ILLNESS REPRESENTATIONS AND PATIENT ADHERENCE:

THE IMPORTANCE OF PROVIDER BEHAVIOR AND PATIENT PERCEPTIONS

By

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A thesis submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Master of Science

Graduate Program in Psychology

written under the direction of

Howard Leventhal, Ph.D.

and approved by

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New Brunswick, New Jersey

October 2010

ABSTRACT OF THE THESIS

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This study used self-report data from patients at a primary care clinic at a University Medical center to further understand the relationship between adherence to treatment and patients' perceptions of their providers' ability to address patient models of illness and treatment (i.e., common sense model mastery; CSM-mastery). Analyses tested whether this relationship was mediated by treatment efficacy beliefs and moderated by pre-visit worry. Results of regression analyses indicated that treatment efficacy beliefs did not mediate the relationship between CSM-mastery and adherence to treatment. Additionally, pre-visit worry did not moderate the relationship between CSM-mastery and adherence to treatment.

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Introduction

Over the last century the average life expectancy for a United States citizen rose by 28.3 years (Shrestha, 2006). While most of the improvement is due to improved sanitation and diet, some of this increase is due to the improved efficacy of medical treatment regimens. However, despite a slight increase in adherence rates to long-term treatments in the last few years, likely due to the development of simpler gastrointestinal and cardiovascular disease treatments (DiMatteo, M. R., 2004), non-adherence to chronic illness treatments as a whole remains high. For example, at least 24% of patients with asthma are non-adherent to controller therapy (Ulrik et al., 2006) and around half of hypertensive patients do not adhere to treatment (Wang et al., 2002).

These low adherence rates are disturbing because they have been linked to several negative treatment outcomes across a diverse range of conditions, including AIDS, asthma, tuberculosis, hypertension and organ transplants (Jin, Sklar, Oh, & Li, 2008). Non-adherence and its associated negative outcomes may also explain why successful treatment efficacy research does not always translate into successful treatment in the real world – patients cannot benefit from treatments they do not use (Ross, Walker, & MacLeod, 2004). Furthermore, even when ignoring clinical outcomes, non-adherence places an undue financial burden on the healthcare system. One estimate places the cost of non-adherence at roughly $300 billion a year, regardless of treatment efficacy (DiMatteo, 2004).

With a price tag that high, identifying variables that are associated with and may affect adherence is extremely important. The interaction between patients and providers is proving to be a promising area for study. For example, how physicians present

information about illness and treatment has been shown to affect adherence to treatment (Ley, 1988; (Phillips, H. Leventhal, & E. A. Leventhal, 2010). However, this relationship may be mediated by factors such as the patient's beliefs in the efficacy of the prescribed treatment and moderated by the factors the patient brings to the clinical setting, e.g., worry about symptoms. Identifying moderating and mediating factors and developing interventions to address them is a likely step toward improving adherence and health outcomes. Therefore, the following review of the literature will explain the necessity of a process oriented approach to empirical research on adherence as well as discuss the importance of the relationship among patient perceptions, treatment efficacy beliefs, worry and adherence.

The Importance of Theory-Based Research

Theory-based research is important for identifying mediators and moderators and understanding when and how they operate in different contexts, i.e., for different diseases, treatments and medical settings. Unfortunately, few of the 16,000 studies published on adherence are empirical works; there are six times as many review articles as empirical studies (DiMatteo & Haskard, 2006). Furthermore, most of the relatively few empirical investigations of adherence do not measure clinical outcomes and as such cannot examine the effects of non-adherence on health (Kripalani, Yao, & Haynes, 2007).

Clearly, there is a gap between needed research and the literature base. One explanation for this gap is the complexity inherent in operationalizing adherence. The seemingly simple dichotomy between intentional and accidental non-adherence is an example of this difficulty. Forms of accidental non-adherence include factors like poor patient-provider communication or a patient inability to follow a treatment regimen. On

the other hand, intentional non-adherence results from deliberate neglect of a doctor's orders (Ulrik et al., 2006). These appear to be discrete concepts, yet it is easy to imagine situations where it would be difficult to determine whether non-adherence is intentional or accidental. For example, a patient who deliberately stops an antibiotic mid-course because he feels better may have stopped because he does not know to take the pills until they run out (accidental), or he may know how long to take the pills, but decide to stop anyway (intentional).

It is impossible to account for such complexities without addressing individual differences in illness and treatment beliefs. However, randomly correlating patient beliefs and behaviors makes it difficult for new research to build upon old research and the resulting lack of momentum makes it impossible for the field to move forward. Rather, it is important for researchers to use a theoretically oriented approach in which theory is used to outline and test causal relationships between patient beliefs and adherence. For example, researchers could use a measure like the revised Illness Perception Questionnaire (IPQ-R;Moss-Morris et al., 2002), which measures the five components of a specific self-regulatory model (H. Leventhal et al., 1997; H. Leventhal, Nerenz, & Steele, 1984). In this way, new findings will enhance our understanding of existing theories as well as provide a roadmap for future research.

One theoretical model that can be and has been useful in understanding adherence is the Health Belief Model (HBM). The HBM suggests that adherence depends on patient perceptions of illness severity, susceptibility, treatment beliefs and motivation or concern for health (Rosenstock, Strecher, & Becker, 1988). The HBM also assumes that these perceptions will be stronger predictors of adherence than will clinically assessed disease

severity. This theory is empirically supported. For example, beliefs about treatment efficacy appear to be the best predictor of adherence to cancer treatments (DiMatteo et al., 1993). However, the HBM does not explain all variance in adherence behaviors. Therefore, researchers must investigate additional factors that may affect adherence (Abbott, Dodd, & Webb, 1996; Bultman & Svarstad, 2000; Harrison, Mullen, & Green, 1992). For example, the HBM ignores the distinction between perceptions (i.e., responding to somatic experience and functional changes) and verbalized beliefs. This distinction is important as many actions occur fairly automatically with verbalized statements serving as "after the fact" comments on a completed, causal process.

The Common Sense Model of Self-Regulation (CSM) is a theoretical framework that specifies a range of additional factors by building on the hypothesis that adherence is a function of a continuum of perceptual to verbal processes for both the representation of an illness, its treatment and the action plans for performing the treatment (H. Leventhal, Brissette, & E. A. Leventhal, 2003). According to the CSM, patients assess and create representations of symptoms and other illness cues across five specific illness domains: 1) *cause*, e.g., whether food, lifestyle or a virus led to symptoms; 2) *consequences*, e.g., whether the symptoms are life-threatening; 3) *control/cure*, e.g., whether the illness can be treated; 4) *identity*, e.g., the illness's name and associated symptoms; and 5) *timeline*, e.g., whether the illness or symptom is chronic or acute.

These illness domains have been associated with a variety of clinical outcomes—both directly and through their association with patient adherence. For example, a 2003 meta-analysis (Hagger & Orbell) found beliefs in serious consequences to be associated with poor coping strategies as well as negative physical and psychological health

outcomes. Additionally, if patients believe that their cardiac events are related to lifestyle factors (the cause domain), they are more likely to adhere to lifestyle interventions prescribed as treatment (Byrne, Walsh, & Murphy, 2005). The control/cure domain has been linked to risky sexual behavior (S. C. Kalichman et al., 2007) as well as adherence to treatments for asthma, HIV and cystic fibrosis (Menckeberg et al., 2008; Beusterien, Davis, Flood, Howard, & Jordan, 2008; Bucks et al., 2009).

These findings underscore how essential it is for providers to address patient models of illness and treatment during medical visits. Phillips et al. (in review) have labeled this ability in providers Common Sense Model Mastery (CSM-mastery). The authors have demonstrated that adherence is significantly greater at one-month follow-up when patients perceive and recall statements of their physicians that reflect CSM-mastery. Specifically, patients are more adherent when physicians discuss the meaning of symptoms, provide a specific response for management, state treatment outcomes, and discuss possible actions if outcomes are not as expected. Phillips, Leventhal, and Leventhal (in review) also report that patient perceptions of CSM-mastery are a better predictor of adherence and health outcomes than patient reports of physician psychosocial skills, or "bedside manner." This finding contrasts with a prior emphasis on bedside manner as the key to adherence (e.g., Bultman & Svarstad, 2000; Roter et al., 1997).

Previous medical research supports the relationship between provider behaviors and adherence described by Phillips and colleagues (in review). In 1976, Inui and colleagues found that a 1-2 hour health belief model-based intervention for physicians was sufficient to improve adherence and treatment outcomes in hypertensive patients.

Despite its age, this study is compelling because it is one of the few that assessed *both* adherence to treatment and treatment outcomes. The effects of the intervention seemed to be due to a change in physician behaviors. Once study physicians had better information about how patients understood hypertension (i.e., patient CSMs of hypertension), the physicians were more skeptical regarding compliance and spent less time on exams and history taking. The physicians then spent more time explaining and reviewing treatment strategies as well as discussing treatment barriers with patients; these communications and the strategies associated with them (e.g., demonstration of procedures) overlap with the concepts in the CSM that are not included in HBM. In others words, the intervention improved one facet of the physicians' CSM-mastery: the ability to address patient representations of illness and use that information to inform the medical visit.

Inui and colleagues (1976) did not address the second facet of CSM-mastery, the ability to give patients an accurate way to assess disease progression and responses to treatment. However, others have found CSM-based interventions to be effective. For example, Petrie and colleagues (2002) successfully used a CSM-based intervention to promote recovery and control disease progression in myocardial infarction patients.

CSM-mastery, Treatment Efficacy Beliefs, and Adherence

Research from the field of clinical psychology also supports the CSM-mastery findings. CSM-mastery is similar to the provision of a treatment rationale in cognitive behavior therapy (CBT). Providing a treatment rationale, or explaining treatment in a persuasive and commonsense way, has been an integral part of CBT since at least the development of Beck’s cognitive therapy for depression (Beck, 1972). Just as with the CSM-mastery findings, the ability of psychologists to provide a compelling treatment

rationale has been linked to clinical improvement and adherence to treatment (Ilardi & Craighead, 1994). Additionally, while providing a treatment rationale has been correlated with clinical improvement, at least one study has demonstrated that the therapeutic alliance, a construct similar to bedside manner, is not correlated with symptom reduction (Addis & Jacobson, 2000).

Providing a treatment rationale is also associated with positive expectancies regarding treatment (e.g., Kazdin & Krouse, 1983). However, despite its importance in CBT theory, only one study has investigated the relationship between providing a treatment rationale and *increases* in treatment efficacy beliefs and adherence. Ahmed and Westra (2009) found that a rationale provided by an experienced CBT psychologist increased participants' confidence in completing a prescribed treatment, perceived helpfulness of treatment and expectations for symptom change. The first two changes were also positively associated with frequency of treatment at one-month follow up. These results suggest that providing a treatment rationale may lead to adherence by increasing positive treatment expectancies. Because CSM-mastery is similar to providing a treatment rationale, it is possible that the effect of CSM-mastery on adherence is also due to an increase in patient treatment efficacy beliefs.

Therefore, one aim of the current study is to determine whether the relationship between CSM-mastery and patient adherence is mediated by patient treatment efficacy beliefs. Based on the HBM, the CSM, and findings from clinical psychology, we hypothesize that the commonsense explanations of symptoms and treatment provided by physicians whose patients rated them high in CSM-mastery would improve adherence by strengthening treatment efficacy beliefs.

CSM-Mastery, Worry, and Adherence

Although the above findings are promising, it is important to remember that physicians do not operate in a vacuum and that factors beyond physician behaviors affect treatment adherence. Evidence suggests that symptom-related worry is such a factor, and one that can have contrasting outcomes. For example, research suggests that patient concerns about treatment can be negatively associated with adherence (e.g., R. Horne & Weinman, 1999) and that an avoidant coping style is associated with decreased adherence to treatments for cystic fibrosis (Abbott, Havermans, & Hart, 2009). Therefore, it is possible that worry reduces adherence because, as clinical psychologists have demonstrated, worry and fear are often associated with avoidance behaviors (e.g., Clark, 2004).

However, other studies suggest that health-related worry is positively associated with adherence. For example, health-related worry is correlated with greater adherence to asthma treatments (Abbott et al., 1996). Additionally, women who are worried about breast cancer risk are more likely to take action and get preventative screenings (Diefenbach, Miller, & Daly, 1999). Research also shows that worry can predict preventative health behaviors even when the worry accompanying the behavior is not experienced as anticipated (Chapman & Coups, 1999).

One explanation for these contrasting results may be the interaction between worry and provider behaviors and its effect on adherence. For example, Leventhal and colleagues (1965) found that while fear and worry alone were not associated with participants getting physician-recommended tetanus vaccinations, fear combined with an action plan was associated with higher vaccination rates. This finding has been replicated

numerous times (Witte & Allen, 2000), suggesting that because CSM-mastery includes the provision of a plan, worry may interact with CSM-mastery such that worry enhances the effect of CSM-mastery on adherence.

Therefore, the second aim of this study is to determine whether and how symptom-related worry moderates the relationship between CSM-mastery and adherence. We propose that symptom-related worry interacts with CSM-masterful physicians' provision of a plan and subsequently enhances adherence.

Method

Participants and Procedures

Between the summer of 2007 and the winter of 2008 patients at an internal medicine primary care practice at a University Medical center were approached for recruitment. Of the patients approached, 56 percent volunteered and completed consent forms. The total sample consisted of 402 patients (63% female) with an average age of 61 years and a range from 18 to 90 years (SD=15.78). The majority of the sample was white (63%), 14 percent African American, 8 percent another minority and 15 percent did not report race. Participants were well educated, as 55 percent had at least 4 years of college-level education and less than 3 percent did not graduate high school or earn a GED. Participants were also well insured, less than 1 percent did not have some form of health insurance. The majority of participants had been diagnosed with at least one chronic illness (74.4%). Of those with a chronic illness, 74 participants (19.4%) had diabetes, 62 participants (15.4%) had asthma or COPD, 69 participants (17.2%) had cardiovascular disease, 193 participants (48%) had hypertension or high blood pressure and 105 participants (26.1%) had another chronic illness diagnosis from a doctor or other health professional.

Participants separately consented to complete a questionnaire and to have their visit with the doctor recorded. Patients who did not consent to the audio recording (29%) were not excluded from the study. The questionnaire participants completed while waiting for their appointment included items assessing the reason for the visit, general health and expectations for the visit. Physicians also completed a questionnaire that included items on their patients' health, expected illness progression and prescribed treatments. Twenty-

four to forty-eight hours after the initial visit, participants were contacted for a 1.5 to 2 hour interview regarding their visit and any prescribed treatment plans. Participants were also asked about physical and mental functioning as well as common-sense models. One month later, participants were interviewed for 30 minutes about presenting problem resolution, physical and mental functioning, general health and adherence to treatment for the presenting problem.

Out of the 402 total recruited patients, 67 (16.7%) were lost to follow-up 1 month later and did not have adherence data. Additionally, 103 (25.6%) people were not prescribed a treatment during the medical visit and so did not respond to treatment efficacy question. Out of all recruited participants, two hundred and fifteen people (53.5%) did not answer all 7 items of the CSM-Mastery scale. This is probably due to the fact that a number of participants answered "not applicable" ("N/A"). It is not likely that participants rated answers as N/A at random, for example some chose "N/A" because they were not prescribed a treatment, others chose "N/A" because the physician did not address that facet of CSM-mastery and others chose "N/A" because they forgot that the physician addressed that facet of CSM-mastery. Because it is impossible to determine the reason for the N/A rating, only participants who answered "Yes" or "No" to all 7 items were included in the analysis. Thus, a total of 101 participants were used to investigate aim 1 and 100 participants were used to investigate aim 2.

Measures

CSM-mastery scale. The CSM-mastery Scale assesses patient perceptions of the physicians' ability to address the causes, identity, control, consequences, timeline, and treatment expectations for a presenting problem and its prescribed treatment during the

visit. Each item in the CSM-mastery Scale is a question about whether or not the doctor behaved in a particular manner, for example, "the doctor told me what s/he was looking for during the physical exam" (identity domain) or "the doctor discussed with me what might be the cause" (cause domain). The scale yields a score for each patient that is a sum of 7 Yes/No items about the patient's report of the physician's behaviors. To limit the effect of social desirability biases the items were designed to assess only the doctor's overt and observable behaviors. The full scale appears in Appendix A.

Patient adherence. Patient adherence was constructed as a composite measure (average) of 5 standardized items from an adapted version of the Medication Adherence Scale (MARS; Horne and Weinman, 2002). The MARS is a ten item self-report measure of adherence to medication, however it was modified to fit the specific circumstances of the study and theory of the CSM-mastery construct. For example, 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: Not at all, A little, Somewhat, Quite a bit, Very much." Additionally, a more general question was added to assess whether patients did something "different from" what was prescribed rather than "more" or "less" than prescribed. This question was added because it is possible that if the patient's CSM is in sufficient conflict with the medical model, the patient may choose a treatment completely different from what the physician prescribed. The items referred to any treatment prescribed by the physician including medication, diet and physical activity.

Pre-visit symptom-related worry. Pre-visit worry was measured with a single item at the initial visit: "I am concerned or worried about this problem: not at all (=1) to very much (=5)."

Treatment efficacy beliefs. Treatment efficacy beliefs were measured with a single item during the 24-48 hour assessment: “The doctor's prescribed treatment will get the problem under control: not at all (=1) to very much (=5).”

Demographic information. Participant sex, age, race and highest level of education were collected.

Analysis Overview

Aim 1: Simple Mediation

Aim 1 was analyzed using an SPSS macro provided by Preacher and Hayes (2004). First, simple mediation was tested using two criteria described by MacKinnon (2008): one, the independent variable (CSM-mastery) must predict the mediator (treatment efficacy beliefs), and two, the mediator (treatment efficacy beliefs) must predict the dependent variable (adherence) while controlling for the independent variable (CSM-mastery). Second, the macro was used to test mediation with a nonparametric bootstrapping procedure in which the mediation effect is calculated in numerous resamplings of the data. While each resampling yields slightly different confidence intervals, the variation decreases with the number of resamplings. The data were resampled 5,000 times as suggested by Preacher and Hayes (2004).

Having output from both tests was important because the method described by MacKinnon (2008) requires a large sample size with a normal distribution whereas bootstrapping does not require normality. Therefore, we were able to confirm the results of the first method with the bootstrapping technique.

All tests of mediation controlled for sex, age, race and education level. However, because none of these effects were significant, they are not included in table 2. They are, however, included in Appendix B.

Aim 2: Moderation

The moderation hypothesis was analyzed using the approach described by Hayes and Matthes (2009) in which a moderation effect is indicated when an interaction between the independent variable (CSM-mastery) and the moderator (pre-visit worry) significantly predicts the dependent variable (patient adherence) when the effects of those variables are included in the model. Again, the authors provide an SPSS macro to complete the analyses.

Results

Table 1 presents means, standard deviations and intercorrelations for all variables. All Pearson correlations between patient adherence, CSM-mastery and treatment efficacy beliefs were in the positive direction as expected. Pre-visit worry was not significantly correlated with any of these variables. However, Pre-visit worry was higher in women, minority patients were younger, and older patients reported greater CSM-mastery in their providers. Education level was not correlated with any other variable.

Aim 1: Simple Mediation

Table 2 presents results for the mediation tests. Only participants for whom data were available on all 3 variables were included in the analyses (N=101). Perceptions of CSM-mastery predicted treatment efficacy beliefs ($B = 1.48$, $t = 2.79$, $p < .001$), thereby confirming MacKinnon's (2008) first criterion for mediation. However, when controlling for CSM-mastery, treatment efficacy beliefs did not significantly predict adherence at one month follow up. The effect of CSM-mastery cannot be carried through to patient adherence through treatment efficacy beliefs unless treatment efficacy beliefs are able to predict patient adherence when controlling for CSM-mastery (MacKinnon, 2008). Therefore, the results do not support a simple indirect effect between CSM-mastery and adherence through treatment efficacy beliefs. This was confirmed by the results of the bootstrapping method (data not shown).

Aim 2: Moderation

Table 3 presents the results for the moderation hypothesis. Only participants who completed data on all 3 variables were included in the analyses (N=100). At mean levels of pre-visit worry, CSM-mastery predicted adherence ($B = 0.57$, $t = 2.33$, $p < .05$). At

mean levels of CSM-mastery there was a trend towards a negative relationship between pre-visit worry and adherence (B = -0.10, t = -1.83, p < .08). However, the interaction of CSM-mastery and pre-visit worry did not significantly predict adherence (B = 0.09, t = 0.58, p > .05). Therefore, the results do not support the hypothesis that worry moderates the relationship between CSM-mastery and adherence.

Discussion

The results indicate that patient perceptions of CSM-mastery are related to subsequent adherence and perceptions of treatment efficacy. However, perceptions of treatment efficacy did not mediate the effects of experiencing mastery on subsequent adherence. These findings do not support the hypothesis that treatment efficacy beliefs mediate the relationship between CSM-mastery and adherence.

There may be multiple reasons for this null effect. For example, the diversity of chronic conditions reported by patients may have created too much "noise." Treatment efficacy beliefs may have been high for some conditions and variable for other conditions making it difficult, statistically, to see a mediation effect. It is also possible that the mediation hypothesis was unsupported because it depends upon factors not assessed in the current study, such as, past experiences with treatment and how treatment efficacy beliefs change over time.

When a patient is prescribed a treatment that has previously worked, treatment efficacy beliefs will be high and will most likely predict adherence regardless of physician behavior (i.e., CSM-mastery). On the other hand, a patient prescribed a treatment that has failed in the past may hold low treatment efficacy beliefs. In this case, a CSM-masterful physician might be able to bolster treatment efficacy beliefs battered by poor results from prior treatment and improve adherence. Imagine an asthmatic patient who stopped using her daily inhaler because she did not feel an immediate effect. A CSM-masterful physician would explain that she has asthma all the time and that the daily inhaler is working even if she doesn’t feel an instantaneous effect. This commonsense explanation may improve the patient’s flawed expectations for treatment

and make her more likely to use the inhaler. If treatment efficacy beliefs function in this way, they may be more important as indicators of feedback than as independent predictors of adherence.

Another possible explanation for the lack of mediation comes from the previously described Ahmed and Westra study (2009). The authors found that after the provision of a treatment rationale, greater perceived helpfulness of the treatment predicted adherence whereas an increased belief that the treatment was credible did not predict adherence. Perceived helpfulness was measured with a scale developed for the study that assessed how helpful participants thought the treatment would be in helping them deal with *specific* problem situations they had listed before listening to the treatment rationale. Treatment credibility was measured as part of an existing scale (Devilly & Borkovec, 2000) that assessed, in general terms, how logical participants found the treatment, whether they thought the treatment would be successful in treating their problem and how confident they would be in recommending the treatment to a friend.

It seems likely that Ahmed and Westra (2009) did not find a relationship between treatment credibility and adherence because it was a less specific measure of participants' beliefs about treatment than the measure used to assess perceived helpfulness of treatment. The measure of treatment efficacy beliefs used in the current study is most similar to Ahmed and Westra's (2009) treatment credibility measure. Therefore, it is possible that the data do not support the simple mediation hypothesis because the measure of treatment efficacy beliefs was not specific enough to capture the effect.

The results of the second aim also differed from the hypothesis set forth in the introduction, as worry did not moderate the relationship between perceptions of CSM-

mastery and adherence. This is surprising given the solid empirical support that worry with the provision of a plan enhances adherence (e.g., Witte & Allen, 2000). One explanation is that CSM-mastery simply overrides the effect of worry. However, there was no evidence that worry by itself had either a positive or negative effect on adherence in the current data set; e.g., pre-visit worry had a slight but non-significant negative effect on adherence in a bivariate model (B = -.08, t = -1.61, p = .11). As the presenting complaints varied greatly among the 101 patients, the effects of worry may have simply "cancelled themselves out" -- worry having a mild positive effect for treatments recommended for some illnesses and a negative effect for others.

Another explanation for the lack of moderation is that while some patients react to worry and CSM-mastery as hypothesized in the introduction, that is, the two combine to improve adherence, others respond differently. For example, the interaction between worry and provider behaviors could reduce adherence because worry and fear are often associated with avoidance behaviors (e.g., Clark, 2004). It is possible that a person worried about his or her chronic illness may attempt to avoid experiencing cues for chronic illness-related worry. These cues could include many of the factors that make CSM-masterful physicians effective (e.g., encouraging patients to think about the illness and treatment, helping patients make plans for and carry out treatment, etc.). As a result, worried patients with CSM-masterful physicians may be less adherent than non-worried patients because CSM-masterful physicians necessarily elicit a number of illness cues that worried patients may want to avoid.

Limitations

There are several limitations to the current study. First, the sample included patients presenting with a variety of complaints that may be associated with varied perceptions of treatment efficacy, different levels of worry, and different relationships between worry and adherence, i.e., avoidant for some illnesses and encouraging of adherence for others. Second, examining these hypotheses in a data set where the mediator and moderator were assessed with only single items may have made it more difficult to detect the hypothesized effects.

Additionally, this mostly White, well educated and insured sample was not representative of the United States. Moreover, only about a quarter of the sample had data on all 4 variables, which limited sample size. As described above, analyses were restricted by available measures of treatment efficacy beliefs and prior experiences with treatment. Additionally, a larger sample size and measures of coping style would have allowed us to assess whether patients were in fact avoiding the information elicited by the CSM-masterful physicians.

Another possible limitation was the use of self-report on the patient adherence scale as self-report is often considered a less rigorous form of assessment than objective measures of adherence like pill counts. However, the MARS has shown good validity when compared with electronic records for use of inhalers for self-management of chronic asthma (Cohen et al., 2009). Additionally, there is evidence that, at least with medication, self-report of adherence is sufficient (DiMatteo, 2004).

Research Implications

One goal of this study was to inform physician training by beginning to develop a model of how CSM-mastery influences adherence. Because this study is one of the few to use theory-based hypotheses to investigate adherence, the data still provide valuable information regarding future areas of research into CSM-mastery, despite the fact that the results of this study did not support the initial hypotheses.

For example, it is clearly important to assess treatment efficacy beliefs and other potential mediators at various time points. While these analyses assumed that CSM-mastery led to patients' treatment efficacy beliefs, treatment efficacy beliefs were not measured over time and as such there can be no firm conclusion that CSM-mastery increases treatment efficacy beliefs. It will also be important to continue to use various measures of treatment efficacy beliefs as well as assess the role that experiences with treatment play in the relationship between CSM-mastery, treatment efficacy beliefs and adherence.

Subsequent research must also assess other components of the worry – adherence relationship, for example, coping style, to determine the true effect of worry on adherence and how physicians can use this information to their advantage. Finally, it is imperative that future research elucidate other mediators and moderators of CSM-mastery so that it can be effectively taught to physicians who can then make treatments more palatable to and effective for primary care patients.

Tables

Table 1

Descriptive Statistics and Study Variable Intercorrelations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Patient Adherence	0.01	0.67	1	.25**	.19*	-0.13	0.00	-0.02	0.03	0.05
2. CSM-mastery	0.57	0.32		1	.36**	0.02	-0.14	0.05	-0.18*	0.09
3. Treatment efficacy beliefs	3.87	1.19			1	-0.08	0.04	0.00	-0.06	0.05
4. Pre-visit worry	2.74	1.27				1	-.15*	0.11	-0.07	0.00
5. Sex	N/A	N/A					1	0.04	-0.04	-0.10
6. Race	N/A	N/A						1	-.19**	0.03
7. Age	61.00	15.78							1	-0.06
8. Education	4.67	2.09								1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 2

Summary of regression models used to test for mediation

Model	*B*	*SE*	*t*	*p*
CSM-mastery predicting adherence	0.60	0.22	2.79	0.01**
CSM-mastery predicting Treatment Efficacy Beliefs	1.48	0.30	4.89	0.00**
Treatment Efficacy Beliefs predicting Patient Adherence	0.10	0.05	2.09	0.04*
Treatment Efficacy Beliefs predicting Patient Adherence when controlling for CSM-mastery	0.10	0.06	1.75	0.08

** Significant at the 0.01 level.

* Significant at the 0.05 level.

Table 3

Summary of regression analysis for predicting patient adherence used to test moderation hypothesis

Variable	*B*	*SE*	*t*	*p*
Sex	-0.08	0.16	-0.51	0.61
Race	0.00	0.05	-0.03	0.97
Age	0.00	0.00	0.36	0.72
Education	0.00	0.04	0.08	0.94
CSM-mastery	0.57	0.25	2.33	0.02*
Pre-visit worry	-0.10	0.05	-1.83	0.07
CSM-mastery X Pre-visit worry	0.09	0.16	0.58	0.56

* Significant at the 0.05 level.

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Appendix A

Common-Sense Model Mastery Scale:

1. The doctor told me what s/he was looking for during the physical exam: Y/N. (Identity domain)
2. The doctor discussed with me what might be the cause: Y/N. (Cause domain)
3. The doctor told me how long I could expect to have this problem: Y/N. (Timeline domain)
4. The doctor gave me clear instructions about my treatment: what to do, when, how often, and for how long: Y/N. (Control and Timeline domains)
5. The doctor told me what I might expect when taking my medication/treatment: Y/N. (Consequences and Identity domains)
6. The doctor gave me some tips to help me work my treatment into my daily routine: Y/N. (Control and Consequences domain)
7. The doctor told me how to monitor my problem to see if the treatment is working: Y/N. (Control domain)

Appendix B

Table 4

Summary of regression analysis for CSM-mastery predicting adherence

Variable	*B*	*SE*	*t*	*p*
Sex	-0.01	0.14	-0.06	0.95
Race	-0.01	0.04	-0.15	0.88
Age	0.00	0.00	0.60	0.55
Education	-0.01	0.04	-0.38	0.71
CSM-mastery	0.60	0.22	2.79	0.01**

** Significant at the 0.01 level.

Table 5

Summary of regression analysis for CSM-mastery predicting Treatment Efficacy Beliefs

Variable	*B*	*SE*	*t*	*p*
Sex	0.15	0.19	0.75	0.45
Race	0.02	0.06	0.32	0.75
Age	0.00	0.01	0.50	0.62
Education	-0.01	0.05	-0.14	0.89
CSM-mastery	1.48	0.30	4.89	0.00***

*** Significant at the 0.001 level.

Table 6

Summary of regression analysis for Treatment Efficacy Beliefs predicting Patient Adherence

Variable	*B*	*SE*	*t*	*p*
Sex	0.07	0.12	0.59	0.56
Race	-0.02	0.04	-0.48	0.63
Age	0.00	0.00	0.08	0.94
Education	0.04	0.03	1.39	0.17
Treatment Efficacy Beliefs	0.10	0.05	2.09	0.04*

* Significant at the 0.05 level.

Table 7

Summary of regression analysis for Treatment Efficacy Beliefs predicting Patient Adherence when controlling for CSM-mastery

Variable	*B*	*SE*	*t*	*p*
Sex	-0.02	0.14	-0.18	0.86
Race	-0.02	0.04	-0.36	0.72
Age	0.00	0.00	-0.25	0.80
Education	0.03	0.04	0.77	0.44
CSM-mastery	0.33	0.23	1.42	0.16
Treatment Efficacy Beliefs	0.10	0.06	1.75	0.08