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Effect of Depression Treatment on Chronic Pain Outcomes

Carrie Farmer Teh, Ph.D.¹, Alan Zaslavsky, Ph.D.², Charles F. Reynolds III, M.D.¹, and Paul D. Cleary, Ph.D.³

¹RAND Corporation

²Department of Health Care Policy, Harvard Medical School

³Yale School of Public Health, Yale School of Medicine

Abstract

Objective—People with chronic pain and depression have worse health outcomes than those with chronic pain alone. Little is known about the effectiveness of depression treatment for this population. We examined the effect of depression treatment on medical and social outcomes for individuals with chronic pain and depression

Methods—Propensity score weighted analyses using both waves (1997-1998 and 2000-2001) of the National Survey of Alcohol, Drug, and Mental Health Problems were used to examine the effect of (1) any depression treatment and (2) minimally adequate depression treatment on persistence of depression symptoms, depression severity, pain severity, overall health, mental health status, physical health status, social functioning, employment status, and number of work days missed. Analyses were limited to those who met CIDI-SF criteria for major depressive disorder, reported having at least one chronic pain condition, and completed both interviews (n=553).

Results—Receiving any depression treatment was associated with higher scores on the mental component summary of the MOS SF-12, indicating better mental health (difference = 2.65 points, p=0.002) and less interference of pain on work (OR=0.57, p=0.02). Among those receiving treatment, minimal adequacy of treatment was not significantly associated with better outcomes.

Conclusions—Depression treatment improves mental health and reduces the effects of pain on work among those with chronic pain and depression. Understanding the effect of depression treatment on outcomes for this population is important for employers, healthcare providers treating this population, and policymakers working in this Decade of Pain Control and Research to improve care for chronic pain sufferers.

Keywords

pain; depression; quality assessment; outcomes

An estimated 50 million people in the United States suffer from chronic pain (1), which has been shown to adversely affect social relationships, work productivity and quality of life and is the leading cause of disability in the United States (2, 3).

Treatment of pain symptoms generally help some, but not all, chronic pain patients (4). One explanation for this finding is that there are psychological correlates to chronic pain, such as depression, that can interfere with the effectiveness of pain treatment if not addressed (5).

Prevalence studies have found that 18 to 56 percent of people with chronic pain suffer from a depressive disorder (6). The relationship between chronic pain and depression is complex. Over the past few decades, researchers have debated whether chronic pain is a somatic expression of depression, a separate disorder caused by depression or a separate disorder that leads to depression (6-10).

Regardless of whether the pain precedes the depression or vice versa, the implications of having both disorders are significant. People with both chronic pain and depression have worse pain outcomes than those with chronic pain alone (6, 7). Several studies show that depression significantly increases disability in chronic pain populations (11-15). Among people with chronic pain, depression has been associated with higher health-care costs (13), increased negative thoughts about pain (16), increased economic burden for patients and their employers (17), and increased risk of chronicity (18). In addition, depression has been associated with suicide attempts and suicide completion among people with chronic pain (19). Finally, several studies suggest that depression adversely affects the effectiveness of treatments for pain (6, 20, 21).

Given the strong relationship between chronic pain and depression, depression treatment for people with comorbid depression and chronic pain should lead to improved outcomes, reducing both depression symptoms and chronic pain severity and outcomes. Sullivan et al. (22) reviewed studies that addressed depression treatment for people with chronic low back pain. They found that while available studies suggested that depressed chronic pain patients may respond favorably to psychological and pharmacological treatment for depression, the research to date was minimal and only one study had used a randomized placebo-controlled design. Similarly, Bair et al. (6) found that most available studies of the effect of antidepressant medications on outcomes for depressed chronic pain patients had small sample sizes, were uncontrolled or used doses that were sub-therapeutic for depression treatment.

Two recent studies explored the effect of improving depression care on pain and functional outcomes for adults with arthritis. Lin et al. (23) found that an intervention to improve depression (Improving Mood-Promoting Access to Collaborative Treatment, or IMPACT) that included collaborative management of depression resulted in better functional outcomes, less pain and improved quality of life compared to usual care. In addition, Parker et al. (24) found that treatment with antidepressant medication for people with rheumatoid arthritis and major depression improved psychological status and health status compared to no treatment. Taken together, these studies suggest that treatment of depression for people with comorbid pain and depression can lead to improved outcomes. However, given that these studies focused only on people with arthritis, whether the findings are generalizable to other chronic pain populations is unclear.

In the present study, we sought to determine whether receiving depression treatment improves clinical and social outcomes for people with chronic pain and depression. We used data from a large, nationally representative longitudinal survey to identify 554 individuals with chronic pain and depression. We assessed the relationship between receiving (1) any depression treatment and (2) minimally adequate depression treatment on 10 clinical and social outcomes. We hypothesized that receiving some depression treatment and minimally adequate depression treatment would be associated with improved outcomes, though we expected larger effect sizes with the receipt of minimally adequate depression treatment.

Methods

We analyzed data from the National Survey of Alcohol, Drug, and Mental Health Problems (25) (Healthcare for Communities, HCC). HCC was a longitudinal national household telephone survey of 14,985 adults that was funded by the Robert Wood Johnson Foundation (RWJF). The first wave of data collection occurred September 1997 to December 1998 (HCC1) and the second wave April 2000 to November 2001 (HCC2). HCC respondents were a stratified probability sample of participants in the 1996-1997 Community Tracking Study (CTS) (26, 27), a nationally representative study of the US civilian, noninstitutionalized population. The HCC sampling strategy was designed to increase the power to study low-income and psychiatrically ill populations; to that end, individuals who reported low income, psychiatric distress, or use of mental health specialty services in the CTS were oversampled. All analyses reported here were weighted to be representative of the US population. There was a 64% response rate, with 9,585 individuals completing the telephone survey.

Sample

Only people who reported a condition commonly associated with chronic pain during HCC1, met criteria for major depressive disorder (MDD) during HCC1, and completed both waves of data collection were included in the sample (N=554). Major depressive and dysthymic disorders were assessed in the HCC using the screening version of the Composite International Diagnostic Interview Short-Form (CIDI-SF). Since our outcome of interest was the quality of depression treatment and current depression treatment guidelines are written exclusively for the treatment of major depressive disorder (MDD) (28), we excluded respondents who met CIDI-SF criteria for dysthymia (29). For the purposes of this study, we defined people with chronic pain as those who reported during HCC1 at least one of: arthritis or rheumatism, chronic back problems, migraine or other chronic severe headaches, or another chronic pain condition. To verify that these conditions were associated with pain, we examined whether individuals with them reported that pain interfered with their normal work. Pain interfered with work at least “a little bit” for 82 percent of those with at least one of these conditions, and pain interfered with work “moderately, quite a bit, or a lot” for 55 percent of those with these conditions.

Treatment variables

Receipt of any depression treatment was defined as self-reported receipt of any mental health treatment (at HCC1), including any antidepressant medication, having a mental health specialist visit, or any PCP visit where mental health or emotional issues were addressed for at least five minutes.

Receipt of minimally adequate depression treatment was defined as self-reported receipt in the last 12 months of either (1) antidepressant medication used at a dosage exceeding the recommended minimum for at least two months, according to the Agency for Healthcare Research and Policy (AHCPR) treatment guidelines (28) or (2) four or more visits with a mental health specialist. Schoenbaum et al. (30) found that treatment with four or more visits to a mental health specialist resulted in improved health outcomes and employment status.

Outcome variables

We assessed *health outcomes* using several items from the Medical Outcomes Study (MOS) SF-12, including the physical component score (PCS). Overall health was assessed as excellent, very good, or good vs. fair or poor. A scale assessing limitations in activities of daily living (ADLs) was created from responses to questions about respondents' ability to

perform vigorous activities such as running, moderate activities such as bowling, and climbing stairs (scale range 0= no ADL limitations to 6= limited a lot in all ADLS).

Depression severity was assessed using items from the CIDI-SF (suicidal ideation and number of depression symptoms) and by the mental component score of the MOS SF-12 (MCS). *Social functioning* was assessed using a scale from the Sickness Impact Profile (31), which recorded respondents' responses to the following statements: I am going out less to visit people, I often act irritable towards those around me, I show less affection, I am doing fewer social activities with groups of people, I act disagreeable to family members, I am doing the things I usually do to take care of my children and family. *Work outcomes* included self-reports of the interference of pain with ability to work (extremely, quite a lot, or moderately vs. a little bit or not at all); employment status; and the number of work days missed due to physical or emotional problems in the previous 30 days.

Analytic Strategy

We assessed the effect of any depression treatment (at HCC1) on 10 clinical and social outcomes (at HCC2). We also assessed whether effects were different for those with minimally adequate depression treatment than for those with treatment that did not meet that standard.

Since HCC is an observational study, patients were not randomized to depression treatment or no treatment (control). Without randomization, simple comparisons of treated and control groups might not result in valid estimates of treatment effects, due to the possibility of selective assignment to treatment. If pretreatment characteristics of the treatment and control groups differ, apparent effects of treatment might be consequences of these differences rather than resulting from the treatment itself. If ignored, these differences can lead to biased estimates of the treatment effect. To address the threat to internal validity caused by selection effects, we used propensity score analysis (32) as a method of analytically controlling for such pretreatment differences in observed characteristics.

We estimated the propensity to receive (1) any depression treatment and (2) minimally adequate depression treatment, conditional on receipt of any treatment. Variables used in the propensity score model were chosen based on (1) an assessment of factors associated with receiving depression treatment (33), (2) a literature review, (3) variables that differed between the treated and untreated groups at HCC1 and (4) variables that were significantly associated with depression treatment ($p < 0.05$).

We also included several additional variables in the propensity score models. First, we included the baseline (HCC1) values of the outcome variables to account for the fact that these variables may have been predictive of treatment. Second, we included interactions between the number of depression symptoms and marital status; between suicidal ideation and age and sex; between pain and education, age, and sex; between overall health and education, age, and sex; and between employment and education, age and sex. Third, we created dummy variables for each propensity score decile and then included these in the final propensity score models. We did this to provide balance across the distribution of propensity scores.

Variables included in the propensity score models were the same for both treatment definitions (Table 1). Logistic regression was used to estimate propensity to receive (1) any depression treatment and (2) minimally adequate depression treatment.

The resulting propensity scores were used as weights in our analyses. If $e(x)$ is the propensity score for a case with characteristics x , then weight = $1 - e(x)$ for the treated group

and weight = $e(x)$ for the control group (34). All analyses were also weighted by a sampling weight to account for the complex sampling design of the HCC. The final weight used in the analyses was the product of these weights. When we compared the treated and untreated groups after weighting, we found that the groups were balanced on the majority of covariates.

We used linear regression to assess the effect of receiving (1) any depression treatment and (2) minimally adequate depression treatment, conditional on receiving any treatment, on continuous outcome variables (number of depression symptoms; activities of daily living limitations; mental health status; physical health status; social functioning; and days of work missed) and logistic regression to assess these effects for our binary outcome variables (suicidality; pain severity; overall health and employment status). To facilitate interpretation of the linear regressions, we estimated the effect size for our continuous outcome variables using Cohen's d (35). Small, medium, and large effects for Cohen's d are 0.20, 0.50, and ≥ 0.80 , respectively (36).

Treatment variables and variables used to construct the propensity score were assessed during HCC1. Outcome variables were assessed during HCC2 (Figure 1). All analyses were conducted using SAS statistical software, version 9.1 (SAS Institute) and SAS-Callable SUDAAN, version 9.0 (RTI International).

Results

The longitudinal segment of the Healthcare for Communities data contains survey responses from 6,659 people who completed telephone surveys in 1996-1997 and again in 2000-2001. Our study population was composed of the 563 individuals who met CIDI-SF criteria for major depressive disorder and who reported that they had a chronic pain condition (Table 2).

Among respondents with chronic pain and depression, 72 percent were female and 80 percent were white. They had completed 12.9 years of education on average and had a mean age of 46. Fifty-two percent were currently working. Most of the respondents had health insurance; the majority either had employer-sponsored insurance (52%) or Medicare (16%). Two-thirds (67%) had received at least some depression treatment; of those, 57% received minimally adequate depression treatment. Most respondents with chronic pain and depression had a usual source of care (90%) and three-fourths saw the same provider at every visit.

Any depression treatment

Receiving any depression treatment is associated with better mental health (Table 3); people who received depression treatment had an MCS-12 score 2.65 points higher (Cohen's $d = 3.9$) on average than those who did not receive treatment ($p=0.002$). A difference of this size on the MCS-12 is of moderate clinical significance (37). There were no differences between the treatment groups, however, in the likelihood of suicidal ideation or in the number of depression symptoms endorsed. Those who received any treatment had slightly higher social functioning scores than those who did not receive treatment (difference = 0.18, $p=0.05$; Cohen's $d = 2.6$). In addition, people who received any depression treatment were less likely to report that pain interfered with their work (OR=0.57; 95% CI=0.34 to 0.96) than those who received no depression treatment, though there were no differences between the groups in number of work days missed or in employment status. Finally, any depression treatment appeared to be associated with improved physical health, though these results were not significant. For example, people who received depression treatment had higher scores on the PCS-12 (difference = 2.08, $p=0.06$; Cohen's $d = 2.5$) and fewer activities of daily living

(ADL) limitations (difference = -0.45, $p=0.07$; Cohen's $d = 2.2$) than those who did not receive any depression treatment.

Minimally adequate depression treatment

Among those who received any depression treatment ($N=372$), receiving minimally adequate depression treatment was not associated with improved health outcomes, reduced depression severity, or improved work outcomes compared to those with inadequate treatment (Table 4). However, those who received minimally adequate treatment had slightly higher social functioning scores than those who received inadequate treatment (difference = 0.26, $p=0.05$; Cohen's $d = 1.7$).

We conducted a post-hoc analysis to explore an alternate method of examining treatment effects. We compared the effect of receiving less than adequate depression treatment to receiving no depression treatment, and, similarly, the effect of receiving minimally adequate depression treatment to receiving no depression treatment. Compared to no treatment, receiving less than adequate treatment was associated with higher MCS-12 scores (difference = 2.86, $p<0.01$, Cohen's $d = 3.8$). Compared to no treatment, receiving minimally adequate treatment was also associated with higher MCS-12 scores (difference = 2.87, $p=0.02$, Cohen's $d = 3.3$). No other differences were significant.

Discussion

In the present study, depression treatment is associated with a positive, but small, effect on clinical and social outcomes for people with chronic pain and depression. Specifically, receiving any depression treatment is associated with better mental health and less interference of pain on work for depressed people with chronic pain. Among those who receiving treatment, however, receiving minimally adequate depression did not have an additional significant effect on outcomes, although there was a small non-significant positive effect on social functioning. The lack of significant findings for this measure of depression treatment may be due to the small sample size; only 353 people in this data set had major depressive disorder, chronic pain, and had received at least some depression treatment. Compared to receiving no treatment, minimally adequate treatment was associated with reduced depression severity; however, this effect was similar to the effect of receiving inadequate treatment.

The results from this investigation are surprisingly modest: although depression treatment among those with chronic pain and depression may moderately improve depression symptoms and positively affect work outcomes, we did not find evidence that minimally adequate depression treatment was any more effective than inadequate depression treatment. One possible explanation for this finding may be the definition we used for minimally adequate depression treatment. Our definition included either four visits with a mental health specialist or receipt of antidepressant medication at an adequate daily dose for at least two months. A simple count of mental health specialty care visits does not provide any information about the content of these visits; for example, we do not know whether these visits were for psychotherapy, and if so, what the quality of that psychotherapy was. Furthermore, even if we assume that they were psychotherapy visits, our threshold of four visits may be too low to find a clinical benefit. Our reason for using a four visit threshold was based on the findings from Schoenbaum et al. (30), who found that four mental health specialty counseling visits was associated with improved depression and employment outcomes. However, these counseling visits were part of a depression care quality improvement trial, where therapists were specifically trained in Cognitive Behavioral Therapy. It is unlikely that “usual care” mental health specialty care visits are of similar quality.

Another possible explanation for our modest findings may be that the antidepressant dose considered adequate according to AHCPR guidelines (38) is not in fact adequate for a population with both depression and chronic pain. Individuals with comorbid pain may require higher antidepressant doses than those without pain to have a significant positive effect on outcomes. In addition, we did not have information on antidepressant class, but this could also be a factor in our modest findings, as research has shown serotonin-norepinephrine reuptake inhibitors (SNRIs) to be more important in pain pathways than more commonly prescribed selective serotonin reuptake inhibitors (SSRIs) (39). When antidepressant therapy can be optimized, as in the recent SCAMP study, it is possible to realize significant reductions in depression severity, pain severity and disability in this population (40).

Recognizing and treating depression among those with chronic pain is essential. We found that even those who received inadequate depression treatment had improved depression severity. This finding presents an opportunity: increasing the rates of depression treatment initiation is a necessary and beneficial first step to improving outcomes. Once treatment has begun, ensuring adequate and high quality treatment, either through following an evidence-based antidepressant medication algorithm, such as in SCAMP (40), or through the implementation of collaborative care models, such as in the IMPACT trial (41), can improve clinical outcomes and quality of life for those suffering from these disorders.

There are several potential limitations to this study. First, propensity scores can only adjust for observed characteristics. The estimates of the treatment effect may still be biased due to differences on unobserved characteristics. For example, if those who received depression treatment had unmeasured worse severity or persistence of depression, the results would be biased toward the null. Second, values of the variables included in the propensity score and variables used to assess depression treatment were assessed at the same time point. Two years passed before the next wave of data collection; it is not clear what may have happened in the intervening year. It is possible that people may have received depression treatment in that year, which is not possible to assess in this dataset. Third, because of the timing of the data collection waves, we were not able to determine the exact order of events, from depression to recognition to treatment, or the duration of depression. The CIDI-SF asks about depression symptoms occurring over any two weeks in the previous 12 months; there was no way to distinguish between respondents who had been depressed for years prior to this assessment or those experiencing their first depressive episode within the past year. It may have been possible that people who met criteria for depression did not have enough time to seek depression care prior to data collection, as their symptoms were too recent. Consequently, people may have received depression care in the year between waves, which we were not able to assess. If this had happened, the effect of HCC1 treatment on outcomes may have been muted, since some of those in the no treatment group may have actually received treatment between waves.

Data was collected in such a way that did not allow us to categorize race/ethnicity beyond white, black, Hispanic, or other. Research has found significant racial and ethnic differences in the experience of pain (42, 43) and depression (44) and disparities in the quality of depression treatment (45, 46). Future research should address these racial/ethnic differences and disparities and their effect on the pain and depression relationship as well as their implications for clinical practice. Finally, sample sizes may not have been large enough to statistically establish differences between those who did and did not receive treatment in these analyses, although the statistically non-significant results were in the expected direction – outcomes improved with depression treatment. With more power, we might have been able to detect these differences. In fact, in analyses of all those who were depressed regardless of chronic pain (N=833), we found that depression treatment was strongly

associated with improvement in health, work, and depression outcomes, suggesting that with a larger sample size, we may have seen similar findings for people with comorbid chronic pain.

Future research is needed to corroborate these findings in a larger sample with a more complete longitudinal design. A three-wave data set where data was collected annually would be ideal. In the first wave, data on depression status and variables used to predict propensity to receive treatment would be collected. In the second wave, data on treatment status would be collected. In the final wave, data on outcomes would be collected. In this way, we would be able to have a clearer picture of the progression from experiencing depression, to receiving treatment, to evaluating the effect of that treatment on outcomes. Healthcare for Communities is designed as a longitudinal dataset; if a third wave of data is collected, repeating these analyses using all three waves may support the findings reported here.

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Table 1
Variables used in propensity score models

Sociodemographic characteristics	Age, gender, race, income, education, marital status
Health status variables	Number of non-pain chronic conditions, severity of chronic illness (mild, moderate, severe), presence of other mental health conditions (yes/no), perceived need for mental health care (yes/no), type of chronic pain
Health care variables	Number of medical visits in last 12 months, source of usual care (yes/no), communication with provider (scale), trust in provider (scale)
Other	Baseline values of outcome variables, interactions, propensity score decile dummy variables

Table 2
Characteristics of the Study Sample

Characteristics*	Individuals with MDD and Chronic Pain (N=563)
Age in years, mean	45.63
Gender, % female	72.11
Race (%)	
White	80.28
Black	12.26
Other	3.55
Hispanic	3.91
Married, %	54.71
Years of education, mean	12.87
Insurance type (%)	
Uninsured	14.39
Private, employer	52.04
Medicare	16.34
Medicaid	7.46
Military	1.24
Other public	0.71
Other insurance	1.78
Private, individual	4.62
Working status (%)	
Currently working	52.58
Worked in past 12 months	7.82
Neither	39.43
Suicidal, %	28.24
Have other mental health diagnosis, %	43.34
Have a usual source of care, %	90.76
Have a usual provider, %	75.31
Received some depression treatment, %	66.61
Received minimally adequate depression treatment [†] , %	57.87
Satisfied with quality of mental health treatment, %	73.00

* Percentages may not sum to 100% due to rounding.

[†] Among those who received any depression treatment (N=353).

Table 3

Effect of any depression treatment on chronic pain outcomes*

	N	OR	95% CI	Difference	SE (β)	P
Health outcomes						
Global health (poor or fair)	528	0.65	0.38 – 1.12			0.12
PCS12	528			2.08	1.09	0.06
# ADL limitations	527			-0.45	0.24	0.07
Mental health outcomes						
Suicidal ideation (suicidal)	528	0.89	0.42 – 1.88			0.76
MCS12	528			2.65	0.94	0.002
# Depression symptoms	527			-0.07	0.35	0.85
Social functioning	528			0.18	0.09	0.05
Work outcomes						
Pain interferes with work (high interference)	528	0.57	0.34 – 0.96			0.02
Employment (employed)	528	1.04	0.32 – 1.74			0.87
No. work days missed	231			-1.14	0.83	0.16

* Odds ratios (OR) are presented for binary outcomes and regression coefficients are presented for continuous outcomes.

Table 4
Effect of min. adequate depression treatment on chronic pain outcomes conditional on receipt of treatment*

	N	OR	95% CI	Difference	SE (β)	P
Health outcomes						
Global health (poor or fair)	353	0.61	0.31 – 1.18			0.14
PCS12	353			-0.07	1.05	0.95
# ADL limitations	352			0.05	0.33	0.89
Mental health outcomes						
Suicidal ideation (suicidal)	353	0.54	0.25 – 1.17			0.12
MCS12	353			1.50	1.19	0.21
# Depression symptoms	353			-0.57	0.48	0.24
Social functioning	353			0.26	0.14	0.05
Work outcomes						
Pain interferes with work (high interference)	353	0.85	0.42 – 1.71			0.65
Employment (employed)	353	1.18	0.52 – 2.66			0.70
No. work days missed	154			-0.73	1.90	0.70

* Odds ratios (OR) are presented for binary outcomes and regression coefficients are presented for continuous outcomes.