Time-Invariant and Time-Varying Predictors of Depression Symptoms in Primary Care Patients

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Objective: The aims of this study were to examine correlates of depression symptoms, baseline predictors of change in depression symptoms, and time-varying predictors of depression symptoms in a primary care sample.

Method: In this study, we assessed depression symptoms and other variables at 3 time points over the course of 6 months in 103 primary care patients with elevated depression symptoms at baseline. Data collection occurred from May 2004 to September 2007.

Results: Individuals with lower income levels and those who were not married had a poorer course of depression, as assessed by Center for Epidemiologic Studies Depression Scale score, over time. Several variables fluctuated in concert with depression symptoms within individuals over time. As depression symptoms improved, family functioning, problem-solving, pain, and general health perceptions also improved. A multivariate analysis showed that problem-solving and general health perceptions predicted significant ($P < .001$) unique variance in fluctuations in depression symptoms within individuals.

Conclusions: Care management programs for primary care depression may benefit from the inclusion of psychosocial interventions that directly target variables closely linked to depression, such as problem-solving and general health perceptions. In addition, special efforts must be made to help depressed individuals with low income and less social support.

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Given that half of all individuals who seek professional treatment for depression receive it in a general medical setting,[1] there has been much attention on the development of depression care management programs that use a chronic care model in order to track and treat a large group of patients in a primary care setting. Some programs include psychotherapy (eg, Unutzer et al[2] and Simon et al[3]), whereas others do not (eg, Dietrich et al[4]). Although depression care management programs have been successful in improving depression outcomes, there continues to be room for improvement. Poor family functioning,[5] alcohol use,[6] poor problem-solving,[7] high levels of pain,[8] and poor general health[9,10] frequently co-occur with depression, and each could contribute to a reduced likelihood of depression remission for some patients. Although there are several psychosocial interventions designed to target these problems (eg, family therapy, motivational interviewing and other alcohol-specific techniques, problem-solving therapy, cognitive-behavioral therapy for pain, and self-management programs for chronic illness), the complexity of triage for co-occurring problems complicates prioritizing referrals for interventions. Understanding the degree to which each of these problems predicts subsequent depression symptoms as well as the extent of covariation with depression may assist with decisions about how to enhance depression care management programs by addressing related problems. However, most or all of the work examining the association between depression and family functioning has been conducted in tertiary care settings rather than in primary care. Further, despite the fact that problem-solving therapy is part of empirically supported depression care management,[2] very little is known about problem-solving and course of depression in primary care.

There has been a fair amount of previous research examining other demographic, health, and psychiatric risk factors for persistence of (or remission from) depression in primary care settings. Risk factors can be divided into 2 categories: largely unmodifiable and historical characteristics of patients (eg, gender, race/ethnicity, and clinical history) and those that are dynamic and malleable (eg, family functioning and alcohol use). Traditionally, most risk factor research has examined these malleable risk factors from a static perspective; ie, researchers examine

the degree to which a given risk factor predicts change in depression symptoms over the months that follow the initial assessment. However, modern statistical techniques (ie, multilevel modeling) allow researchers to examine malleable risk factors *as they vary over time*. This allows researchers to ask a different question: to what extent does a given problem fluctuate in concert with depression symptoms within an individual? Although the answer to this question does not demonstrate causality, it may be consistent with the perspective that the two problems are closely linked and that changing one problem might have an impact on the other.

This study had 3 aims. First, we examined predictors of future change in depression symptoms among primary care patients with elevated depression symptoms at baseline. Predictors examined included demographics, chronic depression and suicidality, family functioning, hazardous alcohol use, problem-solving, pain, and general health perceptions. Second, we examined 4 malleable risk factors (family functioning, problem-solving, pain, and general health perceptions) as time-varying predictors of depression symptoms. That is, we examined the degree to which these risk factors fluctuated in concert with depressive symptoms within individuals. A third aim was to examine cross-sectional correlates of depression symptoms.

This study extends previous research on predictors of change in depressive symptoms in primary care in 3 ways. First, very few previous studies have looked at time-varying predictors. Second, we examine some risk factors (ie, family functioning and problem-solving) for which specific psychosocial treatments exist, but that are not commonly assessed as predictors of depression course in primary care literature. Third, by necessity, many (but not all) of the previous studies of predictors of depressive symptoms in primary care were conducted with samples of individuals who were enrolled in a clinical trial, thus limiting generalizability. The current study also focuses on a relatively low-income primary care population.

METHOD

Participants

Participants were 103 primary care patients with elevated depression symptoms who were recruited from waiting rooms at 2 family medicine clinics. Participants were 77% women (n = 79), with a mean age of 35.6 (SD = 10.9) years. Participants were 4% American Indian/Alaskan Native (n = 4), 9% African American or black (n = 9), 76% white (n = 78), and 1% (n = 1) biracial. Eleven percent of participants (n = 11) did not identify a racial group. Sixteen percent of participants (n = 16) reported being Latino or Hispanic. Participants tended to be low-income, with 49% of participants (n = 52) reporting a family income of less than $25,000 per year and 28% (n = 30) reporting a family income between $25,000 and $50,000. Fifty-one percent of participants (n = 52) reported being unemployed or on disability (considered "not working" in the analyses below); the remainder were working full-time or part-time (n = 36) or were a student (n = 4) or a homemaker (n = 10). (For income and employment status, data from 1 participant was missing; thus, the denominator is 102.) Fifty-three percent were either married or in a marriage-like relationship (n = 44). At baseline, 64% (n = 66) reported taking an antidepressant medication or mood stabilizer, and 45% (n = 46) reported currently being in psychotherapy or counseling.

Setting

Data collection occurred in 2 New England family medicine primary care clinics. One of the clinics was a large family medicine training clinic with 39 residents and 14 faculty family physicians, serving 12,500 patients per year with approximately 30,000 visits annually. This clinic had some colocated mental health care (ie, therapists on site) but few integrated mental health services and no depression care management (ie, services in which the primary care physician and a mental health care provider or nurse worked closely as a team to manage depression by closely monitoring the patient and providing psychopharmacology and/or therapy). The second data collection site was a smaller clinic with the equivalent of 4 to 5 full-time family physicians. This clinic did not have any colocated or integrated mental health care. Data collection occurred from May 2004 to September 2007.

Procedures

Potential participants (n = 1,961) were approached in the waiting area and asked if they were interested in a study on "depression, stress, or fatigue." Research

assistants attempted to approach all patients in the waiting area—regardless of the reason for their visit—during specific clinic sessions. If a person was interested, he/she completed a brief consent for screening (n = 1,053). The remainder of those approached either refused to consent for screening (n = 442), or were not eligible for other reasons (eg, pregnant or did not speak English; n = 466). Following the consent, potential participants completed a Patient Health Questionnaire (PHQ-9). If they scored ≥ 10 (n = 221), they were invited to participate in the next phase of the study, which involved a telephone assessment. Of those who were interested and reachable by telephone (n = 107), 103 completed at least part of the initial telephone interview. There were no significant differences in PHQ-9 scores between those who were eligible and were interested and reachable by telephone (n = 107) and those who were not interested or reachable by telephone (n = 114; t_{219} = 0.16, not significant). During the telephone interview, participants gave informed consent to participate in the study and orally completed assessment measures. This study was approved by the institutional review boards at the relevant institutions. Participants were paid \$50 for this interview. Participants then completed follow-up interviews at 2 months and 6 months postbaseline. They were paid \$25 for each of these 2 follow-up assessments.

Assessment Instruments

Demographics. Demographics were assessed via self-report. In order to assess household income, participants were asked to specify whether their total yearly family income was \$0–\$25,000; \$25,000–\$50,000; \$50,000–\$75,000; \$75,000–\$100,000, or over \$100,000. For the purposes of data analyses, income was dichotomized into 2 groups: less than \$25,000 per family per year and more than \$25,000 per family per year. The cutoff of \$25,000 is slightly higher than the federal poverty line. (In 2004, the poverty line was approximately \$19,000 for a family of 4, \$23,000 for a family of 5, and \$26,000 for a family of 6.[11])

Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Clinician Version. Trained raters administered the mood disorder module of the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Patient Edition (SCID-IV),[12] in order to assess for current major depression, length of depressive episode, and dysthymic disorder. The SCID-IV was administered by telephone. Although it is possible that telephone administration results in reduced detection of certain symptoms (eg, psychomotor symptoms that would be more noticeable in an in-person interview), there are data suggesting that telephone administration produces results very similar to in-person assessment.[13] For the analyses included in this article, chronic depression was defined as either dysthymic disorder or a current major depressive episode of at least 2 years' duration.

Patient Health Questionnaire. The PHQ-9[14] was used to screen patients to determine whether they had elevated depressive symptoms and were eligible for the study. This questionnaire was also used to determine whether individuals endorsed any suicidality.

Center for Epidemiologic Studies Depression Scale. The Center for Epidemiologic Studies Depression Scale (CES-D)[15] is a commonly used scale that assesses level of current depression symptom severity. The CES-D has demonstrated acceptable reliability and validity.[15]

Alcohol Use Disorders Identification Test. The Alcohol Use Disorders Identification Test (AUDIT)[16] was used to identify individuals with harmful drinking behavior over the past 6 months. Not surprisingly, the distribution of the AUDIT scores was highly skewed. Therefore, a standard cutoff of 8 or greater was used to indicate hazardous alcohol use.[17] Due to the nature of the time frame that the measure reflects, the AUDIT was administered only twice (at baseline and at 6 months). Therefore, it was examined only as a time-invariant covariate.

Family Assessment Device. The Family Assessment Device[18] is a 60-item self-report measure of family functioning. For this study, we used only the 12-item general functioning scale, completed by the patient. Scores are continuous and range from 1 to 4; higher scores indicate poorer functioning.

Medical Outcomes Study 20-item Short-Form Health Survey. The Medical Outcomes Study 20-Item Short-Form Health Survey[19] includes items adapted from longer health-related surveys. For the purposes of this research, we used the pain and general health perceptions subscales. Scores range from 0 to 100; higher scores indicate better perceived health.

Social Problem-Solving Inventory-Revised. The Social Problem-Solving Inventory-Revised[20] is a 52-item self-report questionnaire that assesses several dimensions of problem-solving abilities and yields a total score. Higher scores indicate better problem-solving abilities.

Analyses

First, we calculated correlations between baseline depression symptom severity (as assessed by the CES-D) and baseline values of both demographic and clinical predictor variables. Next, we used multilevel modeling[21] with full maximum likelihood estimation in order to determine whether and how much depression and time-varying covariates changed over time. An advantage of multilevel modeling is that it accommodates differences in the correlations of repeated assessments over time and allows for missing data in repeated measurements. We used empirical Bayesian estimates that have multiple advantages over alternative ways of dealing with missing data when estimating individual changes in depressive symptoms. For example, rather than carrying an observation forward to estimate a missing value over time,

Table 1. Schedule of Assessments for the Study of Predictors of Depression Symptoms in Primary Care Patients (N=103)

Variable	Assessment Instrument	Cronbach α	Time 1 (baseline)		Time 2 (2 months)		Time 3 (6 months)		Estimated Mean Change Over Time[a]	
			n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	Parameter	SE
Depression symptoms	CES-D	0.93	103	31.1 (12.7)	81	28.3 (13.7)	68	25.4 (14.9)	–1.01*	1.00
Family functioning	FAD-gf	0.90	100	2.2 (0.6)	80	2.2 (0.5)	67	2.1 (0.6)	–0.01	0.01
Problem-solving	SPSI	0.88	99	88.4 (15.0)	80	89.5 (16.2)	68	90.4 (16.6)	0.39	0.21
Pain	SF-20-p	NA[b]	100	47.0 (28.3)	79	45.3 (27.9)	68	47.9 (27.5)	0.41	0.50
General health	SF-20-ghp	0.86	100	40.1 (25.4)	79	42.3 (27.8)	68	44.9 (27.8)	0.93*	0.42
				n (%)		n (%)		n (%)		
Alcohol use[c]	AUDIT	0.89	100	22 (22)	…	…	68	11 (16)	…	…

[a]The parameter estimate can be interpreted as the estimated mean change over a 1-month time period.
[b]Not available because pain is assessed with only 1 item.
[c]We used a standard cutoff score of 8 to determine whether individuals met criteria for hazardous drinking, thus, n (%) refers to number (%) endorsed (time 1 and time 3—at time 2, the AUDIT was not assessed) and the estimated mean change over time is not applicable.
*P < .05.
Abbreviations: AUDIT = Alcohol Use Disorders Identification Test, CES-D = Center for Epidemiologic Studies Depression Scale, FAD-gf = Family Assessment Device-general functioning scale, NA = not available, SF-20-ghp = Medical Outcomes Study 20-Item Short-Form Health Survey– general health perceptions subscale, SF-20-p = SF-20–pain subscale, SPSI = Social Problem-Solving Inventory–Revised.

Bayesian methods include information from all study participants when estimating individual change over time.

We examined a series of unconditional growth models; ie, models in which a single covariate (time) was the only predictor of the outcome variable. Outcome variables included depression symptoms, family functioning, problem-solving, pain, and general health. Both the initial level of the outcome variable (eg, intercept) and the effects of the covariate (time) were specified as random effects and thus were allowed to vary across individuals; covariance structure was unstructured to reflect the correlations of the outcome variable over time. These models provided us with estimates of the average intercept and slope of depression, family functioning, problem-solving, pain, and general health change trajectories over time. This allowed us to understand, on average, in which direction and how much these variables changed from month to month within and across participants.

Next, we examined whether *baseline* variables were predictive of change in depression symptoms over time. Depression symptom severity was the dependent variable in all cases. We fit separate models with each time-invariant predictor by adding the predictor (value at baseline) and an interaction term (predictor × time) to the unconditional growth model. The interaction term tested whether the proposed predictor variable predicted change in depression over time. Although these are not technically "univariate" analyses, as the statistical model includes 3 predictors of depressive symptoms (time, predictor, and predictor × time), they are analogous in concept.

After conducting separate univariate analyses for all demographic and clinical predictor variables, we fit a multivariate model that included all significant demographic predictors. We also planned to construct a multivariate model that included all significant clinical predictors.

Finally, we examined time-varying predictors in univariate models. In order to examine an individual time-varying predictor, we fit a multilevel model that included both time and the predictor variable as independent variables and depression as the dependent variable. This model allowed us to determine whether the predictor variable changed in concert with depression symptoms *within* individuals over time. Note that this is different from a correlation or simple regression model that only tests associations between a predictor variable and dependent variable (ie, depressive symptoms) *between* individuals. After testing each time-varying predictor individually, we included all significant time-varying predictors in a multivariate model in order to determine which predictors accounted for unique variance in depressive symptoms. Results are considered significant at *P* < .05.

RESULTS

Sample sizes, means, and standard deviations for each variable at each time point are presented in Table 1. Table 1 also includes reliability estimates (Cronbach α) for each assessment instrument. We note that the mean depression scores were consistently in the clinical range, as scores of greater than or equal to 16 on the CES-D are typically interpreted to indicate clinically significant depression.[15] At time 1, 88% of the participants met this criterion for significant depression. At times 2 and 3, 78% and 71% of participants, respectively, met this criterion. Finally, Table 1 includes the parameter estimates for the time variable in the series of unconditional growth models for each of the measures that were repeatedly assessed. These parameter estimates can be understood as the estimated mean amount that particular variable changed in a 1-month period.

We next examined demographic predictors of initial depression symptoms. When we examined correlations, we found that income and work status were significantly associated with depression symptoms at baseline (Table 2). Depression scores at baseline were lower for higher

Table 2. Time Invariate Predictors of Depression Symptoms: Demographic Variables

Variable	Correlation With CES-D at Baseline	Single Predictor of Change Over Time				Multiple Predictors of Change Over Time			
		Estimate	SE	t	df	Estimate	SE	t	df
Intercept	...	30.86	1.23	25.19***	104	30.73	2.67	11.52***	106
Time	...	–1.01	0.30	–3.42***	76	–1.05	0.57	–1.83†	76
Age	0.14	0.15	0.11	1.35	102	...	...	...	...
Age × time	...	0.01	0.03	0.51	75	...	...	...	...
Gender	0.14	–4.36	2.90	–1.50	104	...	...	...	...
Gender × time	...	–1.24	0.71	–1.74†	79	...	...	...	...
Income	–0.27**	6.13	2.40	2.56*	101	4.71	2.71	1.74†	102
Income × time	...	1.13	0.57	2.00*	78	0.79	0.64	1.23	78
Minority	–0.04	–0.81	2.86	–0.28	102	...	...	...	...
Minority × time	...	0.84	0.71	1.20	77	...	...	...	...
Marriage	–0.16	–4.10	2.46	–1.66†	103	0.01	2.76	0.00	103
Marriage × time	...	–1.21	0.58	–2.10*	77	–0.84	0.65	–1.29	78
Work	–0.30**	–6.86	2.37	–2.89**	101	–4.23	2.22	–1.91†	95
Work × time	...	0.14	0.59	0.24	76	...	...	...	...

*$P < .05$.
**$P < .01$.
***$P < .001$.
†$P < .10$.
Abbreviation: CES-D = Center for Epidemiologic Studies Depression Scale.
Symbol: ... = not applicable.

income participants (vs lower income participants) and for individuals working outside the home (or full-time parenting) as opposed to those unemployed or on disability. Next, in Table 2, we also present results of demographic predictors of change in depression symptoms over time. First, we note that unconditional growth model (depicted in the first 2 rows of the body of the table) suggests that the mean estimated intercept for CES-D scores (ie, scores at baseline) was 30.9. On average, estimated depression scores decreased over time at the rate of approximately 1 point per month. In the "univariate" analyses, we found 2 significant predictors of change in depression symptoms over time. Income was a significant predictor of slope: for higher income participants, CES-D decreased over time (parameter = –1.56, SE = 0.41, t_{42} = –3.80, $P < .001$). For lower income participants, CES-D scores did not decrease significantly over time (parameter = –0.48, SE = 0.39, t_{35} = –1.22, not significant). Also, over time, CES-D scores decreased significantly for married participants (parameter = –1.76, SE = 0.46, t_{40} = –3.85, $P < .001$) but not for unmarried participants (parameter = –0.54, SE = 0.34, t_{50} = –1.61, not significant). The right hand side of Table 2 depicts a multivariate analysis that included all significant predictors from the separate individual analyses. In this model, we found that no demographic variables predicted unique variance in the slope.

We conducted exploratory analyses in order to gain a better understanding of why neither income nor marital status predicted change over time in this multivariate analysis. To do this, we used an unconditional growth model to examine change over time in 4 groups. We examined the values for time as a predictor of depressive symptoms in these groups: married, higher income

(n = 33, parameter = –1.76, SE = 0.56, t_{26} = –3.10, $P < .005$); married, lower income (n = 10, parameter = –1.64, SE = 0.82, t_6 = –1.99, $P < .10$); unmarried, higher income (n = 17, parameter = –1.24, SE = 0.54, t_{16} = –2.32, $P < .05$); and unmarried, lower income (n = 42, parameter = –0.24, SE = 0.41, t_{30} = –0.57, not significant). Although exploratory due to the small sample size, these analyses suggest that it may be the combination of being lower income and unmarried that is particularly associated with small (or no) change in depressive symptoms over time.

Table 3 depicts the results of the clinical predictors (used as time-invariant predictors, meaning that we used only the baseline value as a predictor). Correlations of baseline variables showed that problem-solving, pain, general health perceptions, suicidality, and chronic depression were all associated with depression symptom severity. As expected, poorer problem-solving, more pain, poorer health, higher levels of suicidality, and chronic depression were all associated with more severe depression symptoms. Results from the univariate longitudinal analyses are also shown in Table 3. None of these variables were significant predictors of change over time in this sample; therefore, we did not conduct a multivariate analysis.

Finally, we examined clinical variables as time-varying predictors of depression symptoms. In univariate analyses (on the left hand side of Table 4), we found that family functioning, problem-solving, pain, and general health perceptions all fluctuated in concert with depression symptoms within an individual over time. All associations were in the expected direction (ie, as family functioning, problem-solving, and general health became poorer and as pain increased, depression symptoms

Table 3. Time Invariate Predictors of Depression Symptoms: Clinical Variables

Variable	Correlation With Baseline Depression	Single Predictor of Change Over Time			
		Estimate	SE	t	df
Intercept	…	30.86	1.23	25.19***	104
Time	…	−1.01	0.30	−3.42***	76
Baseline family functioning	0.18†	3.56	1.92	1.85†	99
Baseline family functioning × time	…	0.32	0.48	0.67	78
Baseline problem-solving	−0.50***	−0.43	0.07	−6.07***	95
Baseline problem-solving × time	…	0.03	0.02	1.74†	72
Baseline alcohol	−0.10	−1.63	3.00	−0.54	101
Baseline alcohol × time	…	−0.39	0.73	−0.53	76
Baseline pain	−0.32**	−0.17	0.04	−4.16***	103
Baseline pain × time	…	−0.01	0.01	−0.85	79
Baseline general health perceptions	−0.40***	−0.19	0.05	−4.11***	101
Baseline general health perceptions × time	…	0.01	0.01	0.98	77
Baseline suicidality	0.23*	6.31	2.64	2.39*	104
Baseline suicidality × time	…	0.49	0.64	0.77	76
Chronic depression	0.29**	8.30	2.68	3.09**	99
Chronic depression × time	…	0.49	0.72	0.68	74

*$P < .05$.
**$P < .01$.
***$P < .001$.
†$P < .10$.
Symbol: … = not applicable.

Table 4. Time-Varying Predictors of Depression Symptoms: Clinical Variables

Variable	Analyses Using a Single Predictor				Analyses Using Multiple Predictors			
	Estimate	SE	T	df	Estimate	SE	t	df
Intercept	30.86	1.23	25.19***	104	63.18	6.45	9.79***	174
Time	−1.01	0.30	−3.42***	76	−0.69	0.26	−2.63**	74
Family functioning	5.18	1.45	3.57**	239	1.99	1.33	1.50	218
Problem-solving	−0.43	0.06	−7.62***	161	−0.34	0.06	−5.96***	156
Pain	−0.12	0.03	−4.12***	231	−0.02	0.03	−0.77	226
General health perceptions	−0.22	0.03	−6.65***	226	−0.14	0.04	−3.99***	232

**$P < .01$.
***$P < .001$.

increased). For illustrative purposes, one of these associations, ie, the relation between depression over time and general health, is depicted in Figure 1. To create this figure, we split the sample into individuals who reported that their general health became worse over time (n = 28) and those whose general health became better over time (n = 46); those with an estimated 0 slope for general health were excluded. We then plotted the means and standard errors of the CES-D scores for these 2 groups across the 3 time points.

In multivariate analyses that included all significant univariate predictors, we found that problem-solving and general health perceptions predicted significant independent variance in fluctuations in depression symptoms. All results were identical when we reran analyses controlling for income and work status.

DISCUSSION

This study examined time-invariant and time-varying predictors of depression symptoms in primary care among individuals not specifically seeking treatment for depres-

sion and not participating in a controlled clinical trial of depression treatment or a trial of quality improvement. The course of depression in the current sample may more closely resemble the course of depression seen in actual clinical practice than in a sample collected in the context of a clinical trial (eg, Bair et al[8] and Sherbourne et al[10]). In the current sample, depression symptoms decreased more over time for higher income (vs lower income) participants and for married (vs unmarried) participants. In particular, those individuals who were both unmarried and lower income seemed to show minimal change in depression over time. At baseline, low levels of problem-solving, higher levels of pain, and chronic depression were associated with higher depressive symptoms. Over time, as depression symptoms fluctuated, so did family functioning, problem-solving, pain, and general health perceptions. Problem-solving and general health perceptions predicted significant unique variance in depression symptoms over time.

This study adds a further nuance to previous literature that has shown that medical comorbidity,[9] poorer self-reported physical health,[10] and reports of pain[8] may

Figure 1. Depression Levels Over Time as a Function of General Health Levels Over Time
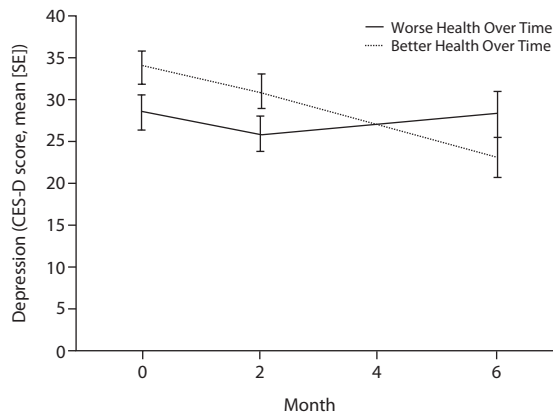
Abbreviation: CES-D = Center for Epidemiologic Studies Depression Scale.

decrease the likelihood of recovery from depression. If perceptions of general medical health and the related problem of pain are both closely tied to depression symptoms, as the current study suggests, depression care management programs may benefit from the inclusion of interventions that increase one's ability to cope with pain (eg, cognitive behavioral therapy for chronic pain[22]), or improve self-efficacy regarding one's ability to care for one's physical health.[23] Even outside of the context of a depression care management program, physicians will want to look for changes in mental health status when they see changes in physical health (and vice versa). Similarly, our results support the use of problem-solving therapy in the context of depression care management, as ability to resolve problems also fluctuated in concert with depression symptoms over time. We do note that this self-report variable of problem-solving ability may not necessarily reflect participants' skills; rather, it could reflect confidence in the ability to solve their problems. However, psychotherapy—and problem-solving therapy more specifically—may have an impact on problem-solving confidence as well as skills.

One area that is relatively unexplored in programs to manage depression in primary care is the role of the family. In this study, we found that as depression symptoms fluctuated, so did family functioning (although this association may be accounted for by the association between depression and problem-solving or general health perceptions). Further, those depressed persons who were married or in a marriage-like relationship tended to show more improvement over time. At a minimum, this suggests that careful assessment of family context is important in depression care in medical settings. Further, in tertiary care settings, couples therapy[24] and family therapy[25] have been shown to have an impact on depression symptoms. Medical family therapy, which is specifically adapted for use with medical patients in medical settings,[26] may improve outcomes for some depressed primary care patients.

Because there are at least 2 common types of outpatient treatment of depression (ie, antidepressant medication and psychotherapy) and many relevant parameters associated with that treatment (ie, adequate vs inadequate dosages; psychotherapy that is empirically supported vs not), treatment used over time was not included in our statistical models. However, one possible effect of targeted depression treatment is that it decreases the association between depression and specific variables over time. For example, Beevers and Miller[27] found that, in comparison to those who did not receive cognitive therapy, depressed individuals who did receive cognitive therapy showed smaller associations between negative cognitions and depressive symptoms over time. In a similar vein, family therapy may work in part by allowing an individual to experience some family conflict without increasing their level of depression (and thereby allowing the conflict to be resolved more quickly).

Finally, we note that being in the lower income group was also associated with a poorer course of depression in this primary care sample. A poorer course of depression may be particularly likely for those individuals with the combination of lower income and not being in a marriage or marriage-like relationship. In interpreting these data, it is important to keep in mind that in this study, "lower income" is approximately equivalent to being below the poverty line, and many of the "higher income" individuals were likely to be struggling financially as well. Other research has shown that indicators of lower socio-economic status (eg, education and employment) are associated with persistence of depression 1 year later in a large, multinational sample.[28] Given the many barriers to care that low-income groups experience, it is likely that persistent outreach is needed to engage individuals with lower income in treatment.[29]

Limitations to this study include a small sample size and the collection of data at only 3 time points. A larger sample would have allowed a more careful examination of interactions between variables. Although we did include African Americans and Latinos, the sample was primarily white. Strengths include the use of a sample *not* enrolled in a clinical trial, and a statistical model that allows for the examination of how depression covaries with other problems *within* an individual, rather than just *between* individuals. Results point to several problems (eg, problem-solving and general health perceptions) that covary with depression within an individual and that could be considered as targets for intervention in care management programs in an effort to improve depression treatment outcomes.

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