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Thomas J. Kniesner
Syracuse University, tkniesne@maxwell.syr.ddu

Regina H. Powers
United States Department of Labor

Thomas W. Croghan
Mathematica Policy Research Inc.

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PSYCHOTHERAPY IN ANTIDEPRESSANT PATIENTS*

Regina H. Powers, Thomas J. Kniesner,
and Thomas W. Croghan

Center for Policy Research
Maxwell School of Citizenship and Public Affairs
Syracuse University
426 Eggers Hall
Syracuse, New York 13244-1020
(315) 443-3114 | Fax (315) 443-1081
e-mail: ctrpol@syr.edu

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Abstract

Depression is a condition with various modes of treatment, including pharmacotherapy, psychotherapy, and some combination of each. The role of psychotherapy in the treatment of depression relative to the role of pharmacotherapy is not well understood, and guidelines for psychotherapy in the primary care setting differ from guidelines for specialty care. There is little evidence about the circumstances in actual practice that affect the use of psychotherapy in conjunction with pharmacotherapy.

We retrospectively identify the most important factors associated with the use of psychotherapy in combination with pharmacotherapy in the treatment of depression. Specifically, we study provider choice, health plan characteristics, and patient characteristics.

We use a comprehensive medical and pharmacy claims data sample of 1,023 individuals during 1992–1994. We select persons prescribed with an antidepressant medication and diagnosed with a depressive disorder by a primary care physician, psychiatrist, or non-physician mental health specialist. Controlling for depression diagnosis and severity, comorbidity, and demographics, we examine the role of provider type and plan benefit characteristics. We study the intensity of psychotherapy using zero-inflated count regression, the intensity of pharmacotherapy using truncated count regression, and the likelihood of relapse of depression using logistic regression.

Patients initially seeing a psychiatrist receive more than double the amount of psychotherapy and slightly more pharmacotherapy than patients of other providers. An additional prescription for antidepressant medication reduces by five percent the likelihood of relapse into depression, but the amount of psychotherapy does not affect relapse. Patients seeing a psychiatrist are half as likely to relapse, independent of any effect of psychotherapy. Case management and coinsurance rates do not affect the amount of psychotherapy, but the presence of case management has a positive effect on the amount of pharmacotherapy and on the likelihood of relapse.

We find no discernible pattern of complementarity or substitution between pharmacotherapy and psychotherapy across providers. Although the amount of psychotherapy provided in conjunction with medication does not affect the rate of relapse to depression, psychotherapy may nonetheless provide beneficial outcomes not studied here. Choice of a psychiatrist reduces the likelihood of relapse, independent of the number of psychotherapy sessions and antidepressant prescriptions. The effect of provider choice on relapse could be an artifact of differences in provider follow-up practices or could represent a difference in provider skills. Managed care strategies do not appear to reduce the intensity of depression treatment, but case management does increase the likelihood of relapse.

Pharmacotherapy and psychotherapy appear to be neither substitutes nor complements in the treatment of depression, suggesting that treatment is individualized. Choice of psychiatrist as the initial provider appears to reduce the likelihood of relapse, suggesting models of coordinated care may be beneficial. The link between psychiatrists and more psychotherapy is consistent with the hypothesis that patients resistant to treatment may nonetheless receive high quality care.

Managed care tools such as case management and coinsurance rates do not appear to restrict the use of either psychotherapy or pharmacotherapy. The association of case management with an increased likelihood of relapse suggests that plan characteristics can affect outcomes.

Our study focuses on psychotherapy combined with medication and does not psychotherapy alone in the treatment of depression, which may be a preferred mode of treatment for some. Outcomes other than relapse, as well as costs, should also be considered. Our findings that psychiatrists are associated with a decreased likelihood of relapse and that case management is associated with an increased likelihood of relapse despite a correlation with greater pharmacotherapy intensity present avenues for additional study.

Key Words: depression, psychotherapy, pharmacotherapy, relapse, count models, zero inflated negative binomial regression

1. Introduction

The role of psychotherapy in the treatment of depression has been a subject of some uncertainty in recent years as pharmacotherapies have proliferated. A recent study has shown that the proportion of individuals treated with psychotherapy has declined even though the rate of outpatient treatment for depression has increased (Olfson et al. 2002). Although psychotherapy alone is recognized as an efficacious treatment, it is often provided in combination with antidepressant medication in the treatment of depression. Psychotherapy in conjunction with medication may be beneficial not only as a direct treatment of the depressive disorder and its symptoms but also as an aid both to medication compliance (Paykel 1995) and family support of treatment (Miller 1996). However, although combined treatment has been shown to be more efficacious than unimodal treatment in specific contexts (Keller et al. 2000), generally the indications for combination treatment are unclear, and guidelines for treatment in the primary care setting differ from guidelines for psychiatric specialty care (Persons 1996). Here we examine how pharmacotherapy and psychotherapy are paired in practice across providers in the treatment of depression and the ultimate consequences of the mix of pharmacotherapy, psychotherapy, and provider for relapse into depression.

The circumstances in actual practice under which psychotherapy is best combined with antidepressant medication are not well understood. Aside from provider and patient preferences, additional factors can affect the use of psychotherapy, such as availability and cost (Thase 1997). Previous work has identified a need for examination of the practice of psychotherapy, including psychotherapy with concurrent pharmacotherapy, as well as characterization of patients in terms of diagnosis, severity, comorbidity, and demographics (Clarkin 1996).

Other work has suggested that characteristics of the health care system can affect the use of psychotherapy in treating depression. Data from the Medical Outcomes Study showed that depressed patients of general medical clinicians receive less counseling than patients of mental health specialists and that health plan prepayment is associated with lower counseling rates (Meredith et al. 1996). In addition, although the cost-containment incentives of managed care organizations have been cited as a potential reason for reductions in the use of psychotherapy, some observers have suggested that psychotherapy, if shown to be cost-effective, might be more compatible with managed care than with traditional health insurance arrangements (Sharfstein 1999). Indeed, in the context of severe mental illness, psychotherapy has been associated with reduced costs (Gabbard 1997). Thus, the relationship between the use of psychotherapy and managed care strategies is not clear.

Recent evidence suggests that psychotherapy and pharmacotherapy are productive complements in treating depression, meaning that they have similar therapeutic effects, ceteris paribus (DeRubeis 1999). However, in clinical practice they need not be used in isolation (as therapeutic substitutes in depression treatment), but rather together (as complementary treatments). Our results shed light on the degree to which, in practice, psychotherapy and pharmacotherapy are substitutes, complements, or appear unconnected quantitatively. Specifically, we attempt to identify retrospectively the most important factors associated with the use of psychotherapy in combination with medication in the treatment of depression using a claims data sample of persons diagnosed with depression and receiving a prescription for an antidepressant medication to study how psychotherapy is used in conjunction with pharmacotherapy.

Our results suggest that patients initially seeing a psychiatrist get substantially more psychotherapy and slightly more pharmacotherapy than patients initially seeing other non-psychiatrist providers of anti-depression care. We find no evidence that the two types of therapies are used in conjunction or that more of one is used in place of less of the other therapy in depression treatment. Concerning the downstream benefits of pharmacotherapy and psychotherapy, our results indicate that pharmacotherapy lessens the likelihood of relapse into depression, but that psychotherapy does not affect relapse; however patients seeing a psychiatrist are less likely to relapse net of any effect of psychotherapy.

2. Methods

Our objective is to disentangle the relative quantitative importance of factors influencing the intensity of psychotherapy in individuals treated for depression with antidepressant medication. We use a retrospective claims database of persons diagnosed with depression and treated with antidepressant medication with or without psychotherapy. Using multivariate statistical models that are appropriate for dependent variables that take on non-negative integer values and that may also be truncated, we assess whether the factors influencing psychotherapy are jointly determined with the intensity of medication use. Finally, we examine the relationship among psychotherapy, pharmacotherapy, and a downstream outcome of interest in the treatment of depression, the likelihood of relapse.

2.1 Data and Variable Definitions

Our data, which come from the MarketScan™ database, contain comprehensive medical and pharmacy claims data for about 700,000 employed persons and their families who worked in 20 different self-insured Fortune 500 companies (The MEDSTAT Group, Ann Arbor, MI).

Health insurance benefits offered by employers include indemnity and managed care plans that were dominated by preferred provider organizations. The particular MarketScan™ information we use centers on claims data for continuously enrolled individuals and their plan benefit information from 1992 through 1994.

Available claims information covers eight quarters post-depression diagnosis and two quarters pre-depression diagnosis. We select antidepressant recipients diagnosed with a depressive disorder by a primary care physician, a psychiatrist, or a non-physician mental health specialist. To identify new treatment episodes we exclude persons with any claims for psychotherapy or antidepressants in the six-month period prior to the diagnosis of depression. We include only people with information about plan benefit characteristics. Our final sample size used in estimation is 1,023.

Table 1 lists the variables of interest in the study sample. In addition to demographic information about the patient's age, sex, and the number of comorbid conditions, we examine effects of the specific depression diagnosis and the type of provider associated with the initial depression diagnosis. We also attempt to account for propensity to use health care and overall health by including non-psychiatric costs in the quarter prior to the diagnosis. We account for the intervening influence of the number of anxiolytic prescriptions filled after the depression diagnosis, which could correspond to the level of psychiatric distress, be an indicator of prescription-filling behavior, or measure inappropriate treatment of depressive symptoms. To examine the effect of characteristics of the health plan and to purify the estimated effects of provider on outcomes of interest in a multivariate setting, we include as control variables the outpatient psychiatric coinsurance rate and whether the health plan employed case management practices. We identify relapse or recurrence of depression when the claims data include any of

the following: a new episode of drug therapy follows a gap of six or more months in medication claims, a suicide attempt, a psychiatric hospitalization; a mental health related emergency department visit, or electroconvulsive therapy.[1]

2.2 Data Analytic Procedures

To study the use of psychotherapy and pharmacotherapy in some quantitative detail, we expand on simple univariate comparisons in by employing multivariate models of the number of psychotherapy visits and antidepressant prescriptions that account for the substantial number of nonusers of psychotherapy and the fact that all patients had at least one antidepressant prescription. Our list of categorical explanatory variables includes depression diagnosis indicators, with Depression Not Otherwise Specified as the reference category, and diagnosing provider indicators, with Primary Care Physicians as the reference category. The amount of psychotherapy is determined by the number of psychotherapy visits after the depression diagnosis, and the amount of pharmacotherapy by the number of antidepressant prescriptions. Because the dependent variables we study are each a non-negative integer we use count data models rather than standard regression models in which the dependent variable is assumed to be a continuous variable.[2]

The Poisson regression model is the most basic count model, but it invokes the restriction of equality between mean and variance, termed equi-dispersion. Because preliminary results show that the conditional mean and variance are unequal for each of the two therapies we study in our sample, we employ the more general Negative Binomial multivariate model, which is a generalization of the Poisson model that allows for overdispersion (the conditional variance exceeds the conditional mean) and has been productively applied to models of health care

utilization (Cameron and Trivedi 1998; Freund, Kniesner, and LoSasso 1999; Jones 2000; Winkelmann 2000).

Expressed algebraically, the conditional mean value of a therapy level in a sample where *i* indexes a case of depression is

$$E(y_i \mid x_i) = \lambda_i = \exp(b'x_i), \tag{1}$$

where b is the vector of parameters to estimate that determine the marginal effect of an independent variable, x, on the discrete value of therapy incidence, y. Additionally, the negative binomial count model includes an overdispersion parameter, δ, that parameterizes the prevalent form of heteroskedasticity where the conditional variance exceeds the conditional mean, λ, which is prevalent in count data such that

$$\text{var}(y_i \mid x_i) = \lambda_i(1 + \lambda_i\delta). \tag{2}$$

Equation (2) illustrates how the negative binomial specification nests inside it the Poisson model, and that if $\hat{\delta} = 0$ then the Poisson count model appears.

An additional complexity common in models of counts is a large number of zero values. In our case about 47 percent of the sample had no claim for psychotherapy, and we attempt to account for the high proportion of patients not receiving psychotherapy in the statistical model. Although the Negative Binomial model accommodates a large number of zeros, we also estimate variations of the Negative Binomial model that further adjust for so-called excess zeros in the sample termed the zero-inflated Negative Binomial model. The ZINB model adds what is termed a splitting parameter, q, that is the proportion of zero use that will occur no matter what the values of the independent variables might be (some people will never submit to psychotherapy).

$$E(y_i \mid x_i) = \lambda_i(1 - q_i(x)) \tag{3}$$

and

$$\text{var}(y_i \mid x_i) = \lambda_i(1-q_i)[1+\lambda_i(q_i+\delta)]\,. \tag{4}$$

Using the same list of explanatory variables we also examine models of the intensity of pharmacotherapy for depression where the dependent variable is the number of antidepressant medication prescriptions filled. To expand upon a simple comparison of means we again use a multivariate count regression model. However, because our sample of depressed persons is constructed by locating patients with at least one antidepressant prescription, we must employ a model that accounts for truncation at zero.[3] We therefore use a truncated negative binomial model to examine the marginal effect of provider type on anti-depressant medication use.

Along with the count regressions for psychotherapy, our regression for pharmacotherapy reveals whether intensity of pharmacotherapy seems to complement, substitute for, or is largely independent of the amount of psychotherapy. If psychotherapy complements pharmacotherapy, then the number of psychotherapy visits should increase with the number of antidepressant prescriptions. If they are substitutes, then the number of psychotherapy visits should decline as the number of prescriptions increases. If neither a positive nor a negative relationship occurs between the two therapies, then we consider decisions to use psychotherapy and pharmacotherapy largely independent.

Lastly we examine the relative importance of the components of anti-depression treatment on treatment success measured by the likelihood of a relapse. For ease of interpretation we use the familiar binary (y = 0, 1) logit specification with

$$\text{Prob(Relapse)} = \text{Prob}(y = 1) = e^{\beta' x}/(1+e^{\beta' x})\,, \tag{5}$$

where we are concerned with the estimates of β to use in constructing case-mix adjusted effects of the regressors related to the specialty of treatment provider and amounts of pharmacotherapy versus psychotherapy. In our data relapse means that the person subsequently experienced a new

episode of anti-depressant therapy, a suicide attempt, psychiatric hospitalization, a mental health related emergency department visit, or electroconvulsive therapy, a measure previously shown responsive to changes in the quality of care (Melfi et al. 1998, Sood et al. 2000).

Before discussing our results it is important to note that the regression coefficients, *b* in Equation Psychotherapy in Antidepressant Patients n (1) and β in Equation (5) are not the objects of interest, because they are not themselves the estimated effects of a change in an independent variable. All of the models we estimate are non-linear index transformations of the regressors with general form $y = G(f(x))$ so that marginal effects (ME) of interest must be evaluated at a particular set of values for *x*, which we generally set equal to $\bar{x}$. For a continuous regressor ME = $\hat{G}'\hat{f}'$, so that for the negative binomial models of pharmacotherapy and psychotherapy ME = $\hat{\lambda}(\bar{x})\hat{b}$ and for the relapse logit the marginal effect is ME = $\hat{P}(\bar{x})(1-\hat{P}(\bar{x})\hat{\beta}$, where *P* = Prob(*y* = 1). For a discrete regressor, say provider type, ME = $\hat{y}(x=1)-\hat{y}(x=0) = \hat{G}(\hat{f}(x=1))-\hat{G}(\hat{f}(x=0)) \cong \hat{P}(\bar{x})(1-\hat{P}(\bar{x})\hat{\beta}$. In the empirical results we focus the discussion on the estimated marginal effects of provider type on the numbers of psychotherapy visits and anti-depressant prescriptions and on the marginal effects of the intensity of pharmacotherapy, psychotherapy, and provider type on treatment success measured by the probability of a relapse.

3. Results

Table 1 presents the descriptive statistics for the entire sample and is stratified by the type of provider making the initial diagnosis of depression. As in our prior research (Kniesner, Powers, and Croghan 2002), the specialty of the first provider is significantly associated with the

mix of treatment patients subsequently receive. Patients diagnosed by psychiatrists average about 11 claims for psychotherapy, while patients of non-physician mental health specialists average about Psychotherapy in Antidepressant Patients.

Five claims, and patients diagnosed by primary care physicians average three to four psychotherapy claims. Inter-provider differences in case-mix, which could reflect diagnostic patterns or real differences in the types of patients who seek care from specific providers, are such that psychiatrists are the main provider of treatment for cases of single episode and recurrent major depression while non-physician mental health specialists are the main provider of treatment for cases of dysthymia and reactive depression. Psychiatrist patients also receive more prescriptions for anxiolytics and are less likely to relapse than those seeing other providers. Overall, about three fourths of the sample received at least four prescriptions in the first six months of treatment, and there were no differences among providers. Because univariate comparisons do not reveal fully the degree of differences in case-mix among various providers, we proceed to control for case-mix details in order to identify better the role of provider type in the use of psychotherapy, pharmacotherapy and treatment success.

3.1 Psychotherapy Visits

Table 2 presents the zero-inflated negative binomial (ZINB) count model of the number of psychotherapy visits. We include both model coefficients and marginal effects computed at the means of the independent variables. Both the estimated overdispersion parameter ($\hat{\delta}$) and the estimated zero-inflation parameter (which is a function of $\hat{q}_i$) are significant statistically, which means that the data reject both the simpler Poisson specification and the basic negative binomial specification in favor of the ZINB count model form.[4] Concerning the variables controlling for case-mix across providers, a diagnosis of recurrent major depressive disorder is significantly and

positively related to the number of psychotherapy visits, resulting in approximately four to five additional psychotherapy visits, such that the number of visits for a major depressive disorder is about twice the mean. The effects of all other types of depression are small and insignificant statistically as are the influences of age and gender on psychotherapy.

Neither the psychiatric coinsurance rate nor the presence of case management in the health insurance plan are statistically significant predictors of the amount of psychotherapy.[5] Using the mean amount of psychotherapy as a comparison point, ceteris paribus the existence of case management lowers the amount of psychotherapy by about 9 percent and doubling the coinsurance rate on mental health care reduces psychotherapy by about 7 percent, but insurance plan characteristics appear to be statistically weak determinants of the number of psychotherapy visits.

Because provider type appears related to the subsequent mix of treatments, a focal point of our research effort is whether there is a statistically significant differential effect of provider, ceteris paribus, on the use of psychotherapy. If the amount of psychotherapy is a substitute for pharmacotherapy, then it follows that providers who use more psychotherapy should use less pharmacotherapy. Adjusting for case-mix, diagnosis by a psychiatrist is associated with approximately six more psychotherapy visits than if the diagnosis is by a primary care physician.[6] The result is quite different for diagnosis by non-physician mental health specialists. In contrast to the results for psychiatrists, there is a quantitatively small but insignificant increase in the use of psychotherapy subsequent to an initial diagnosis by a non-physician mental health specialist. After adjusting for case-mix, diagnosis by a mental health specialist does not result in any additional psychotherapy visits than does diagnosis by a primary care physician. Finally, we note that the case-mix adjusted differential in the amount of psychotherapy in Table 2 between

psychiatrists and other providers is about the same as the unadjusted difference in Table 1; patients whose initial providers were psychiatrists got about twice the psychotherapy as patients whose initial providers of anti-depression therapy were general medical practitioners or non-physician mental health specialists.

3.2 Anti-depressant Medication

The results for the truncated count model of anti-depressant prescriptions are presented in Table 3. The most striking result is that the presence of case management in the health plan is significantly associated with the number of antidepressant prescriptions, increasing the number of prescriptions by more than three. Using the mean as a point of reference, case management increases the intensity of pharmacotherapy by about 30 percent. No other covariates had a large statistically significant estimated marginal effect. The most important result to emerge from our truncated negative binomial count model of anti-depression pharmacotherapy is that the case-mix adjusted results for inter-provider differences mimic the unadjusted results of Table 1. We find no differences across the initial provider in the amounts of anti-depressant prescriptions that patients fill.[7]

3.3 Relapse

One way to assess the success or failure of anti-depression treatment is by examining whether a person receives any therapy at all or discontinues therapy early, failing to complete and adequate amount of therapy according to recommended guidelines (Dobrez et al. 2000; Kniesner, Powers, and Croghan 2002). Another way is to examine the downstream consequences of therapy by examining whether a patient suffers a relapse of depression. In our data about 22 percent of patients suffer a relapse. Table 4 presents logit coefficient estimates for how intensity of treatment and provider type influence the probability of a relapse, ceteris paribus.

The most notable results concerning treatment success as indicated by a reduced likelihood of a relapse relate to a subtle aspect of having a psychiatric provider. In Table 4 we capture treatment in three dimensions: the amount of psychotherapy, the amount of pharmacotherapy, and the type of treatment provider. Remember that the count regression results in earlier tables had patients of psychiatrists receiving significantly more psychotherapy. Thus, one way a psychiatrist could affect the success of treatment for depression was through greater amounts of psychotherapy. The results in Table 4 reveal that the number of psychotherapy visits does not affect the likelihood of a relapse.

Although the amount of psychotherapy does not affect relapse, the amount of pharmacotherapy does affect relapse in our data. Using the mean as a reference point, an extra anti-depressant prescription lowers the probability of relapse by approximately 4 to 5 percent (–0.01/0.22). Our results in Table 3 indicated no differences in the amount of pharmacotherapy patients receive across providers; however, there is no direct effect of having a psychiatric provider operating through differential amounts of anti-depression medication.

What we find is more subtle. Holding psychotherapy visits and anti-depressant prescriptions constant, having a psychiatric initial provider lowers the probability of relapse by almost 50 percent using the mean likelihood of relapse as a reference point ($\widehat{ME} / \bar{P} = -0.109 / 0.223 = 0.49$). In our data there appears to be a benefit to having a psychiatric provider, in terms of reducing the chance of relapsing into depression, that is over and above the measured amounts of psychotherapy and pharmacotherapy psychiatrists provide relative to other providers.

4. Discussion

Our research objectives have centered on understanding any connections among the amounts of psychotherapy received by depressed patients who also receive an antidepressant with an eye for several questions of medical interest. Do there appear to be significantly different amounts of psychotherapy across providers, how large are the inter-provider differences in psychotherapy, and are psychotherapy and pharmacotherapy used as substitutes or complements in the treatment of depression? Finally, are there quantitatively important inter-provider differences in anti-depression treatment success as measured by relapse likelihood and how is any difference related to inter-provider differences in the amounts of pharmacotherapy versus psychotherapy?

We find that after adjusting for case-mix psychiatrists' patients receive almost twice the number of psychotherapy visits but fill no more prescriptions for anti-depressant medication than the patients of general medical providers or non-physician mental health specialists. In the sense that psychiatrists' patients get more psychotherapy than other providers' patients but no more or less pharmacotherapy, there is no pattern of complementarity or substitution of one type of therapy for the other across providers. It appears that decisions regarding use of psychotherapy and pharmacotherapy are largely independent.

Although the research presented here generally agrees with prior research there are patterns of treatment we observe that are somewhat surprising. For example, although the first treatment for depression appears to depend largely on the specialty of the provider at the point of entry (Powers et al. 2000), the number of visits and the number of prescriptions appears independent of who first diagnosed a patient's depression. The only exception to the diagnoser-treatment pattern is the finding that psychiatrists use more psychotherapy than other

providers; whether a patient first entered care through a general medical doctor or a non-physician specialist makes no difference in the relative amount of psychotherapy and pharmacotherapy received.

Our research has several implications for research, clinical practice, and mental health policy. The notion that receiving treatment from psychiatrists may be associated with reductions in the incidence of relapse is provocative, but we must acknowledge a possible confound imposed by how relapse is identified here. Specifically, relapse here means that a new "clean" period with no evidence of pharmaco- or psychotherapy occurs between two episodes of medication treatment. However, we could fail to observe such a gap in treatment because of the increase in the number of psychotherapy visits associated with psychiatrists. Suppose, for example, that psychiatrists are more likely to see patients intermittently in follow up for a prior episode. If the frequency of follow up visits is every three months or more, then we do not observe a "clean" period and thus have no opportunity to observe a relapse even if one occurs clinically. Thus, our results regarding psychiatrists should be interpreted with caution but provide an opportunity to investigate further the relationship between provider type and relapse.

As is true for other studies that rely on MarketScan™ data, we report relative high levels of quality of pharmacotherapy. Nearly three in four patients in our study received care consistent with a measure used in prior research to monitor adherence to clinical practice guidelines. The relatively high baseline in mind, it appears that psychiatrists are more likely than other providers to offer additional psychotherapy to their patients. Our findings of a link between initial provider and psychotherapy are consistent with the hypothesis that the additional psychotherapy may be used for patients whose symptoms are resistant to treatment but who nonetheless may receive high quality treatment, which is another line of research to pursue.

Case management is utilized by about a third of the plans studied here and is associated with more prescriptions. Because the case management identified in MarketScan™ represents a form of utilization review designed to limit care to those most in need, we hypothesize that plans which make use of such a cost-containment tool may also utilize quality improvement strategies that will result in better care. Because we cannot explicitly control for depression severity in our study, our finding of a positive correlation between case management and the probability of relapse might suggest that plans target case management toward patients who are more severely depressed and, therefore, more likely to relapse. Our finding of a positive link between case management and pharmacotherapy intensity represents both an opportunity for research and an example for clinical practice.

Finally, we point to the finding that pharmacotherapy and psychotherapy appears to be used independently and not as substitutes or complements. Because the two treatments have similar efficacy rates, economists have tended to view them as perfect substitutes. We suggest, however, that physicians appear to apply the two therapies on an individual basis, perhaps attempting to individualize treatment based on need and patient preferences, a worthy if difficult goal.

Endnotes

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1. For another example of a similar claims-based method of identifying relapse see Sood, et al (2000).

2. OLS is clearly a misspecified functional form as the dependent variable is both bounded and bunched at zero. Alternatives to count models include ordered probit, Tobit, or an exponential functional form estimated with non-linear least squares. For empirical examples see Delgado and Kniesner (1997) and for discussion of the relative strengths and weaknesses of alternative models see Cameron and Trivedi (1998).

3. Adjusting for truncation involves rescaling the likelihood that the pharmacotherapy dependent variable takes on any particular value by the inverse of the probability of $y > 0$ (Greene 1998).

4. The zero generating process was modeled as a logistic function of all x's. Changing the list of regressors or functional form of the zero generating process proved uninformative. The estimated zero inflation statistic in Table 2 is the Vuong (1989) statistic that is used to check the non-nested hypothesis whether the zero-inflated negative binomial model detects excess zeros after controlling for overdispersion (Greene 2000). When a ZINB model is supported by the data the absolute value of the computed Vuong statistic is at least 2.0. As a point of reference the estimated marginal effect of psychiatrist is about 15 percent smaller in a model where possible zero inflation is ignored incorrectly in our data.

5. We note that lack of a coinsurance rate effect is driven by the fact that the rate varies little across the patients of primary care physicians and other mental health specialists. A

separate count regression for only the patients of psychiatrists shows a significantly negative coinsurance rate effect on psychotherapy visits such that a doubling of the coinsurance rate leads to 25 percent fewer visits. The possibility of heterogeneity in the effect of health care plan characteristics across providers remains an interesting issue for future research.

6. As a basic robustness check we estimated the psychotherapy model in Table 2 using Tobit regression. The results were similar in that the estimated marginal effect of having a psychiatric provider was a statistically significant 6.2 additional visits with no significant difference for non-physician mental health specialist.

7. As a basic robustness check we also estimated the pharmacotherapy model in Table 3 using truncated normal regression (Greene 2000). The results were similar in that there were also no statistically significant differences across providers in the number of anti-depressant prescriptions filled.

Table 1: Descriptive Statistics Stratified by Provider – Mean (Standard Deviation)

Variable	Total	Psychiatrist (n = 272)	Non-Physician Mental Health Specialist (n = 163)	Primary Care Physician (n = 588)
Psychotherapy Visits	5.727	10.882	5.098	3.517
	(10.262)	(12.726)	(8.630)	(8.409)
Antidepressant Prescriptions	11.413	12.456	11.123	11.010
	(9.255)	(9.815)	(9.459)	(8.903)
Anxiolytic Prescriptions	2.895	4.272	3.160	2.185
	(7.658)	(9.905)	(9.953)	(5.299)
Relapse	0.223	0.154	0.233	0.252
	(0.416)	(0.362)	(0.424)	(0.434)
4+ Antidepressant Prescriptions	0.765	0.739	0.785	0.772
	(0.424)	(0.440)	(0.412)	(0.420)
Log Medical Costs	8.031	8.035	8.260	7.966
	(1.341)	(1.545)	(1.171)	(1.277)
Age	42.642	42.188	41.865	43.068
	(9.335)	(10.087)	(8.336)	(9.227)
Female	0.738	0.665	0.724	0.776
	(0.440)	(0.473)	(0.448)	(0.418)
Major depression, single episode	0.179	0.313	0.135	0.129
	(0.383)	(0.464)	(0.343)	(0.336)
Major depression, recurrent	0.109	0.265	0.141	0.029
	(0.312)	(0.442)	(0.349)	(0.168)
Dysthymia	0.264	0.313	0.460	0.187
	(0.441)	(0.464)	(0.500)	(0.390)
Reactive depression	0.077	0.066	0.239	0.037
	(0.267)	(0.249)	(0.428)	(0.190)
Depression NOS	0.370	0.044	0.025	0.617
	(0.483)	(0.206)	(0.155)	(0.486)
Log Pre-Diagnosis Costs	4.568	4.301	4.892	4.602
	(2.622)	(2.836)	(2.686)	(2.490)
Comorbidities	6.829	6.688	7.190	6.794
	(2.992)	(3.182)	(2.856)	(2.934)
Mental Health Coinsurance Rate	0.126	0.140	0.120	0.121
	(0.095)	(0.121)	(.087)	(.083)
Case Management	0.362	0.379	0.288	0.374
	(0.481)	(0.486)	(0.454)	(0.484)

Source: Authors' calculations.

Table 2: Psychotherapy Visits – Zero Inflated Negative Binomial Regression

	Coefficient	Std. Error	t-ratio	P-value	Marginal Effect	Std. Error	t-ratio	P-value
Constant	1.671	0.281	5.951	0.000	11.745	3.294	3.565	0.000
Age	–0.013	0.005	–2.732	0.006	–0.094	0.065	–1.456	0.146
Female	0.104	0.118	0.879	0.380	0.731	1.389	0.527	0.599
Major depression, single episode	0.090	0.159	0.564	0.573	0.629	1.862	0.338	0.736
Major depression, recurrent	0.657	0.210	3.135	0.002	4.620	2.458	1.880	0.060
Dysthymia	0.253	0.115	2.193	0.028	1.775	1.350	1.314	0.189
Reactive depression	0.125	0.242	0.519	0.604	0.881	2.834	0.311	0.756
Log Pre-Diagnosis Costs	0.007	0.018	0.400	0.689	0.052	0.217	0.237	0.812
Anxiolytic Prescriptions	0.030	0.008	3.678	0.000	0.214	0.102	2.102	0.036
Comorbidities	0.010	0.018	0.562	0.574	0.072	0.217	0.333	0.739
Psychiatrist	0.950	0.201	4.737	0.000	6.676	2.353	2.838	0.005
Non-MD Mental Health Specialist	0.225	0.154	1.459	0.145	1.580	1.808	0.874	0.382
Plan Coinsurance Rate	–0.444	0.621	–0.715	0.475	–3.122	7.282	–0.429	0.668
Case Management	–0.069	0.099	–0.702	0.482	–0.487	1.157	–0.421	0.674
Overdispersion Parameter	2.316	0.389	5.950	0.000				
Zero Inflation Parameter	–0.895	0.329	–2.723	0.006				

Source: Authors' calculations.

Table 3: Antidepressant Prescriptions – Truncated Negative Binomial

	Coefficient	Std. Error	t-ratio	P-value	Marginal Effect	Std. Error	t-ratio	P-value
Constant	1.716	0.196	8.773	0.000	18.194	5.993	3.036	0.002
Age	0.004	0.004	0.951	0.341	0.043	0.049	0.877	0.381
Female	–0.016	0.084	–0.196	0.845	–0.175	0.932	–0.187	0.851
Major depression, single episode	0.121	0.109	1.114	0.265	1.285	1.265	1.016	0.310
Major depression, recurrent	0.137	0.152	0.901	0.368	1.452	1.746	0.832	0.406
Dysthymia	–0.136	0.100	–1.359	0.174	–1.438	1.216	–1.182	0.237
Reactive depression	0.048	0.159	0.300	0.764	0.505	1.761	0.286	0.775
Log Pre-Diagnosis Costs	0.003	0.014	0.202	0.840	0.031	0.160	0.193	0.847
Anxiolytic Prescriptions	0.035	0.014	2.552	0.011	0.369	0.194	1.906	0.057
Comorbidities	0.015	0.006	2.474	0.013	0.158	0.089	1.780	0.075
Psychiatrist	0.038	0.097	0.391	0.696	0.401	1.081	0.371	0.711
Non-MD Mental Health Specialist	0.049	0.108	0.456	0.648	0.521	1.207	0.432	0.666
Plan Coinsurance Rate	0.193	0.378	0.510	0.610	2.047	4.239	0.483	0.629
Case Management	0.326	0.079	4.136	0.000	3.452	1.446	2.387	0.017
Overdispersion parameter	0.836	0.062	13.395	0.000				

Source: Authors' calculations.

Table 4: Relapse – Logit Regression

	Coefficient	Std. Error	t-ratio	P-value	Marginal Effect	Std. Error	t-ratio	P-value
Constant	–0.322	0.449	–0.717	0.473	0.052	0.072	–0.719	0.472
Age	–0.013	0.009	–1.443	0.149	–0.002	0.001	–1.445	0.149
Female	–0.338	0.189	–1.790	0.074	–0.054	0.030	–1.794	0.073
Major depression, single episode	–0.103	0.258	–0.399	0.690	–0.017	0.041	–0.399	0.690
Major depression, recurrent	–0.133	0.338	–0.392	0.695	–0.021	0.054	–0.392	0.695
Dysthymia	0.076	0.221	0.343	0.732	0.012	0.035	0.343	0.732
Reactive depression	0.176	0.335	0.524	0.600	0.028	0.054	0.524	0.600
Log Pre-Diagnosis Costs	–0.015	0.032	–0.466	0.641	–0.002	0.005	–0.466	0.641
Anxiolytic Prescriptions	0.036	0.011	3.261	0.001	0.006	0.002	3.267	0.001
Comorbidities	0.077	0.029	2.617	0.009	0.012	0.005	2.625	0.009
Psychiatrist	–0.682	0.241	–2.829	0.005	–0.109	0.038	–2.851	0.004
Non-MD Mental Health Specialist	–0.216	0.253	–0.853	0.393	–0.035	0.040	–0.854	0.393
Plan Coinsurance Rate	–0.986	0.378	0.510	0.610	2.047	4.239	0.483	0.629
Case Management	0.565	0.165	3.420	0.001	0.091	0.026	3.450	0.001
Antidepressant Prescriptions	–0.063	0.011	–5.945	0.000	–0.010	0.002	–6.229	0.000
Psychotherapy Visits	0.004	0.009	0.510	0.610	0.001	0.001	0.510	0.610

Source: Authors' calculations.

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