial industries. The data types include demographic information for each employee, payroll records, health insurance and prescription drug claims, short- and long-term disability claims, sick leave records, and workers' compensation claims information.

Inclusion Criteria and Cohort Definition

Data from the HCMS RRDb were included in this study for employees who were employed and had health insurance and prescription drug coverage throughout the study period of Jan. 1, 2001, to Dec. 31, 2002. Data from approximately 230,000 employees were selected.

Two cohorts were created for comparison purposes. The first comprised 761 employees with a bipolar disorder diagnosis in 2001 (primary, secondary, or tertiary ICD-9 code of 296.0x, 296.1x, 296.4x, 296.5x, 296.6x, 296.7x, or 296.8x). Employees with no bipolar disorder diagnosis during 2001 or 2002 made up the comparison cohort (229,145 employees). Persons with a bipolar disorder diagnosis during 2002 but no diagnosis in 2001 were excluded from the analysis because 1 year of data following the first known diagnosis was needed for analysis.

Analytic Comparisons

Comparisons of descriptive characteristics. The research first compared descriptive characteristics between the employees with bipolar disorder and the employees without bipolar disorder. The means and 95% confidence intervals of the following descriptive characteristics were compared between the 2 cohorts: age, tenure (the number of years the employee has worked for his or her current employer), gender, marital status, race, exempt/nonexempt

status, full-time/part-time status, annual salary, and region (grouped by the first digit of the employee's zip code). Exempt employees are generally not paid on an hourly basis and are usually ineligible to receive overtime pay under the Fair Labor Standards Act.

Comparisons of health benefit costs and absence days. The main portions of the analysis compared health benefit costs and health-related work absences between the 2 cohorts summed over the year following the employee's index date. For the bipolar disorder cohort, the index date was defined to be the date of a subject's first bipolar disorder diagnosis in 2001. For the nonbipolar cohort, the index date was defined as the average index date from the bipolar cohort. Annual outcomes were measured during the year immediately following the index date.

The specific health benefit cost outcomes were (1) health care insurance claims cost, (2) prescription drug claims cost, (3) sick leave, (4) short-term disability salary replacement payments, (5) long-term disability salary replacement payments, and (6) workers' compensation medical cost and salary replacement indemnity payments (combined). Health-related work absence outcomes included work days missed during the year due to (7) sick leave, (8) short-term disability, (9) long-term disability, and (10) workers' compensation.

Comparisons of coexisting conditions. To obtain further insight into why differences in the health-related outcomes existed between the 2 population cohorts, coexisting diagnostic conditions for each cohort were compared using 2 Agency for Healthcare Research and Quality (AHRQ) categorizations.[21] Each health care insurance claim was assigned both one of the 17 AHRQ major diagnostic categories (MDCs) and one of the 261 AHRQ specific diagnostic categories based on the primary ICD-9 code from that health care claim. The total annual claims cost was summed for each MDC and each specific AHRQ category. These sums were divided by the total number of employees in each cohort so that the average cost per employee for each MDC and specific AHRQ category could be compared across the 2 employee cohorts.

Risk stratification of the bipolar cohort. A risk stratification quintile analysis was performed to determine whether differences in health care costs, prescription drug costs, absence costs, lost days, and demographic information exist within the bipolar cohort, possibly signifying varying degrees of illness severity.

Total health care and prescription drug costs incurred by each employee with bipolar disorder were summed for the year following the employee's index date. Those employee costs were then sorted from highest to lowest and divided into 5 cohorts, each representing 20% of the total cohort cost. Employees with bipolar disorder who had the lowest cost were defined as being in the first quintile, and employees with bipolar disorder who had the highest cost were defined as being in the fifth quintile.

The risk stratification quintile analysis then compared health benefit costs, health-related work absences, real productivity output, and demographic characteristics among the 5 bipolar disorder quintile subgroups. Additionally, for this portion of the analysis, health care costs were divided into bipolar disorder–related costs and other health care costs using the bipolar disorder ICD-9 codes. Similarly, prescription drug costs were divided into bipolar disorder–related drug costs and other drug costs. Drugs defined as bipolar disorder–related included atypical antipsychotics, conventional antipsychotics, primary mood stabilizers (carbamazepine, divalproex sodium, valproic acid, and lithium), potential mood stabilizers (gabapentin, lamotrigine, oxcarbazepine, and topiramate), and specific anticonvulsants (zonisamide and tiagabine).

Statistical Analyses

In the descriptive characteristic comparisons and in the coexisting conditions comparisons, differences between cohorts were considered to be statistically significant ($p < .05$) if the 95% confidence intervals surrounding the mean values for each cohort did not overlap.

For the comparisons of health benefit costs, absences, and productivity outcome measures, 2-stage multivariate regression methods were used. Separate regression models were run on the following claims cost and absence dependent variables: health care cost, prescription drug cost, sick leave cost, short-term disability cost, long-term disability cost, workers' compensation cost, sick leave days, short-term disability days, long-term disability days, and workers' compensation days. In each case, the multivariate regression models controlled for the impacts of confounding factors such as age, tenure, gender, marital status, race, exempt/nonexempt status, full-time/part-time status, salary, and region.

A 2-stage multivariate regression methodology was chosen over a matched case-control study for the following reasons: (1) it controls for differences in confounding factors as does matching cases to controls, but without the resulting reduction in sample size; (2) it allows the researcher to identify and adjust for a greater number of confounding factors than with matched case-controls (without combining them via some propensity score); (3) it can allow the researcher to quantify the impact of each confounding factor on the dependent variable being modeled; and (4) it is more appropriate for data that are not normally distributed, have extreme outliers, do not have balanced comparison cohort sizes, do not have constant variances, and have many observations wherein the cost or lost time value is zero.

In these 2-stage models, 2 separate regression models are run for each outcome.[22,23] For example, in the modeling of health care costs, logistic regression was first used to predict the likelihood of having any health care costs

Table 1. Descriptive Statistics

| Characteristic | Employees With Bipolar Disorder (N = 761) | | | Employees Without Bipolar Disorder (N = 229,145) | | |
	Mean	Lower 95% Confidence Limit for Mean	Upper 95% Confidence Limit for Mean	Mean	Lower 95% Confidence Limit for Mean	Upper 95% Confidence Limit for Mean
Age at index date, y[a]	41.2	40.5	41.8	40.4*	40.4	40.5
Tenure at index date, y	10.6	10.0	11.3	9.8*	9.7	9.8
Annual salary, $[b]	47,351	45,685	49,017	48,468	48,072	48,864
Female, %	54.4	50.9	57.9	44.5*	44.3	44.7
Married, %[c]	46.2	42.4	49.9	56.0*	55.8	56.2
Race, %[d]						
White	83.5	79.6	87.5	65.1*	64.8	65.3
Black	9.1	6.0	12.2	21.3*	21.1	21.5
Hispanic	4.1	2.0	6.2	8.0*	7.8	8.1
Exempt status, %	21.2	18.2	24.1	27.3*	27.1	27.5
Full-time, %	89.1	86.9	91.3	85.7*	85.6	85.8
Zip code 1st digit, %						
0	18.8	16.0	21.6	12.5*	12.3	12.6
1	22.3	19.4	25.3	15.4*	15.3	15.6
2	18.8	16.0	21.6	14.1*	14.0	14.3
3	14.1	11.6	16.5	22.5*	22.4	22.7
4	3.3	2.0	4.6	5.3*	5.2	5.4
5	0.1	0.1	0.4	0.7*	0.6	0.7
6	2.8	1.6	3.9	3.0	2.9	3.1
7	5.8	4.1	7.4	9.6*	9.5	9.7
8	4.6	3.1	6.1	4.3	4.2	4.4
9	9.5	7.4	11.5	12.4*	12.3	12.6

[a]Based on 229,127 nonbipolar patients due to incomplete data.
[b]Based on 760 bipolar patients and 225,641 nonbipolar patients due to incomplete data.
[c]Based on 676 bipolar patients and 206,343 nonbipolar patients due to incomplete data.
[d]Based on 340 bipolar patients and 152,124 nonbipolar patients due to incomplete data.
*Mean is significantly different than the corresponding mean from the bipolar cohort (p < .05).

during the year. Second, linear regressions on the natural log of health care costs were used to estimate the average annual health care costs for those employees with positive health care costs. Those results were then combined to yield estimates of annual health care costs for all employees in the population. The 2-stage technique was used for all cost and absence dependent variables.

The second stage of each 2-stage model could use either log-linear regression or generalized linear models, based on the distributions of the dependent variable and on steps outlined in prior work by Manning and Mullahy.[24] Transformation of the multiplicative results given by the log-linear models into additive results required special corrections for heteroskedasticity (nonconstant variances) as described by Ai and Norton.[25]

All models and statistics were generated via version 8.02 of the SAS System for Windows (SAS Institute, Inc.; Cary, N.C.).

RESULTS

Comparisons of Descriptive Statistics

The analysis identified 761 employees (0.3%) with bipolar disorder from the database of 229,906 eligible employees. The 2 cohorts are compared in Table 1, with mean values and 95% confidence intervals for age, tenure, gender, marital status, race, exempt/nonexempt status, full-time/part-time status, annual salary, and region. Employ-

ees with bipolar disorder were on average 0.75 years older than employees without bipolar disorder—a statistically significant (p < .05) difference.

Similarly, there were significant differences between the 2 cohorts for nearly every other variable; however, differences in salary and in proportion of the population with zip code first digits of 6 and 8 were not significant. Specifically, employees with bipolar disorder were older, had more tenure (the length of time they had been employed by their current employer), more often were female, less often were married, and more often were white. Such employees also were less often of exempt status, more often were full-time, and were more concentrated in regions for which the first zip code digit is 0, 1, or 2, which represent the Northeast and Mid-Atlantic regions of the United States.

Comparisons of Health Benefit Costs and Absence

Analysis of health benefit costs found employees with bipolar disorder to be more costly in every health benefit cost category studied (Figure 1). In total, employees with bipolar disorder were $6836 more expensive annually than employees without bipolar disorder (p < .05).

Employees with bipolar disorder had more health-related work absence than did employees without bipolar disorder (Figure 2). Employees with bipolar disorder missed an average of 18.9 workdays annually, while employees without bipolar disorder missed 7.4 days per

Figure 1. Health Benefit Cost Comparison[a]
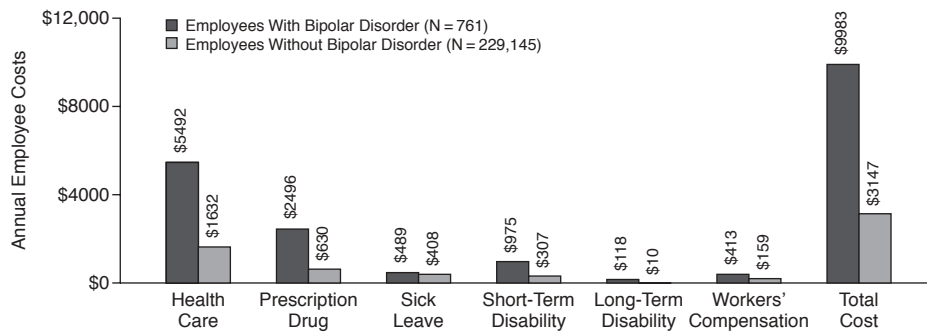
[a]Costs were measured during the year following each person's index date. For employees with bipolar disorder, the index date was the date of the first bipolar diagnosis in 2001. For employees without bipolar disorder, the index date was the average index date from the bipolar employee group. Costs shown were adjusted using regression modeling and controlling for age, tenure, gender, marital status, race, exempt status, full-time/part-time status, salary, and location. All cost differences between groups were significant (p < .05).

Figure 2. Comparisons of Work Absence (annual absence days per person)[a]
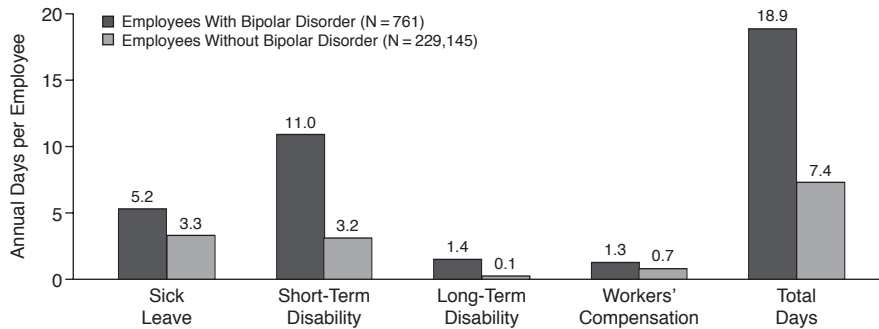
[a]Days are measured from leaves begun during the year following each person's index date. For employees with bipolar disorder, the index date was the date of the first bipolar diagnosis in 2001. For employees without bipolar disorder, the index date was the average index date from the bipolar employee group. Days shown were adjusted using regression modeling and controlling for age, tenure, gender, marital status, race, exempt status, full-time/part-time status, salary, and location. All differences between groups were significant at the p < .05 level except workers' compensation, where p = .0521.

year. Most (58%) of the time lost by employees with bipolar disorder occurred under the short-term disability benefit. All lost-time differences between employees with bipolar disorder and employees without bipolar disorder were significant, at p < .05, except the difference in workers' compensation days—1.3 versus 0.7—which was significant at the p = .0521 level.

Comparisons of Coexisting Conditions

Comparison of the concurrent conditions of employees with bipolar disorder with the conditions of employees without bipolar disorder found that in almost every MDC, employees with bipolar disorder incurred higher average costs than employees without bipolar disorder (Figure 3).
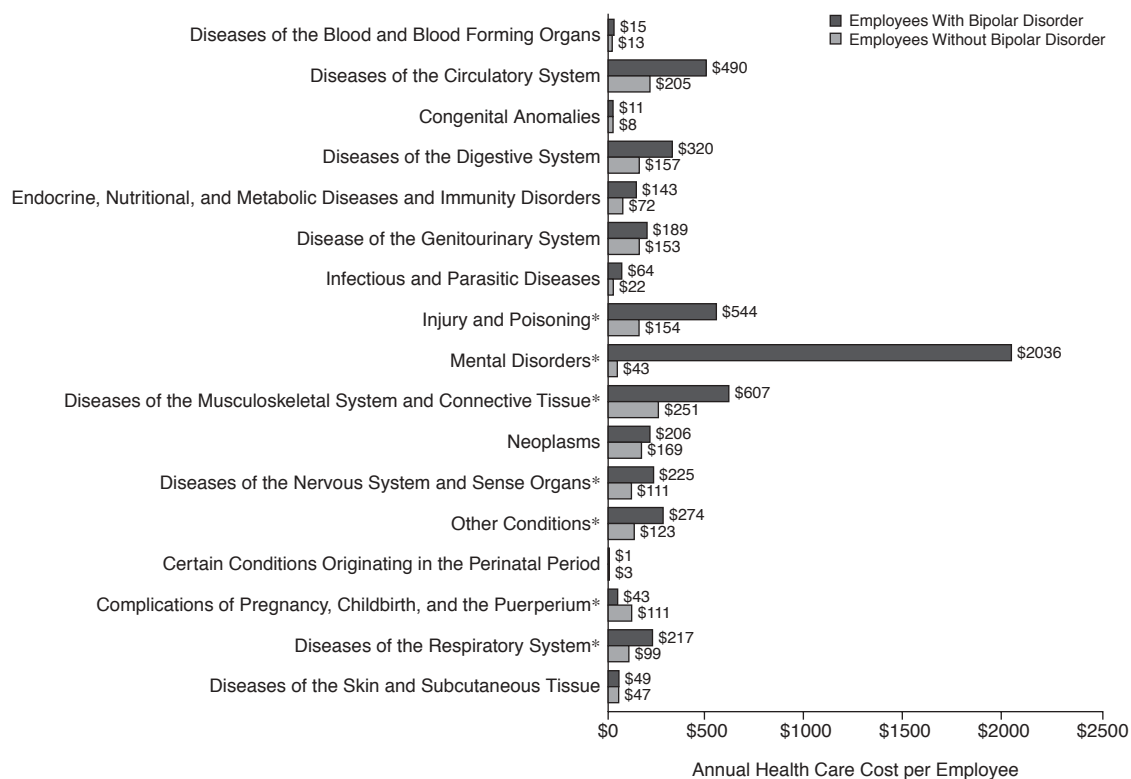
Examination of specific concurrent conditions identified many significant differences in average costs, some of which are shown in Figure 4. Notably, several of the physical health condition categories had significantly higher costs among employees with bipolar disorder than among employees without bipolar disorder. These included headaches and migraines (3.2 times higher), intervertebral disk disorders (2.1 times higher), hyperlipidemia (2.1 times higher), and other nontraumatic joint disorders (1.7 times higher). Other notable, but not statistically significant, physical health condition category cost differences included acute myocardial infarction (9.2 times higher for employees with bipolar disorder), coronary atherosclerosis (2.1 times higher), and nutrition/endocrine/metabolic disorders (2.1 times higher).

Risk Stratification of the Bipolar Cohort

Figure 5 displays the results of risk stratification quintile analysis for the cohort of employees with bipolar dis-

Figure 3. Major Diagnostic Category Concurrent-Condition Costs by Population Cohort[a]

Legend:
- Employees With Bipolar Disorder
- Employees Without Bipolar Disorder

Category	With	Without
Diseases of the Blood and Blood Forming Organs	$15	$13
Diseases of the Circulatory System	$490	$205
Congenital Anomalies	$11	$8
Diseases of the Digestive System	$320	$157
Endocrine, Nutritional, and Metabolic Diseases and Immunity Disorders	$143	$72
Disease of the Genitourinary System	$189	$153
Infectious and Parasitic Diseases	$64	$22
Injury and Poisoning*	$544	$154
Mental Disorders*	$2036	$43
Diseases of the Musculoskeletal System and Connective Tissue*	$607	$251
Neoplasms	$206	$169
Diseases of the Nervous System and Sense Organs*	$225	$111
Other Conditions*	$274	$123
Certain Conditions Originating in the Perinatal Period	$1	$3
Complications of Pregnancy, Childbirth, and the Puerperium*	$43	$111
Diseases of the Respiratory System*	$217	$99
Diseases of the Skin and Subcutaneous Tissue	$49	$47

Annual Health Care Cost per Employee

[a]Costs were measured during the year following each person's index date. For employees with bipolar disorder, the index date was the date of the first bipolar diagnosis in 2001. For employees without bipolar disorder, the index date was the average index date from the bipolar employee group.
*$p < .05$.

order. It presents for each of the quintile subpopulations the average bipolar disorder–related health care cost, other-conditions health care cost, bipolar disorder–related drug cost, other drug cost, workers' compensation medical cost, sick leave cost, and other-absence cost (short-term disability, long-term disability, and workers' compensation disability).

On one hand, the fifth quintile is made up of only 2.4% of the population of employees with bipolar disorder. These high-cost employees incurred 20% of the total health care insurance and drug claims costs that were incurred by the entire population of employees with bipolar disorder. On the other hand, 61.6% of the bipolar disorder population had low health benefit costs, making up the first quintile of cost. Employees in the higher quintiles also had much more absence from work. In fact, employees in the first quintile averaged 10.4 health-related lost days from work per year, while employees in the fourth and fifth quintiles averaged more than 72 health-related lost days per year—almost 7 times higher. The analysis also found that the concurrent health condition (non–bipolar disorder) costs for employees in the

fifth quintile were 60 times higher than the concurrent health condition costs for employees in the first quintile.

DISCUSSION

Summary

This analysis used a comprehensive source of health benefit claims and health-related absence information for employed individuals. The present results indicate that total health benefit costs of employees with bipolar disorder were 3.17 times higher than those of employees without bipolar disorder. The health care costs were 3.36 times higher, and the health care and pharmaceutical costs combined were 3.53 times higher for employees with bipolar disorder. The current research found that adjusted mean short-term disability costs were $975 versus $307, workers' compensation costs were $413 versus $159, long-term disability costs were $118 versus $10, and sick leave costs were $489 versus $408 (all representing bipolar vs. nonbipolar, respectively). Overall, employees with bipolar disorder had 2.5 times more health-related work absence days annually than employees without bipolar disorder.

Figure 4. Specific Diagnostic Category Concurrent-Condition Costs by Population Cohort[a]
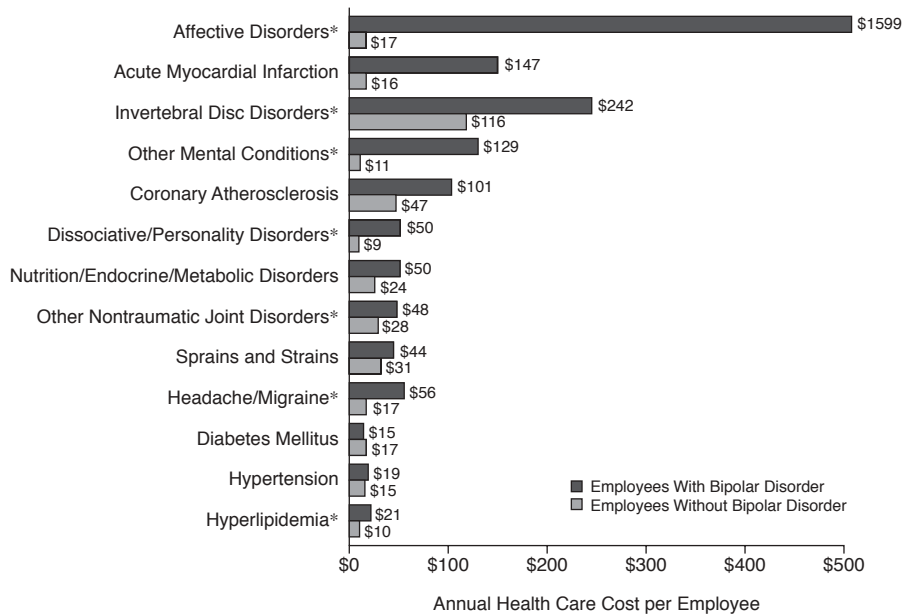
[a]Costs were measured during the year following each person's index date. For employees with bipolar disorder, the index date was the date of the first bipolar diagnosis in 2001. For employees without bipolar disorder, the index date was the average index date from the bipolar employee group.
*p < .05.

Figure 5. Risk Stratification Quintile Analysis for Employees With Bipolar Disorder[a]
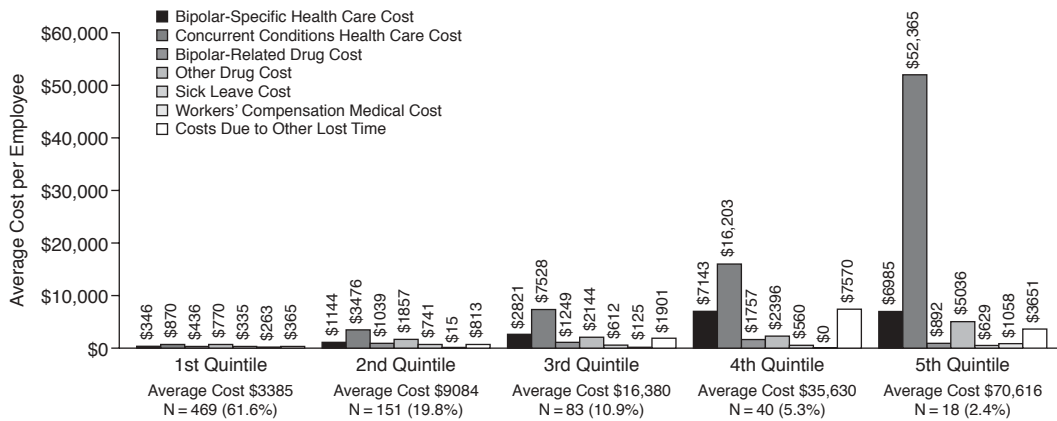
[a]Reprinted with permission from Brook et al.[26] The 761 employees with bipolar disorder were ranked according to their total medical and drug cost during the year following their index date (date of the first bipolar diagnoses in 2001). After being ranked, the employees were grouped into 5 quintile groups such that the total medical and drug cost for each quintile group summed to 20% of the overall total medical and drug cost.

Additionally, the present research incorporated 2 subanalyses to help describe the nature of the cost and absence differences between employees with and without bipolar disorder. First, using 2 AHRQ diagnostic classifications, health care costs within 17 MDCs and 261 specific diagnostic categories were compared. The Mental Disorders MDC accounted for 37.5% of health care costs for employees with bipolar disorder compared with 2.5% for the nonbipolar cohort. Second, a quintile analysis was performed on bipolar disorder–specific health care and prescription drug costs to obtain a proxy for disease and cost severity. This analysis found that employees in the highest 2 quintiles had nearly 7 times more work absence days than employees in the lowest quintile.

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Context

The study's prevalence rate of 0.3% was slightly higher than that of other employer-based studies.[2–4] This prevalence, however, is less than the estimated prevalence of 0.8% to 1.6% of the general U.S. population.[14] Factors that can influence that rate may include the rate of misdiagnosis of major depressive disorder[16] as well as employment issues. It has been demonstrated that compared with a control group of persons with major unipolar affective disorder, persons with bipolar disorder were significantly more likely to report declines in job status, including loss of employment and income at the end of a 1-year follow-up.[27] Self-reported survey data also indicate problems with employment among the bipolar disorder population.[13]

The health benefit cost and health-related work absence results of the study corroborate and add to the limited number of published findings on the economic impact of bipolar disorder on an employed population. The present findings are consistent with other published literature, including the recent study of 2883 persons with bipolar depression that were compared with an age- and sex-matched cohort from electronic health insurance claims. The bipolar cohort's mean total patient cost of health care in 1997 was $7663 compared with $1926 for the nonbipolar cohort—a difference of almost 300%.[1] Another study found similar results, as persons with unrecognized bipolar disorder had significantly (p < .05) greater monthly direct health care costs: $1179 per month compared with patients with recognized bipolar disorder ($801) and patients without bipolar disorder ($585).[4] When annualized, those costs represent $14,148, $9612, and $7020 for the 3 cohorts, respectively. That study also estimated the monthly indirect costs as $570, $514, and $335 for the 3 cohorts, respectively, with the difference between the bipolar and nonbipolar cohorts significantly different (p < .05) but with the differences between the 2 bipolar disorder cohorts not significantly different.[4]

It has been reported elsewhere that mental health costs accounted for only 22% of all health care costs for the bipolar cohort.[1] Our study, with an entry criterion that considered only diagnosis, not treatment, reported 37.5%.

Some studies examined health-related absences and absence costs due to bipolar disorder in a limited way.[3,12] One study only provided estimated sick leave and short-term disability costs on an episode basis and did not provide any lost work time comparisons.[12] The Matza et al.[3] study reported lost work time for sick leave using data from an employer health claims database containing age-matched, sex-matched, and job-type–matched controls. The mean annual sick leave hours for employees with bipolar disorder amounted to 55 compared with 21 for controls (N = 740). Assuming 8 hours per workday, those persons had, respectively, 6.9 and 2.6 days of sick leave per year, similar to the 5.2 and 3.3 days of sick leave reported

in the current study. Matza and colleagues' study also provided absence cost information for short-term disability and workers' compensation (but no lost work time comparisons for these absence types). The mean short-term disability payments amounted to $1231 for employees with bipolar disorder compared with $131 for controls, and mean workers' compensation payments came to $554 for those with bipolar disorder compared with $228 for controls,[3] results similar to the short-term disability and workers' compensation results reported in the present study.

Thus far, no single bipolar disorder study examined as many health-related absence cost and lost time outcomes. Furthermore, the few studies that addressed the incremental impact of bipolar disorder on limited types of work absence only used t tests and analysis of covariance methods to compare absence days and costs. The current study improved on these methods by using a 2-stage regression methodology to account for the nonnormality of the data distributions and thereby obtained a more accurate quantification of the bipolar disorder impact.

Limitations

A potential limitation on this research is that the bipolar cohort was restricted to only those diagnosed with bipolar disorder ICD-9 codes, and therefore it may underestimate the prevalence and costs for persons with bipolar disorder who are not diagnosed, who are misdiagnosed, or who do not have a diagnosis on their medical records.[28] One study found that the initial treatment for bipolar disorder was delayed an average of 10 years from the onset of symptoms.[29] The economic burden of undiagnosed bipolar disorder has been found to be greater than among those who carry a formal diagnosis.[4]

Some comparisons in the quintile analysis had limitations due to sample size. In addition, given the way the quintiles were defined, employees in the higher quintiles will most likely have higher concurrent-condition health care costs than employees in the lower quintiles.

Another limitation of this report is the lack of real at-work productivity output comparisons between employees with bipolar disorder and employees without bipolar disorder. These comparisons, however, are reported by the authors elsewhere (showing 20% lower adjusted annual productivity for the bipolar cohort), and they add a significant component to the study of the impacts of bipolar disorder.[10]

The research described in this report is limited in that it does not provide a comparison of bipolar disorder with other related diseases. The authors provide health care cost and comorbidity comparisons between bipolar disorder and other mental disorders in another report,[30] but the literature encompassing comparisons of other health benefits costs and absence between bipolar disorder and other diseases should be expanded. Although it is not surprising

that employees with bipolar disorder have higher health care and prescription drug costs than employees without bipolar disorder, the present research answers several important questions, including "Is bipolar disorder severe enough among employees that they take significantly more time off work?" and "How much more do employees with bipolar disorder cost than other employees?" It is important to quantify these differences so that caregivers and employers are aware of the economic impact of the disease and the need for effective treatment. The only way to quantify the incremental economic impact of bipolar disorder is to compare employees with the disease to employees without the disease. Employers' concern for and action surrounding bipolar disorder may hinge on the answer to the question "How much more do employees with bipolar disorder cost?" Once that is established, then the incremental impact of bipolar disorder can be compared to the incremental impacts of other diseases in subsequent research.

Implications

The human capital growth of employees could be severely limited by ineffective management of bipolar disorder.[14] There is a need for more cost-efficient patient management,[1] and early recognition of bipolar disorder would lower the health care and drug costs as well as the work-loss costs.[4] The 7 times higher number of work absence days between the highest 2 quintiles and the lowest quintile suggests that there may be differences in bipolar disorder severity among the bipolar employee population, differences that could require distinct management strategies. In addition, cost savings could be realized by prevention of the progression of bipolar disorder from a single manic episode to chronic episodes and hospitalization.[31] Effective pharmacotherapy may make an impact in bipolar disorder as it has in other types of depression.[32,33] Unfortunately, without continued coverage of maintenance therapies and the health care insurance that comes with employment, persons with bipolar disorder may experience relapses that complicate care.[34]

Our future research intends (1) to analyze the impact of therapies, of medication compliance, and of the venues where care is delivered—such as hospitals versus outpatient clinics—and (2) to determine why some of the employees with bipolar disorder in our study had high costs and lost time, while others with bipolar disorder had little lost time and much more reasonable levels of health care and drug costs.

In conclusion, the present approach found that the impact of bipolar disorder is not limited to health care and pharmaceutical costs but, rather, encompasses a wide array of employee health benefit costs and health-related absences. By our presentation of the human capital impact of bipolar disorder, it is hoped that employers, insurers, and clinicians may become able to better address the needs of such employees, may develop programs that identify the disease earlier, and may more effectively manage patients' health care and drug treatment needs.

Drug names: carbamazepine (Carbatrol, Equetro, and others), divalproex sodium (Depakote), gabapentin (Neurontin and others), lamotrigine (Lamictal), lithium (Lithobid, Eskalith, and others), oxcarbazepine (Trileptal), tiagabine (Gabitril), topiramate (Topamax), valproic acid (Depakene and others), zonisamide (Zonegran and others).

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