Association of higher costs with symptoms and diagnosis of depression

EDWARD J. CALLAHAN, PhD; KLEA D. BERTAKIS, MD, MPH; RAHMAN AZARI, PhD;
JOHN A. ROBBINS, MD; L. JAY HELMS, PhD; AND J. PAUL LEIGH, PhD
Davis, California

KEY POINTS FOR CLINICIANS

- Diagnosis of depression is associated with higher costs.
- Failure to diagnose depression may raise laboratory costs.
- Diagnosis of depression with few symptoms deserves study.

■ OBJECTIVE We examined the relationships among depressive symptoms, physician diagnosis of depression, and charges for care.

■ STUDY DESIGN We used a prospective observational design.

■ POPULATION Five hundred eight new adult patients were randomly assigned to senior residents in family practice and internal medicine.

■ OUTCOMES MEASURED Self-reports of health status assessment (Medical Outcomes Study Short Form-36) and depressive symptoms (Beck Depression Inventory) were determined at study entry and at 1-year follow-up. Physician diagnosis of depression was determined by chart audit; charges for care were monitored electronically.

■ RESULTS Symptoms of depression and the diagnosis of depression were associated with charges for care. Statistical models were developed to identify predictors for the occurrence and magnitude of medical charges. Neither depressive symptoms nor diagnosis of depression significantly predicted the occurrence of charges in the areas studied, but physician diagnosis of depression predicted the magnitude of primary care and total charges.

■ CONCLUSIONS A complex relationship exists among depressive symptoms, the diagnosis of depression, and charges for medical care. Understanding these relationships may help primary care physicians diagnose depression and deliver primary care to depressed patients more effectively while managing health care expenditures.

■ KEY WORDS Depression; fees and charges and utilization; primary health care. (*J Fam Pract* 2002; 51:540–544)

As US medical care has evolved, physicians have been expected to recognize and treat mental health problems in primary care,[1] "the hidden mental health network."[2,3] Primary care clinicians are expected to observe signs of possible mental health problems, incorporate those observations into differential diagnoses, and decide which problems to treat or monitor and which to send for consultation or referral.[4] These decisions can have important financial and health consequences, especially in dealing with depression.

Depression is common in the community[5] and among primary care patients, 6% to 9% of whom report symptoms of major depression.[6–8] An additional 10% to 15% of primary care patients show signs of less severe but important depressive problems.[8,9] "Subclinical depression" is marked by symptoms that might indicate physical disease, signs of depression, or both; recognition may affect costs of care.[10–13]

Research has begun to define the impact of depression on processes[14] and costs of care.[15–17] For example, elderly patients reporting symptoms of depression have more laboratory tests performed at higher cost.[15] Primary care patients diagnosed with depression had total yearly health care costs almost double those of patients without depression, with increased costs secondary to higher medical utilization and not mental health specialty treatment.[16] There is evidence that depressive symptoms and the diagnosis of depression may predict increases in costs of care.[17]

Costs of care might be influenced by the model used by primary care physicians to identify depression.[18] For example, a biomedical model might use more laboratory testing to reach a diagnosis of depres-

sion by exclusion, whereas a psychosocial model would use fewer laboratory tests while the physician pursues psychosocial issues. To identify optimal strategies for practice, it is important to determine how symptoms of depression and physician diagnosis of depression might interrelate and affect medical care costs.

We explored the following hypotheses: (1) that there are significant differences in each type of charge determined by the presence or absence of symptoms and diagnosis of depression; (2) that depressive symptoms and physician diagnosis of depression predict the occurrence of charges for specialty care, emergency services, laboratory services, and hospitalization; and (3) that depressive symptoms and physician diagnosis of depression predict the magnitude of medical charges for primary care, specialty care, emergency services, laboratory services, hospitalization, and total charges.

METHODS

Study design

Five hundred eight adult nonpregnant new patients were assigned randomly to primary care providers in either family practice or general internal medicine clinics in a teaching hospital. Children younger than 18 years and pregnant women were excluded because they are not followed in general internal medicine. At enrollment and follow-up, self-reported depression was determined with the abbreviated Beck Depression Inventory (BDI)[19] and health status was measured with the Medical Outcomes Studies Short Form-36 (MOS SF-36).[20] To avoid altering clinician practice, physicians were not provided with either score. Physicians included 105 senior residents (second and third year) in family practice and general internal medicine.

Measures

Beck Depression Inventory. The BDI is a reliable and valid instrument used to measure depressive symptoms.[19,21] The abbreviated version includes 13 items weighted and summed to produce a total score.[19] A score between 9 and 15 indicates moderate depression, and a score of at least 16 indicates severe depression. The BDI is used widely for screening and to assess treatment efficacy.[22] In this study, a BDI score between 0 and 8 was considered "low" or normal, and a score of at least 9 was considered "high" or indicative of symptoms of depression.

At study entrance or exit, 130 patients were identified with significant symptoms of depression (BDI > 8) by meeting criteria for moderate or severe depression[19] and thus identifying roughly the top quartile of BDI scores among participants. This proportion approximates that of primary care patients estimated to experience significant depression.[6,7]

Medical Outcomes Studies Short Form-36. Health status was measured with the MOS SF-36,[20] a 36-item self-report questionnaire. Reliability has been verified for difficult populations.[23] Summary measures can describe a physical component score and a mental component score.[24,25] The physical component score was used in this study to measure physical health status.

Medical chart review. Two physicians (K.D.B. and J.A.R.) reviewed the charts to identify notations of depression on problem lists and in visit notes to signify physician diagnosis of depression.

Charges. Charges were used as a proxy for costs. Electronic data for all health system charges were monitored from the initial visit through 1 full year of care. Six categories were monitored: primary care, specialty care, laboratory testing, emergency department, hospitalization, and total charges. Pharmacy charges were excluded because some patients purchased prescriptions outside the hospital system.

Statistical procedures

Mean log values for each area of medical charges were determined and contrasted with the Duncan multiple range test[26] to explore the first hypothesis that charges are associated with symptoms and diagnoses of depression. Next, a double hurdle model was used to test the hypotheses that depressive symptoms and physician diagnosis of depression predict the occurrence and magnitude of charges for a variety of services.[27,28] In a double hurdle model, the first "hurdle," or step, involves exploring whether there are variables that can significantly predict the occurrence of an event (such as a medical charge). The second step involves exploring whether there are variables that can predict the magnitude of the event (eg, a medical charge).

Log-transformation of charges was performed to eliminate undue influence from outliers. No logistic regression models were developed for the occurrence of primary care charges or total charges (the first hurdle) because all study patients had charges in both categories. Results are presented by hypothesis.

RESULTS

Seventy-seven of 508 study patients (15.1%) were identified as depressed by their primary care providers in chart notes. BDI scores showed considerable spread (range, 0–31) and were significantly associated with the diagnosis of depression ($P < .001$). Whereas 140 patients reported BDI scores of at least 9, only 36 of these patients were diagnosed as depressed by their physicians. Similarly, 41 patients were diagnosed as depressed despite reporting low (normal) BDI scores. Patients were assigned to 1 of 4 groups: those diagnosed as depressed and having high (abnormal) BDI scores (n = 36); those diagnosed as depressed despite low BDI scores (n = 41); those not diagnosed as

Log charges of care by diagnosis and symptoms of depression

Charges[†]	Diagnosis of depression		No diagnosis of depression	
	BDI ≥ 9	BDI < 9	BDI ≥ 9	BDI < 9
Primary care	5.868*	6.054*	5.431	5.347
Specialty care	4.266*	3.742*	3.332	2.927
Emergency care	1.681	2.172	1.604	1.248
Laboratory tests	6.121	6.473‡	6.357‡	5.401
Hospital charges	2.174	3.742	1.548	1.1893
Total charges	7.704	7.878	7.508	6.979

*Log costs were higher for patients with the diagnosis of depression regardless of BDI score than for those with no diagnosis and a BDI below 9.
†All charges are logarithmic.
‡Log costs were higher for patients with the diagnosis of depression and a BDI score below 9 or no diagnosis and a BDI score of at least 9 than for those with no diagnosis and a BDI score below 9.
BDI, Beck Depression Inventory.

depressed despite high BDI scores (n = 94); and those not diagnosed as depressed and not having high BDI scores (n = 337).

Hypothesis 1: overall impact of symptoms and diagnosis on charges

Groups diagnosed with depression had significantly higher log primary care charges than did those not diagnosed (Table 1). Both groups diagnosed with depression showed the highest primary care and total medical charges. Patients diagnosed with depression and reporting high BDI scores had higher specialty charges than those not depressed. Highest laboratory costs were found for those diagnosed as depressed despite low BDI scores and those with elevated BDI scores who were not diagnosed as depressed. There were no significant differences among groups for log charges for emergency care and hospital charges.

Hypotheses 2 and 3: factors predicting occurrence and magnitude of charges

Cost models are presented as regressions in Table 2. The left side of the table presents logistic regressions exploring which variables predict whether or not a patient accrues charges in all areas except primary care and total charges. Because all patients had at least 1 primary care visit charge and, hence, a total charge, it was not possible to develop a model to predict the occurrence of those charges.

Physical health status (measured by the physical component score of the MOS SF-36) predicted the occurrence of all charges measured with the exception of laboratory tests. Advanced patient age predicted increased likelihood of charges in each area; female sex showed a trend toward predicting occurrence of emergency care charges; and education

showed a trend toward predicting occurrence of laboratory charges. BDI scores (measure of symptoms of depression) and physician diagnosis of depression failed to contribute significantly to the prediction of specialty care, emergency care, laboratory testing, or hospital charges. However, there was a trend for depressive symptoms to predict the occurrence of laboratory charges.

The right side of Table 2 presents regression models that predicted the magnitude of the different categories of charges. Physical health status was a significant predictor of the magnitude of all types of charges except emergency care. Patient age contributed to prediction of size of all types of charges except emergency visits and laboratory tests. Female sex was a significant predictor of magnitude of charges in primary care, laboratory tests, and total medical charges. The diagnosis of depression was a significant predictor of magnitude of primary care (P = .0029) and total medical (P = .0158) charges. Neither depressive symptoms nor the diagnosis of depression contributed significantly to the prediction of magnitude of charges for specialty care, emergency care, laboratory testing, or hospital use, although there was a trend for depressive symptoms to predict the magnitude of laboratory costs. Although an interaction term was entered into both kinds of regression equations, there was no evidence of a significant contribution from the interaction of symptoms of depression and diagnosis of depression in any of the predictor models developed.

DISCUSSION

Medical charges were related to symptoms of depression and physician diagnosis of depression in this study. Although the patient sample was small, it was representative of the primary care population in displaying a wide range of depressive symptoms as measured by the BDI.[6,7] In this study, physician diagnosis of depression was related to self-reported depression ratings: those diagnosed as depressed had significantly higher BDI scores than did those not diagnosed as depressed. However, the relationship between self-reported symptoms and diagnosis was not perfect: 72% of patients with high BDI scores were not recognized as depressed, as often occurs in primary care.[6,7] In fact, more patients diagnosed with depression had low BDI scores (< 9, n = 41) than high BDI scores (> 8, n = 36). Clearly, other factors enter the process by which primary care physicians reach the diagnosis of depression.

Symptoms of depression and the diagnosis of depression probably influence the process of care in different ways. Differences in process of care likely would be reflected in different relationships to medical charges. Physician diagnosis of depression was associated with higher primary care and total costs and contributed to models predicting magnitude of primary care and total charges. However, neither

TABLE 2

Regression analyses predicting charges

Charges	Independent variable*	Occurrence		Magnitude		R^2
		Beta	P	Beta	P	
Primary care	PCS	—	—	-.0961	.04	10.40%
	Sex	—	—	-.1271	.004	
	Age (y)	—	—	.1891	.0001	
	Diagnosis	—	—	.2097	.003	
Specialty care	PCS	-.1583	.005	-.1904	.004	2.40%
	Age (y)	.2235	.0002	.1261	.07	
Emergency care	PCS	-.2518	.0003	—	—	9.75%
	Sex	-.1344	.06	—	—	
	Education	—	—	-.2827	.0068	
	Age (y)	-.1621	.04	—	—	
Laboratory tests	PCS	—	—	-.2689	.0001	19.90%
	Sex	—	—	.1459	.0009	
	Education	.0408	.09	—	—	
	Age (y)	-.0411	.0001	.1978	.0001	
	BDI score	.2487	.08	.0945	.08	
Hospital care	PCS	-.2583	.0007	-.2554	.04	9.40%
	Education	—	—	-.2632	.02	
	Age (y)	.0089	.0007	—	—	
Total charges	PCS	—	—	-.2547	.0001	17.00%
	Sex	—	—	.0846	.05	
	Age (y)	—	—	.2193	.0001	
	Diagnosis	—	—	.1631	.02	

*Only variables significantly associated with the occurrence or magnitude of charges for each component are shown.
BDI, Beck Depression Inventory; PCS, physical component score.

symptoms of depression nor diagnosis of depression predicted which patients were more likely to incur charges for specialty care, emergency care, laboratory tests, or hospitalization. There was a trend only for the symptoms of depression to predict who would incur laboratory charges. These findings suggest that the relationship between depression and primary care charges and total charges is clear but less apparent when looking at less frequently occurring charges.

Other demographic factors showed fairly robust associations with the occurrence of charges. Patient age predicted who would get specialty care, emergency care, laboratory costs, and hospitalization, and there was a trend for female sex to predict occurrence of emergency department charges. Health status proved to be a significant predictor of the magnitude of all charges except those for emergency care. These powerful influences must be considered to accurately assess the impact of depression on charges.

Age also predicted the total amount of charges for primary and all medical care for the year and showed a trend toward prediction of magnitude of specialty charges. Female sex was a significant predictor of magnitude of primary care charges, laboratory charges, and total charges, and less education was a significant predictor of magnitude of emer-

gency department and hospital charges. Some of these demographic predictors are readily explained. For example, as patients age, the number and costs of medical problems often increase. More education may enhance socioeconomic status and self-care, each of which may buffer against the need for emergency care and hospitalization. The reasons that charges are often higher for women are probably more complex. Higher utilization of primary and specialty care for women was associated with lower self-reported health status, less education, and lower socioeconomic status in our previous study.[29]

These results also suggest that physician diagnosis of depression in the absence of elevated BDI scores may flag a different kind of patient presentation. Diagnosis of depression without elevated BDI scores could result from effective treatment controlling the symptoms of previously diagnosed depression, but this does not adequately explain the occurrence. Perhaps other aspects of physician–patient interaction trigger a depression diagnosis without symptoms. This group ranked highest for log-transformed charges for 5 of the 6 areas explored: only for specialty care did those with high BDI scores and diagnosis of depression rank higher in total cost. This strong association with charges implies that these patients represent diagnostic dilemmas, thereby generating more primary care visits and laboratory tests. They may be diagnosed as depressed despite their low BDI scores simply because no organic explanation can be readily identified.

BDI scores showed a trend toward predicting higher laboratory charges in our models. This finding supports the importance of depressive symptoms in influencing the process of primary care, especially laboratory testing.[15,30] Perhaps the diagnosis of depression actually slowed the ordering of laboratory tests.[18] Because our data did not allow a separation of charges for laboratory tests before and after the diagnosis of depression, we did not test this possibility.

The size of this sample (N = 508) and the length of time patients were followed (1 year) might not

have provided adequate power to fully test the contributions of symptoms and diagnosis of depression to the 6 sets of charges. This was likely true for hospitalization charges because hospitalization was an infrequent event in this study. Previous, larger studies found indications of increased hospitalization charges for those diagnosed as depressed[17] and those with symptoms of depression.[15,30] Alternatively, the recent emphasis on decreasing hospitalizations to reduce medical costs may mean that hospitalization for depressive symptoms rather than for physical illness is less likely to occur.[31] In addition, these observations were made by resident physicians and not by community clinicians. It is not clear whether these results would generalize to another setting, although they are consistent with community observations in previous research.

These data do suggest an intriguing interplay of the impact of physician diagnosis of depression and presence of symptoms of depression in a number of indicators of charges and utilization in primary care. Even though each element was associated with increased utilization and charges, their differential impact is unclear. Both may prove important for efforts to enhance recognition of depression; recognition of a mental health problem appeared to shift the process of care in this and previous studies.[14,32] To date, there are no data indicating that the diagnosis of depression reduces utilization or costs of primary care delivery. What is known is that physicians working in primary care are more apt to accurately diagnose those with more severe symptoms of depression than those with more transient or less severe symptoms.[16,33] Although introducing a screening device such as the BDI or the PRIME-MD[9] likely would increase the number of patients diagnosed with depression, it is unclear what impact that would have on the process, costs, and outcomes of care. Simpler interventions such as training in communication skills such as empathy[34] might provide the primary care physician with all the tools needed for identification of emotional distress and mental health problems[14,30] and appropriate treatment or referral.

REFERENCES
1. deGruy F. Mental health care in the primary care setting. In: Donaldson MS, Yordy KD, Lohr KN, Vanselow NA, eds. Primary Care: America's Health in the New Era. Washington, DC: National Academy Press; 1996: 285–311.
2. Regier DA, Goldberg ID, Taube CA. The de facto US mental health services system: a public health perspective. Arch Gen Psychiatry 1978; 35:685–93.
3. Schurman RA, Kramer PD, Mitchell JB. The hidden mental health network. Treatment of mental illness by nonpsychiatrist physicians. Arch Gen Psychiatry 1985; 42:89–94.
4. Nutting PA, Franks P, Clancy CM. Referral and consultation in primary care: do we understand what we're doing? [editorial; comment]. J Fam Pract 1992; 35:21–3.
5. Laepine JP, Gastpar M, Mendlewicz J, Tylee A. Depression in the community: the first pan-European study DEPRES (Depression Research in European Society). Int Clin Psychopharmacol 1997; 12:19–29.
6. Panel DG. Clinical Practice Guidelines. Vol I. Washington, DC: Agency for Health Care Policy and Research; 1993.
7. Panel DG. Clinical Practice Guidelines. Vol II. Washington, DC: Agency for Health Care Policy and Research; 1993.
8. Katon W. The epidemiology of depression in medical care. Int J Psychiatry Med 1987; 17:93–112.
9. Spitzer RL, Williams JB, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care. The PRIME-MD 1000 study [see comments]. JAMA 1994; 272:1749–56.
10. Greenberg PE, Stiglin LE, Finkelstein SN, Berndt ER. The economic burden of depression in 1990 [see comments]. J Clin Psychiatry 1993; 54:405–18.
11. Kirmayer LJ, Robbins JM. Three forms of somatization in primary care: prevalence, co-occurrence, and sociodemographic characteristics. J Nerv Ment Dis 1991; 179:647–55.
12. Kirmayer LJ, Robbins JM, Dworkind M, Yaffe MJ. Somatization and the recognition of depression and anxiety in primary care. Am J Psychiatry 1993; 150:734–41.
13. Kirmayer LJ, Robbins JM. Patients who somatize in primary care: a longitudinal study of cognitive and social characteristics. Psychol Med 1996; 26:937–51.
14. Callahan EJ, Bertakis KD, Azari R, et al. The influence of depression on physician-patient interaction in primary care. Fam Med 1996; 28:346–51.
15. Callahan CM, Kesterson JG, Tierney WM. Association of symptoms of depression with diagnostic test charges among older adults. Ann Intern Med 1997; 126:426–32.
16. Simon GE, VonKorff M, Barlow W. Health care costs of primary care patients with recognized depression. Arch Gen Psychiatry 1995; 52:850–6.
17. Simon G, Ormel J, VonKorff M, Barlow W. Health care costs associated with depressive and anxiety disorders in primary care. Am J Psychiatry 1995; 152:352–7.
18. Carney PA, Rhodes LA, Eliassen MS, et al. Variations in approaching the diagnosis of depression: a guided focus group study. J Fam Pract 1998; 46:73–82.
19. Beck AT, Beck RW. Screening depressed patients in family practice. A rapid technique. Postgrad Med 1972; 52:81–5.
20. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992; 30:473–83.
21. Beck AT, Ward CH, Mendelson M. An inventory for measuring depression. Arch Gen Psychiatry 1961; 4:561–71.
22. Beck AT, Steer RA, Garbin MG. Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. Clin Psychol Rev 1988; 8:77–100.
23. Stewart AL, Hays RD, Ware JE Jr. The MOS short-form general health survey. Reliability and validity in a patient population. Med Care 1988; 26:724–35.
24. McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care 1993; 31:247–63.
25. Ware JE, Kosinski M, Keller SD. SF-36 Physical and Mental Health Summary Scales: A User's Manual. Boston: Nimrod Press; 1994.
26. Harter HL. Critical values for Duncan's new multiple range test. Biometrics 1960; 16:671–85.
27. Duan N. Smearing estimates: a nonparametric retransformation method. J Am Stat Assoc 1983; 78:605–10.
28. Duan N, Manning WG, Morris CN, Newhouse JP. A comparison of alternative models for the demand for medical care. J Business Econ Stat 1983; 1:115–26.
29. Bertakis KD, Azari R, Helms LJ, Callahan EJ, Robbins JA. Gender differences in the utilization of health care services. J Fam Pract 2000; 49:147–52.
30. Unutzer J, Patrick DL, Simon G, et al. Depressive symptoms and the cost of health services in HMO patients aged 65 years and older. A 4-year prospective study. JAMA 1997; 277:1618–23.
31. Leslie DL, Rosenheck R. Shifting to outpatient care? Mental health care use and cost under private insurance. Am J Psychiatry 1999; 156:1250–7.
32. Callahan EJ, Jaén CR, Crabtree BF, et al. The impact of recent emotional distress and diagnosis of depression or anxiety on the physician-patient encounter in family practice [see comments]. J Fam Pract 1998; 46:410–8.
33. Coyne JC, Schwenk TL, Fechner-Bates S. Nondetection of depression by primary care physicians reconsidered [see comments]. Gen Hosp Psychiatry 1995; 17:3–12.
34. Suchman AL, Markakis K, Beckman HB, Frankel R. A model of empathic communication in the medical interview [see comments]. JAMA 1997; 277:678–82.

JFP