AFFECTIVE DISTRESS MODERATES THE RELATIONSHIP BETWEEN TREATMENT BELIEFS AND ADHERENCE IN CHRONIC ILLNESS PATIENTS

By

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and approved by

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ABSTRACT OF THE DISSERTATION

Affective distress moderates the relationship between treatment beliefs and adherence in chronic illness patients

By RACHEL FORSTER HELD

Dissertation Director:
Howard Leventhal, Ph.D.

In chronic illness patients, nonadherence to prescribed medical regimens is common. Many factors can contribute to nonadherence, including depressive symptoms and patient perceptions of treatment. Having fewer depressive symptoms often predicts better adherence, as do three types of treatment perceptions: stronger belief in one’s ability to adhere to treatment, stronger belief that the treatment will be effective, and greater concerns about the treatment. However, these predictors are rarely examined together, and individually they often predict only a small amount of variance in adherence.

The current study investigates treatment perceptions and affective distress as predictors of adherence in a sample of 102 primary care patients. Participants had newly prescribed treatments for problems related to a chronic condition. Interview data was collected after doctor visits and one month later. It was hypothesized that the three treatment variables – believing treatment would be easy to do, having concerns about the treatment, and believing it would be effective – would predict adherence to medical regimens. It was also hypothesized that affective distress, as measured by the mental health (MH) subscale of the SF-12, would moderate the effects of treatment perception. Patients with poor MH scores were expected to show better adherence only if they
believed the treatment would be effective and easy to do, and they had few treatment-related concerns.

Believing treatment would be effective predicted adherence, and having concerns about treatment approached significance, while perceived ease of treatment did not. Moderation was seen for one of the three expected interactions; belief in the treatment’s ability to control the problem predicted adherence for patients with low but not high MH scores. A possible explanation is that patients with fewer depressive symptoms may be more hopeful and motivated to try treatments, even if they are less sure the treatments will be effective. Findings support the importance of doctors addressing patients’ confidence in treatment effectiveness, and of screening for depression not only to address depressive symptoms themselves but also to determine which patients may require more discussion of prescribed treatments.
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Introduction

Adherence refers to the extent to which patients follow prescribed healthcare interventions for medical problems. Non-adherence has been a major problem in modern medical treatment (Haynes, et al., 2005), with about 20 to 50 percent of patients being non-adherent to prescribed treatments (Kripalani, Yao, & Haynes, 2007). Nonadherence rates are higher for chronic as opposed to acute conditions, as well as for lifestyle, as opposed to medication-based, interventions (DiMatteo, 2004; Kripalani, et al., 2007; Osterberg & Blaschke, 2005). Since effective medical treatments have been developed to treat many major chronic illnesses, one of the strongest barriers to improving health outcomes is ongoing patient non-adherence to these treatments.

Many factors can contribute to non-adherence, including demographic variables, psychiatric characteristics, and patient perceptions of their illness and treatment (Vermeire, Hearnshaw, & Van Royen, 2001). These factors have thus far shown an inconsistent relationship with patient adherence (Osterberg & Blaschke, 2005) which may be due in part to being examined independently of one another. However, well-being measures and patient treatment beliefs often, if sometimes weakly, influence adherence. (See Appendix for more detailed review of the literature.) Inconsistent and weaker findings suggest that there are a variety of factors that may work in concert, or under different circumstances, to determine treatment adherence (Vermeire, et al., 2001).

One of the models that often predicts adherence is Leventhal’s self-regulation model (SRM). According to the SRM, patient beliefs about disease and treatment can
influence decisions about whether and when to adhere to medical recommendations (Leventhal, Brissette, & Leventhal, 2003). Three types of beliefs about treatment are often examined (Horne, 2003). First, perceived ability to adhere, or situation-specific self-efficacy, relates to factors including belief that one can remember to take a medication and belief that physical limitations will not interfere with following through. Second, perceived necessity of the prescribed treatment refers to the perception that the treatment will be effective and helpful. Third, having concerns about the treatment may include worrying about the impact on overall health, or worrying about potential side effects or consequences of a medication.

The three treatment beliefs are separate constructs that all predict adherence in several previous studies (French, et al., 2000; Gauchet, Tarquinio, & Fischer, 2007; Horne, Cooper, Fisher, & Buick, 2001; Horne, James, Weinman, & Vincent, 1999; Horne & Weinman, 2002; Meckenberg, et al., 2008; Wolf, et al., 2007). While many studies find a relationship between treatment perceptions and adherence, these beliefs tend to account for only modest amounts of variance in adherence. In many studies, the SRM accounted for between 5% and 20% of variance in the model predicting adherence (Brewer, Chapman, Brownlee, & Leventhal, 2002; Coutu, Dupuis, D'Antono, & Rochon-Goyer, 2003; Jessop & Rutter, 2003; Petrie, Weinman, Sharpe, & Buckley, 1996; Reynolds, et al., 2007). Treatment beliefs may have predictive value, but they work in concert with many other variables and do not explain adherence alone.

Another factor that has consistently shown some relationship with adherence is affective distress. In a meta-analysis, depressed patients were three times more likely than non-depressed patients to be non-adherent across medical conditions (DiMatteo,
Several different mechanisms for the relationship between depressive symptoms and adherence have been proposed, including depression causing decreased motivation to adhere or increased hopelessness about prognosis (DiMatteo, et al., 2000; Gonzalez, Penedo, & Antoni, 2004), which can in turn contribute to poor medical adherence. Chronically ill patients with depressive symptoms are likely to display specific patterns of depressive symptoms, retaining intact self-worth but feeling hopeless and helpless about their medical situation (Moorey & Greer, 1989; Moorey & Steiner, 2007). Hopelessness and helplessness-related depressive cognitions may in turn lead to decreased confidence about a treatment’s effectiveness.

In sum, both affective distress and treatment beliefs can affect adherence to chronic illness treatment regimens. Treatment beliefs can directly affect motivation to adhere, leading to poorer adherence if patients question the treatment’s effectiveness or their ability to follow it, or if they have concerns about it. Depressive symptoms in chronic illness patients may manifest in illness-related hopelessness, pessimism, and lack of motivation.

Few studies examine these variables together, and none has specifically looked for an interaction between affect and treatment beliefs in determining adherence. One highly likely possibility is that affective distress moderates the relationship between treatment beliefs and adherence. Patients with both affective distress and negative treatment beliefs would be expected to have high rates of nonadherence. In the absence of depressive symptoms, patients may remain hopeful about their conditions improving, and therefore be somewhat motivated to try to adhere to prescribed treatments, even if they are unsure of their ability to do so, of the treatments’
effectiveness, or of possible risks. In the presence of depressive symptoms, however, patients may want to improve, but be less motivated to attempt to in the face of negative treatment beliefs. That is, the combination of depressive symptoms and negative treatment beliefs may interfere more with adherence than an additive model would suggest.

The current study tests the above hypothesized interaction through testing the relationship between affective distress, treatment perceptions, and adherence in a primary care sample. This sample was taken from a larger study of patients visiting their primary care doctors (Phillips, Leventhal, & Leventhal, in review). As affective distress and treatment beliefs are less likely to influence adherence and outcomes for acute problems that clear on their own, the hypothesis was tested on patients with a chronic illness who were prescribed a new treatment for their condition during their doctor visit. Testing the interaction hypothesis with chronically ill patients with a newly prescribed treatment is optimal theoretically, as expectations of treatment efficacy and affective states are expected to be maximally salient at a time when the treatment these patients had been receiving failed to fully control their condition.

Since age (D. C. Park, et al., 1999), gender (Dunbar-Jacob, 2002) and ethnicity (Gazmararian, et al., 2006) can influence adherence demographic information was collected for all study participants. Data were also gathered on affective distress, the three types of treatment beliefs, and adherence. Based on prior research, it is hypothesized that treatment beliefs will show a main effect in predicting adherence, i.e., adherence will be related positively to perceived necessities and negatively to concerns. It is also hypothesized that affective distress will moderate the relationship
between treatment beliefs and adherence. Specifically, that patients with greater affective distress will require more positive treatment beliefs (that the treatment will be effective, that it will be easy to do, and that they have few concerns about it) in order to adhere, while patients with less affective distress will be more likely to adhere regardless of their treatment beliefs.

Methods

Participants

The study was conducted from summer 2007 to winter 2008 in an internal medicine, primary care practice at a university medical center. All patients were asked to participate in the study regardless of the reason for their doctor visit. Of those approached, 56 percent volunteered to participate and completed consent forms. The total number of participants who were recruited and eligible for the larger study was 402. Of this group, 346 patients were interviewed for the first follow-up, and 327 were interviewed for the second (one-month) follow-up. For the current analyses, data from a subsample of this group were used, as this study examines only patients who were prescribed some treatment at their visit (excluding lab tests and other diagnostic procedures), and whose presenting problem was related to a chronic condition. The final sample for the current analyses consisted of 102 patients. This group was 62 percent female, and ranged in age from 18 to 88 years old, with a mean of 63 years (SD=14.68), was 72 percent white, 16 percent African American, and 12 percent other ethnic minority. Fifty-eight percent of this sample was married, 10 percent divorced, 16 percent widowed and 16 percent single. Fifty-three percent of the sample had at least 4 years of college education, while only 2 percent had no high school diploma or
equivalent. These subsample demographic characteristics were extremely close (each within 5 percent) to the characteristics of the larger sample.

All patients selected for the subsample reported having a chronic condition; 32% reported a prior diagnosis of diabetes, 25% cardiovascular disease, 60% high blood pressure, 26% asthma or COPD, 30% reported another chronic condition; 52% reported two or more chronic conditions. Types of treatments prescribed are listed in Table 1, along with the percentage of the sample that received each treatment, and how many received co-prescriptions.

Procedure

Patients who consented to participate were given a one-page questionnaire to fill out while waiting for their appointment. The items assessed the reason for their visit, their general health (self-assessed health), and expectations for the doctor visit. Patients were contacted by phone 24-48 hours after the visit by research personnel for a 1.5 to 2 hour interview regarding the doctor visit and any prescribed treatment plans. Measures of physical and mental functioning were taken, as were measures of general health and patient common-sense model beliefs. One month after the doctor visit, patients were called by research personnel for a thirty-minute follow-up interview about the presenting problem resolution, physical and mental functioning, general health, and adherence to treatment.

Measures

Demographic information. Questions assessed participants’ demographic information including age, gender, ethnicity and marital status.
**Illness and treatment information.** Questions at the post-doctor visit interview assessed participants’ illness and treatment status. Participants were asked to rate the question “Is your current problem related to a chronic condition” on a scale of 1 to 5. A response of 3, labeled as “somewhat,” or higher, was required in order to be included in analyses for this study. Those who responded “not at all,” or “a little bit,” were not included. If participants elaborated on their response to this question, for example naming their chronic condition, this response was recorded as qualitative data. Qualitative data confirmed that many patients who responded “a little bit” did not in fact have a diagnosed chronic condition (e.g. overweight, post-nasal drip), leading to the decision not to include them in analyses. Participants were also asked, “at your visit, did the doctor prescribe any medications or other types of treatment?” Participants were only included if they responded affirmatively. Participants were also asked to specify the type(s) of treatment prescribed, and responses fell into the following categories: over the counter medications, prescription medications, change in diet, exercise, increase fluid intake, vitamin supplements or herbs, rest/relaxation, and other.

**Treatment perception.** During the post-visit interview, participants were asked three questions about their treatment perception. They were asked to rate the statement “The doctor’s prescribed treatment will get the problem under control” on a scale of 1 to 6, from “not at all,” (1) to “very much” (5), with (6) being “don’t know.” For the purposes of quantitative analysis, responses of 6 were excluded. In addition, for each treatment that was prescribed for the presenting problem (e.g. prescription medication, diet, exercise etc), participants were asked “Do you expect this treatment
to be easy to do?” and “Do you have any concerns about the prescribed treatment?” Participants responded with yes or no answers. Single-item treatment belief-related questions have been used in previous research to represent treatment belief constructs (Mann, Ponieman, Leventhal, & Halm, 2009). Because analyses focus on any type of prescribed treatment, responses for each type of treatment were combined. If participants were prescribed more than one treatment and considered only one of them easy to do, their general response would be coded as “no.” Similarly, if they had concerns about only one of the treatments, their general response to having concerns was considered to be “yes.” These responses were grouped because the study aims focused on adherence to any and all types of prescribed treatment, so finding just one type of recommendation difficult to follow may suffice to influence adherence.

Affective Distress. The SF-12 (Ware, Kosinski, & Keller, 1996) is a validated, shortened measure of the SF-36 (McHorney, Ware, & Raczek, 1993), which assesses subjective health status. It was administered at the one month follow-up interview, and asked about the span of the past four weeks, which is the approximate time between the doctor visit and the follow-up interview. Eight subscales are computed from the 12 questions: physical functioning, role limitations due to physical and emotional health, mental health, bodily pain, general health, vitality and social functioning. The mental health (MH) subscale, which measures affective distress, is the focus of the current study. The mental health questions on the SF-12 ask about feeling “downhearted and depressed” and “calm and peaceful.” In the current study, the between-item correlation was .55 (p<.01). This scale has been validated and shown to be highly correlated with other measures of depression depressive symptoms (Rogers, Adler, Bungay, & Wilson,
This and all SF-12 measures are scored on a scale of 1 to 100, with higher scores representing better functioning.

Adherence. Our patient adherence scale was administered at the one month follow-up interview and was constructed for an earlier study (Phillips, et al., in review). The adherence score was the Z-score of an average of 5 standardized items from a modified version of the Medication Adherence Scale (MARS; Morisky, Green, & Levine, 1986), which was changed to fit the specific circumstances of the study. The internal consistency (Cronbach's alpha) was .72, which indicates acceptable reliability. For our purposes, questions focused not only on medication adherence but on adherence to any medical or behavioral treatments the doctor prescribed. Also, a more specific adherence question related to a common primary care occurrence was added: “I followed this treatment for as long as the doctor prescribed,” and a more general question was added to assess if patients did something “different from” what was prescribed rather than “more” or “less” than prescribed. We added this general question due to our focus on treatment perception and the possibility that if a patient does not believe the prescribed treatment will help, he may choose to do something different to treat the problem on his or her own. The other three questions asked about forgetting to adhere, deciding to skip doses or treatments, and doing or taking less than prescribed. Responses were only included for this variable if patients answered all adherence questions. Higher values indicate better adherence.
Analyses

Hierarchical regression models were run using SPSS software version 18.0 to test for significant predictors of adherence. Pairwise deletion was used for missing values due to our assumption that within the subsample of patients selected to fulfill certain criteria, any missing data were missing at random. Adherence was used as the outcome variable for the model. In step one of the model, age and gender were first entered into the model to adjust for these variables as the literature shows they have predictive power in adherence models. Ethnicity was not included in the model because there was a small percentage of non-white participants. In step two of the model, all three treatment beliefs (centered) were added, as it was hypothesized that they may have a main effect on adherence. Initial analysis revealed that the significance of the demographic variables did not change between steps 1 and 2. Since they are not meaningful to look at independently for this study, and preliminary analyses showed them to have a small, insignificant $R$ squared value, in all further analyses, age, gender and treatment beliefs are grouped into a single first step. In the next step, the SF-12 mental health measure, also centered, was entered into the model. In the final step, moderation was tested by adding three interaction variables: each treatment belief measure was centered and multiplied by the centered mental health measure. The regression model was tested for normality of the outcome variable, nonlinearity, and heteroscedasticity. Significant interactions were graphed, and simple slopes were tested for significance at different levels of the moderator variable.
Results

Descriptives

Adherence scores were negatively skewed, with some ceiling effect of patients reporting adherence to their prescribed regimens. The belief that the doctor’s prescribed treatment would get the problem under control was also somewhat negatively skewed, with a range of 1 to 5 and a mean score of 3.84 (SD 1.06). The other two treatment belief scores, belief that the treatment is easy to do and concerns about treatment, were asked as yes or no questions and therefore had a smaller range and less balanced responses. Eighty-one percent of participants reported having no concerns about their treatment, and 83 percent believed their treatment would be easy to do. Mental health subscale scores were also negatively skewed, which is to be expected given that the population sampled was not one with known mental health problems. Mental health subscale scores ranged from 12.5 to 100, with mean MH subscale score of 73.37 (SD 19.28). Bivariate Pearson’s correlations were computed for all variables used in these analyses (Table 2).

Analyses

To test hypotheses the hypotheses that treatment beliefs would have a main effect and an interactive effect with depressive symptoms on adherence, a hierarchical regression model was run as described above. Table 3 shows standardized and unstandardized coefficients, standard errors, sr² and ΔR² for the model. Histograms and normal P-P plots revealed that residuals of the models were close to normally distributed. Residuals plotted against each independent variable did not reveal evidence of nonlinearity. Plots of regression standardized predicted values against regression
standardized residuals did not reveal evidence of heteroscedasticity, nor did regressing the predicted value onto the squared residual, which revealed no significant findings.

In step 1 of the model, believing the doctor’s prescribed treatment would get the problem under control predicted adherence \((\beta = .35, p<.05)\). The positive coefficient indicates that higher belief in the effectiveness of the treatment predicted better adherence. The other treatment beliefs did not significantly predict adherence, although having concerns about the prescribed treatment approached significance \((\beta = -.26, p=.08)\), with fewer concerns predicting better adherence. While this is not listed in Table 3, when the three treatment beliefs are added to the control variables, this accounts for an \(\Delta R^2\) of .22 (\(P<.05\)). The \(\beta\) values of belief in treatment to control the problem (.43, \(P=.01\)) and concerns about treatment (.30, \(p=.05\)) in the final step of the model indicate that they continue to significantly predict adherence independently of any moderator.

When MH was added into the model in step 2, it did not predict adherence. In step 3, all three interaction terms were added: MH multiplied by each of the three treatment belief variables. Only one of these three terms, MH by belief that treatment will get the problem under control, was significant \((\beta = -.39, P<.05)\). The interaction points to a moderation effect of MH. The other two interaction terms did not approach significance and did not contribute to the model’s \(\Delta R^2\); they were dropped from further analyses (graphs, and data in Table 3). Their omission from the model does not significantly change any other results.

The significant interaction in step 3 was graphed with MH as the moderating variable (Figure 1); treatment and adherence were graphed at three values of MH: the
mean, +1SD, and -1SD. The simple slopes of all three lines on this graph were calculated by centering the MH score at the mean, +1SD, and -1SD and re-running the regression analyses, and the values were significant at the mean and one standard deviation below the mean of MH ($\beta = .43, p < .01$ and $\beta = .91, p < .01$, respectively), but were nonsignificant at one standard deviation above the mean. This indicates that at high mental health score values, belief in treatment to control the problem does not predict adherence, whereas at lower values of mental health, this belief does predict adherence.

**Discussion**

The results of the analyses supported some, but not all, hypotheses. Of the expected main effects, the belief that the treatment would get the problem under control predicted adherence, while and having concerns about the treatment approached significance, while perceiving the treatment as easy to do did not. It is possible that perceiving the treatment as easy to do did not predict adherence because this perception can be outweighed by the other two treatment beliefs; if one perceives a treatment as easy to do but not effective, or easy to do but with concerning side-effects, one may not adhere despite believing one is able to.

One hypothesized interaction was significant: affective distress moderated the effect of the belief in treatment effectiveness on adherence. The graph of this interaction shows that the relationship between the three variables is consistent with the hypothesis. In participants with greater affective distress, belief in treatment effectiveness predicted adherence, while in those with less affective distress it did not. No previous studies have tested this interaction, but findings support the concept that
depressive symptoms, which often include self denigration in severely depressed populations, more likely include illness-related hopelessness in chronic illness populations (Moorey & Steiner, 2007). Based on this interpretation, chronic illness patients with affective distress may wish to improve their health, but action in the face of high levels of depressive hopelessness requires stronger beliefs in the efficacy of their treatment. Motivation-increasing treatment beliefs, in this case belief that the treatment will help, may then serve as the force leading to increased adherence. On the other hand, patients not reporting affective distress may be more hopeful and willing to envision positive, rewarding outcomes even if they question their prescribed treatment’s effectiveness.

Of the expected interactions, two were not significant: affective distress did not moderate the effect of concerns about treatment or perceived ease of treatment on adherence. One explanation is that the data collected for these two treatment belief measures is not adequate due to dichotomous responses. Alternately, it is possible that even with scaled responses, interactions would still not be detected. In the literature, having concerns is less consistently predictive of adherence than believing the treatment to be necessary (Bucks, et al., 2009; Llewellyn, Miners, Lee, Harrington, & Weinman, 2003), and it is possible that in the current sample, concerns about treatment are in fact not predictive of adherence at any levels of affective distress. If belief in treatment effectiveness is strong, it could override any concerns about side effects or treatment regimens and therefore be a stronger determinant of motivation to adhere. Another explanation is that concerns about treatment do predict adherence, but this could not be detected in the current study due to low reliability or power, and these
beliefs override hopefulness about treatment in high MH-scoring patients in a way that confidence in treatment does not.

Depression has been found to increase care seeking behaviors (Egede, Zheng, & Simpson, 2002; Simon, Von Korff, & Barlow, 1995), but also found to decrease adherence (DiMatteo, et al., 2000). This apparent contradiction could be related to the finding in the current study, and could suggest that depressed patients seek medical care and are hopeful about improving their conditions, but are less likely to follow through if they question their prescribed treatments, which may lead to further care-seeking in the future when the problem has not been controlled.

The moderation effect found in this study, if replicable, may have clinical relevance. Study participants with higher affective distress may or may not show a clinical manifestation of depression; this is not known since a more detailed depressive symptom scale was not used. It is possible that depressive symptoms, even if subclinical, impact the cognitive mechanisms that lead to adherence or nonadherence. Screening for depression in primary care settings has increased, and the results of this study suggest that screening is important not only to address the depressive symptoms themselves, but also to be aware of possible manifestations of depression in health behavior. Doctors should also attend to treatment beliefs during patient visits, attempting to understand and address patients’ cognitive representations of illness and treatment. Addressing inaccurate treatment beliefs may be especially important in patients with depressive symptoms, and having information about these symptoms can alert doctors to patients who are at greater risk for nonadherence and therefore require additional discussions of their treatments, and additional interventions.
It will be important to conduct further research based on the current findings, both to gain additional information and to apply it. In order to gain further information, future studies should use more developed and detailed measures of depressive symptoms, as opposed to simply measuring affective distress. This would allow for investigation of the specific depressive symptoms that may interact with treatment beliefs to influence adherence. It was hypothesized that cognitive features of depression such as hopelessness and helplessness are at work in moderating the relationship between treatment beliefs and adherence. Several depressive symptom inventories including the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) measure these and other cognitive depressive symptoms and could help explain the effect found here.

Future studies should also look more closely at the types of treatments prescribed (e.g. prescription medication versus complex lifestyle interventions). Rates of nonadherence tend to be higher for lifestyle interventions (DiMatteo, 2004), which require more motivation and effort in order to adhere. It is possible that this increased level of motivation may influence the cognitive processes that lead to adherence. In addition, future studies should control for illness severity, which was not available in the current study but may also influence patients’ motivation to adhere. Measures of SRM illness perception, in addition to treatment perception, should also be included in order to more fully understand the cognitive process that occurs when patients are prescribed a new treatment, leading them to different levels of adherence. Finally, future research can take the knowledge gained from this study and include it in an intervention that takes place in the doctor’s office, at the time when a new chronic
illness treatment is prescribed. Training doctors to address beliefs and cognitions during office visits may improve adherence outcomes, especially if they are specifically looking for and discussing depressive cognitions.

There are several limitations to this study. The dependent variables would have revealed more information had they been more detailed measures; measuring affective distress with the SF-12 MH subscale did not provide information on specific depressive cognitions. Also, treatment beliefs were each measured with a single item, preventing tests of reliability and validity, and two of the treatment belief items were measured with dichotomous responses. The population sampled for the study also limits generalizability of the findings. For one, the sample was highly educated and included few minorities, which is not representative of the population with chronic illness. This may affect results, since illness beliefs, trust in one’s doctor, and therefore belief that the doctor’s prescribed treatment will work, can all be influenced by culture (Berger, 1998). More severely depressed patients may also be less likely to agree to participate in research studies, leading to a less severely depressed sample than is representative. Finally, it is unclear whether similar results would be found in a chronic illness population with ongoing, static illness management, as opposed to those receiving a new treatment. With ongoing illness management, some patients’ symptoms may already be under control, and adherence would be required in order to maintain existing regimens or improvements in symptoms. Treatment beliefs would likely already be more cemented based on patients’ previous treatment experiences. Despite the study’s limitations, findings are important for advancing understanding of
chronic illness patients’ cognitions and behaviors, especially for understanding the role of affective distress in predicting adherence in chronic illness patients.
References


## Table 1

*Percent prescribed each type of treatment, and number with co-prescriptions*

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<th>4EX</th>
<th>5VT</th>
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<td>3. Diet (DI)</td>
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<td>6. Rest/relax (RR)</td>
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<td>7. Other (OT)</td>
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Table 2

Pearson’s correlations between all variables used in analyses

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<td>* .35</td>
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<td>8. Prescription med</td>
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*p<.05
Table 3

**Summary of Hierarchical Regression Analysis for predicting Patient Adherence.**

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<th>Variable</th>
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<th>sr²</th>
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<td>.34*</td>
<td>.11</td>
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<td></td>
<td></td>
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*p<.05
Figure 1. Adherence Z-score vs. belief that treatment will control the problem, at different levels of Mental Health.
Appendix

The following is a detailed review of the existing literature on the relationship between the variables relevant to this study: the SRM, affective distress or depressive symptoms, and chronic illness treatment adherence. Although only treatment beliefs are examined in the current study, this review covers both illness and treatment belief components of the SRM, since they appear to overlap and can both predict adherence, and since future studies would benefit from including both types of beliefs as predictors. Also, while the current study examines affective distress as measured by the MH subscale of the SF-12, the review below includes studies of depressive symptoms, which are often highly correlated with our affective distress measure.

*The Self-Regulation Model and adherence*

Leventhal’s self-regulation theory has been used to identify how beliefs about health and illness are associated with adherence (Leventhal, et al., 2003). According to the model, illness representations, i.e. the ways that patients perceive their illnesses, are categorized into five domains. The identity domain includes patients’ illness labels and diagnosis (i.e. what they call the problem), as well as which symptoms they associate with the illness. The timeline domain refers to how long the illness will last, as well as its acute, chronic, or cyclical pattern. The final three domains are cause (e.g. biological, lifestyle, or environmental factors), control/cure (e.g. the patient’s, or medicine’s perceived ability to cure the illness or control symptoms), and consequences (e.g. side effects of treatment, and social, financial, and functional results of the illness). In addition to illness representations, beliefs about prescribed treatments also contribute to a patient’s illness model under the SRM (Horne, 2003).
According to current research and the SRM, following a prescribed regimen correctly depends both on one’s ability to do so, and on one’s motivation to do so (Horne, 2003). Perceived ability and motivation represent different cognitive constructs regarding treatment beliefs, both of which can influence adherence. In self-report assessments, one’s perceived ability is often measured with task-specific self-efficacy, i.e. the belief that one is able to follow through with the prescribed treatment. Measures of motivation, or how driven a patient is to use medication, tend to factor into two categories: belief in the necessity of the specific prescribed treatment, and having concerns about the specific treatment.

Treatment-specific self-efficacy has been found to correlate with adherence in several studies across different treatments and illnesses. Several factors may influence this belief including perceived difficulty fitting the prescribed regimen into one’s schedule, forgetfulness, or physical disabilities that may interfere with adherence (e.g. manual dexterity in opening pill bottles, bodily pain that prohibits an exercise regimen, etc.; (Horne, 2003). For example, in patients with chronic headaches, the belief that one could adhere to the prescribed treatment predicted adherence (French, et al., 2000). Medication self-efficacy also predicted medication adherence in HIV patients (Wolf, et al., 2007). In three studies, treatment self-efficacy was shown to mediate the relationship between depression or depressive symptoms and treatment adherence, for samples of patients with hypertension (Schoenthaler, Ogedegbe, & Allegrante, 2009), HIV (Cha, Erlen, Kim, Sereika, & Caruthers, 2008) and diabetes (Chao, Nau, Aikens, & Taylor, 2005). This mediation effect may in part be due to actual ability to adhere, in that depression may coincide with increased forgetfulness, increased pain, or other
barriers to adherence. The effect may also be due to depression’s impact on cognition, lowering confidence in one’s own abilities or increasing hopelessness and the perception of barriers to treatment, which may indirectly affect perceived ability to follow a prescribed regimen. Of the studies cited here regarding treatment self-efficacy, none include perceived necessity and concerns about treatment as predictors. The concept of perceived ability to adhere has largely been researched separately from the necessity and concerns-based beliefs, although both can predict adherence. The following paragraphs discuss the SRM and adherence, with a focus on the relationship between SRM treatment variables and adherence.

Several research studies examining a variety of chronic illnesses have found different components of the SRM to predict treatment adherence. One of the SRM domains most commonly associated with adherence is that of perceived control, with lower perceived illness control associated with lower rates of adherence in HIV (Reynolds, et al., 2007), asthma (Jessop & Rutter, 2003), type 2 diabetes (Mann, et al., 2009), and post-myocardial infarction (Petrie, et al., 1996). It is not surprising that lower perceived control would contribute to lower rates of adherence; if someone believes that his actions will have a weaker effect on outcome, he will be less likely to follow behavioral recommendations strictly. Perceived illness timeline also correlates with adherence in patients with end-stage renal disease (O'Connor, Jardine, & Millar, 2008), hypertension (Meyer, Leventhal, & Gutmann, 1985), asthma (Halm, Mora, & Leventhal, 2006) and diabetes (Mann, et al., 2009), with the belief that illness was temporary, acute, or cyclic predicting worse adherence compared to those who perceived a chronic course. Acute and cyclic illness perceptions may decrease
patients’ motivation to continue treatment due to believing that they will recover without treatment, that unpleasant symptoms will subside without treatment, or that they are not sick and therefore not in need of treatment if they are not experiencing symptoms.

Fewer studies have found associations between treatment adherence and the other three illness domains of cause, consequences, and identity; however, a few studies have found a relationship with adherence. For example, confidence in illness label predicted adherence in asthma patients (Jessop & Rutter, 2003), with patients who were more confident that they truly had asthma being more adherent than those who questioned the diagnosis. Also, in patients with symptomless illnesses such as hypertension, perceiving oneself as experiencing illness-related symptoms predicted worse adherence (Coutu, et al., 2003; Meyer, et al., 1985). Jessop and Rutter (Jessop & Rutter, 2003) also found a relationship between external perceived causal factors of asthma (e.g. caused by environmental pollutants as opposed to internal factors, like smoking), low perceived control, and low medication adherence. The connection between casual beliefs, perceived control and adherence may be due to the findings on control beliefs discussed above; perception of external causes may be related to decreased perception of control, since one cannot control external factors as well as internal causes and behaviors. Perceived consequences have rarely been found to predict adherence. However, in two studies of patients with hypercholesterolemia, perception of severe consequences predicted better adherence (Brewer, et al., 2002; Coutu, et al., 2003).

Although not as commonly studied, cognitive representations of one’s treatment are an important part of the SRM. They include beliefs about the necessity of taking one’s
medications to treat a specific condition, concerns about one’s medications for the condition, and the difference between the two (i.e. whether one outweighs the other; (Horne & Weinman, 1999). Horne and Weinman (1999) studied asthma, renal, cardiac and oncology patients, and found that higher medication necessity beliefs correlated with higher reported adherence and higher concerns correlated with lower adherence. Medication beliefs were found to be stronger predictors of adherence than clinical and demographic variables. Other studies have also found a relationship between adherence and treatment beliefs. Adherence was correlated with both necessity- and concern-related beliefs in patients with asthma (Horne & Weinman, 2002; Meckenberg, et al., 2008), HIV (Gauchet, et al., 2007; Horne, et al., 2001) and myocardial infarction (Horne, et al., 1999). Beliefs about the necessity of treatment, but not concerns about treatment, predicted adherence in cystic fibrosis patients (Bucks, et al., 2009) and haemophilia patients (Llewellyn, et al., 2003). In another sample of patients with HIV, negative attitudes towards medication treatment, which were measured on a scale that did not focus on necessity and concern categories, predicted nonadherence (Royal, et al., 2009). In a sample of diabetes patients, necessity and concern beliefs both predicted medication adherence in univariate analysis (Mann, et al., 2009), while multivariate analysis found that worrying about side-effects of medications, a type of medication-related concern, and believing medications are difficult to take, a form of the self-efficacy measure, predicted lower adherence. No studies of adherence have included patient necessity and concern beliefs about behavioral treatments such as diet and exercise.
Treatment beliefs are important predictors of adherence independent of the role of illness beliefs. In a study of asthma patients, treatment beliefs explained an additional 17 percent of the variance in predicting adherence, over and above the 13 percent explained by illness perceptions (Horne & Weinman, 2002). In fact, illness beliefs and the SRM can help to explain the process by which perceptions of treatment influence adherence, since the contents of illness representations are closely tied to the perception of treatment necessity (Horne, 2003). In one of the few studies that included analyses of both illness and treatment beliefs, adherence correlated with necessity and concerns beliefs, and necessity beliefs correlated with perceived timeline and consequences (Horne & Weinman, 2002). As expected, viewing one’s asthma as chronic was related to stronger beliefs in the necessity of taking one’s asthma medication; without having a chronic model of asthma there would be little motivation to adhere, because patients would assume that the condition would go away on its own without medication. Similarly, perceiving one’s illness as having more severe consequences was related to a higher perceived need for medication, which could be viewed as necessary for preventing or lessening the feared consequences. While the illness control domain was not significantly correlated with treatment necessity beliefs in this study, these two constructs may overlap as well; believing that one’s illness is more easily controlled is likely connected with the belief that one’s medication can effectively control it, and therefore that the medication is necessary. In fact, according to Horne and Weinman’s study (2002), the influence of illness perceptions was largely mediated by necessity of medication beliefs. Illness representations were less directly
linked with adherence and instead played a role by influencing beliefs in the necessity of treatment.

The construct referred to here, belief in the necessity of one’s specific, prescribed medication, is a separate construct from that of concerns about the medication (Horne & Weinman, 2002). It consists of several components, one of which is the belief that one’s treatment will be effective. However belief in effective treatment (which was used in the current study) and perceived necessity of treatment are not entirely the same construct, since for a severe condition, a patient may view a given treatment as only moderately effective but still feel a strong need for the treatment if no better options are available (Horne, 2003). However, these two constructs overlap and both help to explain the predictive value of perceived necessity when examining adherence.

In sum, illness and treatment beliefs are important for predicting treatment adherence across a variety of chronic illnesses with a range of different disease characteristics, including the number and type of associated symptoms and the immediacy of threat to life. Timeline and control perceptions appear to most often predict adherence; adhering to a prescribed regimen requires some belief that one can control the problem, and that it will not go away on its own but instead requires ongoing maintenance and vigilance. The connection between the other three illness domains and adherence is less consistent, although it is possible that these domains are not as predictive because they are almost always examined in the same model with timeline and control beliefs, which may be stronger and more relevant in motivating adherence. While less research has examined the relationship between treatment beliefs and adherence, the existing evidence suggests that stronger beliefs about the necessity
of treatment consistently predict better adherence, as does better treatment self-efficacy, while greater concerns about treatment often predict worse adherence. The explanation for this seems evident, as these beliefs seem directly related to decisions about whether to adhere to treatment. Perceived illness control, timeline and consequences often predict adherence, possibly due to their overlap with beliefs about treatment necessity, as is evidenced by the mediating effects of treatment necessity beliefs. Based on the evidence, it seems likely that beliefs about treatment are closely related to how one carries out such treatment.

In addition, while many studies mentioned above find a relationship between certain domains of illness and treatment representation and adherence, the majority show only modest amounts of variance accounting for adherence. Illness representations have predictive value, but they work in concert with many other variables and do not explain adherence alone. In many studies, the SRM accounted for between 5% and 20% of variance in the model e.g. (Brewer, et al., 2002; Coutu, et al., 2003; Jessop & Rutter, 2003; Petrie, et al., 1996; Reynolds, et al., 2007).

*Mental health and adherence in chronic illness patients*

It is important to understand the impact of depressive symptoms on medical adherence, especially since depression is more commonly seen in chronic illness patients than in the general population (e.g. (Anderson, Freedland, Clouse, & Lustman, 2001; Lett, Sherwood, Watkins, & Blumenthal, 2007), and since it can contribute to worse health outcomes (Lett, et al., 2007; Moussavi, et al., 2007). Several studies of chronic illness patients have shown correlations between adherence and level of depression or depressive symptoms. In a meta-analysis of twelve correlational studies
of chronic illness patients who were not being treated for MDD or psychiatric illness, patients with depressive symptoms were three times more likely to be nonadherent across a range of different treatments and chronic illnesses (DiMatteo, et al., 2000). No moderators were included in the meta-analysis. Since this meta-analysis was published, other studies have also shown a relationship between depression or depressive symptoms and adherence. In a study of patients post-myocardial infarction, depressed patients were more likely to report decreased adherence to many, but not all, types of treatments (Ziegelstein, et al., 2000). In studies of diabetes patients, depression also predicted poorer adherence to many but not all types of treatment (Ciechanowski, Katon, & Russo, 2000; H. Park, Hong, Lee, Ha, & Sung, 2004).

Several different mechanisms for the relationship between depressive symptoms and adherence have been proposed, including depression causing decreased motivation to adhere, increased hopelessness about prognosis, or poor social support (DiMatteo, et al., 2000; Gonzalez, et al., 2004), which can in turn contribute to poor adherence. If the types of treatments affected by depression are in fact related to difficulty of treatment regimen, this may suggest that nondepressed patients are more likely to follow through with more minor lifestyle adjustments such as taking a pill, which may require extra effort or motivation for depressed patients, while all patients, depressed or not, require stronger effort and motivation, or possibly a stronger belief in treatment efficacy, in order to follow difficult treatments. Mediational studies have found that beliefs such as perceived barriers to treatment (Chao, et al., 2005) and medication-specific self-efficacy (Cha, et al., 2008; Chao, et al., 2005; Schoenthaler, et al., 2009) mediate the relationship between depressive symptoms and adherence. Chao et al.
suggest that features of depression including pessimism and hopelessness may contribute to these mediational illness beliefs, which in turn may lead to decreased adherence.

There is a separate body of literature on depression’s negative effect on adherence to antidepressant medications. However, due to the different population sampled in this type of study, conclusions should not be extrapolated to chronic illness populations and other medical treatments for two reasons: First, mental health patients are likely to have more severe depression, often major depressive disorder (MDD), in order to be prescribed antidepressant medication, whereas depressive symptoms in medical patients will likely be less severe, on average, since patients are not presenting for depression treatment. Second, it has been suggested and observed that depressive cognitions may be different in these two populations. In a mental health sample, depression may more likely be related to a negative self-concept and feelings of worthlessness, while in a chronically ill sample, some patients with depressive tendencies may experience damage to their self-worth while many others retain intact self-worth but feel hopeless and helpless about the situation, and experience more somatic depressive symptoms (Moorey & Greer, 1989; Moorey & Steiner, 2007).

*The self-regulation model and mental health in chronic illness patients*

As discussed above, beliefs about illness and treatment can predict adherence, as can mental health. These two predictors have rarely been examined in relation to one another, which is necessary in order to determine the strength of their relationship, and whether and how their interplay may have an even stronger effect on adherence than either variable alone.
Studies on the relationship between illness perceptions and mental health have found varying results. Some studies have found no relationship between any illness representation domains and depression, including samples of multiple sclerosis patients (Spain, Tubridy, Kilpatrick, Adams, & Holmes, 2007) and patients with atrial fibrillation (Lane, Langman, Lip, & Nouwen, 2009). However, in a study of type 2 diabetes patients, higher perceived control and better perceived consequences were associated with fewer depressive symptoms in a cross-sectional study (Paschalides, et al., 2004). And, two longitudinal studies have found that illness beliefs predicted subsequent depression. In patients undergoing cardiac surgery, a low summary score of illness beliefs (i.e. more generally negative beliefs) predicted depressive symptoms three months after surgery (Juergens, Seekatz, Moosdorf, Petrie, & Rief, 2010), and in patients with myocardial infarction, those who perceived a longer timeline and less control were more likely to subsequently develop depression (Dickens, et al., 2008).

Few studies have examined the relationship between treatment beliefs and depression. In a sample of cancer patients, perceiving negative illness consequences predicted distress, but treatment beliefs and distress did not correlate (Thune-Boyle, Myers, & Newman, 2006). In patients with head and neck cancer, baseline treatment beliefs did not predict depression six months after treatment (Llewellyn, McGurk, & Weinman, 2007).

In sum, there have been few consistent findings on the relationship between beliefs and depression, and the mechanisms that may influence this relationship are unclear. Two of the studies discussed above controlled for illness severity and still found a correlation (Juergens, et al., 2010; Paschalides, et al., 2004), which suggests that actual
health does not fully mediate the relationship. It is possible that if a patient views his illness more negatively, this may contribute to decreased confidence and increased feelings of hopelessness or depression. Or, poorer emotional health may contribute to decreased confidence and low perceived control. The relationship of treatment beliefs and depression has not been examined enough to draw firm conclusions, although thus far no relationship has been established.

The self-regulation model, mental health, and adherence

The above sections describe the relationships between illness and treatment beliefs and adherence, depressive symptoms and adherence, and illness beliefs and depressive symptoms. Both depressive symptoms and certain treatment beliefs appear to predict medical adherence in many cases, but not all, while the two predictors are not closely related with one another. Findings have been somewhat inconsistent, which may be due to variations in study design and patient characteristics, and may also be due to the three variables’ possible interactions with one another. It is possible that when looked at together, mental health and the SRM predict adherence more consistently than one or the other alone, due to the interplay of the two predictor variables on influencing behavior.

Few studies have analyzed mental health, treatment beliefs and adherence together. Only one study specifically examined both depressive symptoms and treatment beliefs in predicting adherence (Maguire, Hughes, & McElnay, 2008). The study examined a sample of hypertension patients recruited from pharmacies, and findings were negative, with no relationships among the three variables. Several factors could have contributed to the negative findings. First, adherence in the sample was so negatively skewed as to
require dichotomizing the adherence variable and performing logistic regression, thereby losing information on gradations in adherence. Second, the recruitment method, giving out questionnaires in pharmacies, and the specific illness, hypertension, might somehow have contributed to the findings. In this study, no interactions were tested, so it is not clear whether significance would have been found had moderation been tested.

As mentioned above, some studies (Cha, et al., 2008; Chao, et al., 2005; Schoenthaler, et al., 2009) found that certain health beliefs including treatment self-efficacy mediated the relationship between depression and adherence. Chao et al. proposed that depression-related pessimism and hopelessness may contribute to certain beliefs, which in turn lead to decreased adherence. While DiMatteo et al. (2000) did not include illness beliefs in their meta-analysis of depression and adherence, they did hypothesize that depression-related pessimism and hopelessness may distort patient perceptions of treatment benefits and barriers, and faulty treatment perceptions would likely contribute to nonadherence. Horne and Weinman (1999) checked for a role of depression in their study of patients with asthma, kidney disease, heart disease, cancer and HIV, and did not find one; controlling for negative affect did not affect treatment adherence. However the authors did not examine the role of negative affect in greater depth than simply using it as a control variable, so it is unclear whether it may have moderated the relationship. The information presented in this appendix, and the lack of existing research on moderation, led to the current study and hypotheses. Moderation may help explain the current findings, since treatment beliefs may predict adherence more consistently in patients with certain depressive characteristics.
Curriculum Vitae

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