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Medication and Lifestyle Adherence Behaviors in Hypertensive Patients

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By

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Abstract

Hypertension is a serious chronic condition that afflicts many Americans. The present study used the Common Sense Model (CSM) of Self Regulation as a theoretical framework to aid in the examination of predictors of medication and/or lifestyle adherence. Based upon the literature reviewed, the current study proposes that predictors would be different for medication and lifestyle adherence. Three hypotheses were proposed: 1. CSM-related variables (blood pressure monitoring, condition-worry hypertension duration, control beliefs, and medication beliefs items) would be correlated with medication adherence; 2. specific CSM-related variables, self assessed health (SAH) and physical functioning would significantly be correlated with lifestyle adherence; 3. If there are common predictors of medication and lifestyle adherence, the predictors would account for more of one type of adherence than the other. The current study utilized data from a larger study evaluating patients' management of acute and chronic conditions. Results supported the three hypotheses. There was no correlation between medication and lifestyle adherence. The overall model was significant in a stepwise regression with all CSM-related predictors, including age, race and education predicting medication adherence. The stepwise regression model was significant with all CSM-related predictors, including, age, race and education predicting lifestyle adherence. Different predictors in medication (the side effect of this treatment are manageable for me") and lifestyle adherence ("the prescribed treatment for my hypertension keeps it under good control" were found supporting hypothesized independence of the two constructs.

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Introduction

Hypertension, commonly referred to as high blood pressure, is a serious chronic illness that is pervasive in American society. One in three adults in the United States has high blood pressure (American Heart Association, 2008), and epidemiological research indicates that hypertension may affect 90% of individuals during their lifetime (Wand & Vasan, 2005). It is also a condition which is very likely to be co-morbid with other illnesses; in addition, it is a disease that has behavioral and physiological connections to other health problems (American Heart Association, 2008). Individuals with hypertension are at a greater risk than those without hypertension for renal failure, heart attacks, and strokes (Wang & Vasan, 2005). Conversely, controlling hypertension has been shown to reduce risk of stroke and congestive heart failure (Appel, Brands, Daniels, Karanja, Elmer, & Sacks, 2006). As individuals age, the incidence of hypertension continues to rise (65.4% of individuals 60 years of age or older (Hajjar & Kotchen, 2003).

Treatment of hypertension

The treatment of hypertension typically encompasses two approaches: drug/medication therapy and lifestyle approaches (e.g. diet, exercise, and other). The goal of treatment is often not to cure but instead to reduce blood pressure so that patients have a lower possibility of developing complications. What is important to note is that clinical recommendations for disease management is multi-faceted encompassing both medication and lifestyle behaviors. The National Heart, Lung and Blood Association has recommended that patients diagnosed with hypertension should work with their physicians in developing individualized blood pressure goals through lifestyle and medications regimens based upon individual risk factors. Lifestyle changes include

exercise and healthier eating habits, such as diet, reduced sodium intake, reduced caloric intake, and weight loss. Medication protocols for those with hypertension often include one or more of a number of medicines such as alpha blockers, beta-blockers, calcium channel blockers, Angiotensin-converting enzyme (ACE) inhibitors, Angiotensin receptor blockers (ARBs), Central alpha agonists, diuretics, Renin inhibitors and Vasodilators (High blood pressure treatment, lifestyle, medication, DASH diet. n.d.).

Adherence to hypertension treatment has however been problematic for many patients (Meyer, Leventhal, & Gutmann, 1985). This can be attributed to hypertension being a disease which is often asymptomatic and the treatments (especially medications) may make patients feel worse than the disease itself (Morrell et al, 1997; Chapman, Brewer, Coups, Leventhal, & Leventhal, 2001). While adherence may be difficult for some, individuals who have been able to satisfactorily control their blood pressure through a combination of a healthy lifestyle and medication have been able to, with doctor supervision and monitoring, step down or even withdraw from medications. The most successful at this endeavor are those individuals who have managed to maintain lifestyle changes (e.g., lose weight, reduce sodium intake), those who have had mono drug therapy (e.g., as opposed to combined medications) and those who have been able to maintain lower systolic blood pressure over the course of multi-faceted treatment (High blood pressure treatment, lifestyle, medication, DASH diet., n.d.).

Due to the scope and pervasiveness of hypertension it is a disease that has been the subject of considerable research. In a community-based cross-sectional survey in Ontario, Canada, 21% of individuals surveyed had hypertension (total adult population was 7,996,653) (Fodor, McInnis, Helis, Turton, Frans, & Leenen, 2009). Fodor and

colleagues (2009) found that 42% of hypertensive patients were on antihypertensive medications and practiced lifestyle changes while 41% received drug therapy only. Controlled blood pressure was found in 85% of those who only were on drug therapy and 78% of patients on the combination of drug and lifestyle treatments. There was not a significant difference between blood pressure and treatment modality (medication only versus medication plus lifestyle treatments). The researchers suggest that lifestyle changes are disappointing in "real life" when comparing to medication treatment (p. 34). An important limitation to this study was that self report was used to determine lifestyle changes and medication adherence. Interestingly, less than half of the hypertension patients who responded to the survey practiced lifestyle changes in addition to their regular medications.

Although Fodor and colleagues (2006) suggest that the combination of medication and lifestyle treatments are not as effective as medication alone, the limitation of the study may point to why these results occurred. Moreover, the findings from Fodor and colleagues contradict what is recommended by the National Heart, Lung and Blood Institute (i.e. High blood pressure treatment, lifestyle, medication, DASH diet, n.d.) which points out that it is important to look at hypertension treatment, in terms of both drug therapy and lifestyle treatments. If practitioners, researchers, patients and other stakeholders are to truly understand treatment regimens for high blood pressure, it is critical to evaluate the extent to which medication and lifestyle adherence has been studied in order to gain a comprehensive picture of how patients' beliefs relate to adherence. Research has looked at factors involved in medication adherence in hypertensive patients (Haynes, Ackloo, Sahota, McDonald, Yao, 2008). Additionally,

research has also looked at the factors involved in adherence to non-medication treatments such as dietary regimens, exercise regimens, or physical therapy (lifestyle treatments) (Whelton, Chin, Xin, & He, 2002). Research has investigated interventions that address both medication and lifestyle adherence simultaneously in order to improve blood pressure (Fahey, Schroeder, & Ebrahim, 2006). Due to the importance of lifestyle and medication adherence concurrently, the evaluation of factors that relate to either medication or lifestyle adherence is important.

Adherence to treatment for hypertension

There are a number of social factors that have been correlated with the incidence and prevalence of hypertension. The rates of high blood pressure are alarmingly high among African Americans, pursuant to the American Heart Association, almost one-third (31.2%) of all African American adults have high blood pressure. As a result of these elevated rates, researchers who look at adherence have sought to focus on culturally appropriate interventions that may increase adherence to hypertension treatment (medication and lifestyle changes). While taking into account cultural issues, Haafkens and colleagues' (2009) study protocol is useful because it aids in the understanding how interventions address both medication and lifestyle adherence. Haafkens and colleagues (2009) have developed a study protocol to address more specifically the disparities found with individuals of African descent (in Europe) in controlling hypertension. The proposed interventions compare the standard Dutch clinical guidelines to a culturally-appropriate hypertension education in which elicitation and discussion of patients' perceptions of hypertension and treatment will be encouraged, however the findings from this proposed program are not yet published. This study is important to note, not only because of the

focus on cultural and race/ethnicity disparities, but because of its holistic approach to hypertension treatment, and the inclusion of both medication and lifestyle change.

Expanding on this notion that the two types of treatments should be examined together, the present study will look at factors/predictors involved in both medication and lifestyle treatment adherence. As previously stated, simultaneous investigation is important because adherence to both types of treatment is critical for controlling hypertension. It is possible, for example, that some individuals adhere to one type of treatment but not the other (e.g. Individuals who only take their medications and are non-adherent to their lifestyle changes); without simultaneous measurement of both types of treatment, researchers will not be able to understand these individuals and the factors involved in their behavior accurately. If medication and lifestyle treatment adherence are distinct constructs, which factors determine one versus the other? If some patients are adherent to both medication and lifestyle treatments, what makes these patients different from patients who are non-adherent to either or both forms of treatment?

To begin, the important factors known to be involved in non-adherence to medication and to lifestyle treatments will be reviewed before discussing how these factors may be similar or different to each other and how they may interact to predict adherence. Adherence rates are lower for chronic conditions, such as hypertension, than for acute conditions (Osterberg & Blaschke, 2005). Patients who report missing any dose of their medication for their chronic conditions are non-adherent 60% of the time (Haynes, McDonald, & Garg, 2002). Thus, when a patient admits to missing any doses of their medication, the health professional can be confident that they are missing more than half the doses of the medication. Morrell and colleagues (1997) showed that 30-50% of

hypertensive patients are non-adherent in taking their medications with some patients taking less and some taking more of their medications than prescribed.

Other factors known to affect medication adherence include an individual's age (Morrell, Park, Kidder, & Martin, 1997), the asymptomatic nature of hypertension which hinders the patient from being able to see improvement with treatment (Meyer, Leventhal, & Gutmann, 1985), and the fact that the treatment can sometimes cause side effects (Chapman, Brewer, Coups, Leventhal, & Leventhal, 2001). Conversely, a positive predictor of medication adherence is how often the patient uses a blood-pressure monitor which is additionally associated with more active self-care in general (Feldman, Bacher, Campbell, Drover, & Chockalingam, 1998). The relationship of monitoring behavior to medication adherence may be due to a general healthy lifestyle; alternatively, the relationship between monitoring behavior and adherence may be specific to particular medications and not related to lifestyle treatments. However, the question remains, do those who monitor their hypertension also adhere to lifestyle treatments?

Low adherence is problematic not only when considering medication management but also when considering lifestyle changes. It has proven to be challenging for patients to stick to lifestyle treatments. Diet and exercise adherence have a relationship with obesity and high blood pressure (Appel, Brands, Daniels, Karanja, Elmer, & Sacks, 2006); therefore, adherence to diet and exercise can address hypertension more fully than blood pressure medication alone. However, adherence to diet and exercise regimen is poor (Leventhal, Dienfenbach, & Leventhal, 1992).

Many reasons for individuals not adhering to exercise and diet plans are well documented and include intention-behavior gap, preference reversals, conservation of

energy in the elderly, and ratings of self assessed health. More specifically, non-adherence to lifestyle treatments may be a result of the "gap" between individuals' behavioral intentions and their actual behavior ("intention–behavior gap"; Sniehotta, Scholz, & Schwarzer, 2005). Additionally, individuals reverse their preference for a behavior when it comes time to perform it. For example, an individual may decide that after indulging in an evening treat to run five miles the following day at 6 am. However, when the alarm goes off, the individual reverses his/her preference (running) for the snooze button. The above example demonstrates how challenging it is to effectively alter one's behavior ("preference reversals"; Berns, Laibson, & Loewenstein, 2007).

Specifically, with regard to elderly patients with hypertension, Duke and colleagues (2002) found that patients may limit their activities above and beyond their illness severity. A loss of activities was predicted by both chronic conditions, illness and age severity. That is some patients reduce their activities beyond their physical limitations which adversely affects their physical health. However, patients who had social support, were optimistic and had less of a need to conserve energy were more likely to replace lost activities. Leventhal and colleagues (1993) proposed that patients who limit their activities may do so in order to conserve energy resources. Thus, when considering the complexities underlining adherence to lifestyle treatments one should consider an individual's inclination to reverse their preference for a health behavior (diet and/or exercise). Additionally, elderly patients may have a desire to decrease physical activities as a function of needing to conserve energy.

Lower ratings of self-assessed health are predictive of less activity, and individuals with hypertension and other chronic illness rate themselves lower in general

health (Idler, Leventhal, McLaughlin, & Leventhal, 2004). Patients who are low in physical functioning and/or who rate themselves low in general health may not be adherent to their lifestyle regimen because of the need to conserve energy. However, patients who are low in physical functioning and either unable or unwilling to adhere to their lifestyle treatments may also not adhere to their medical treatment.

Research has looked at interventions that promote lifestyle modifications. Scala and colleagues (2008) used a motivational approach compared to a control group to control blood pressure, in a twelve month follow up study. The motivational group (Intervention group) participated in a focus group at 2 months and 4 months post recruitment. The control group received only oral information. Additionally, the control group was called two and four months after recruitment so that the clinical staff could obtain blood pressure, heart rate and weight in order to compare them with the intervention group. Both groups had their blood pressure recorded and "drug therapy registered" pre intervention and 12 months post intervention (p. 836). Although, this study is not a direct assessment of medication adherence it suggests that assessing one's beliefs as they relate to lifestyle changes and being a part of a group increases lifestyle modification and thus improves blood pressure.

The Common Sense Model of Health Beliefs and Behavior

The Common Sense Model (CSM) of health beliefs and behavior, first proposed by Leventhal, is a useful theoretical framework that can support the investigation of factors that influence adherence to medication and lifestyle treatments (Leventhal, Dienfenbach, & Leventhal, 1992; Leventhal, Brissette, & Leventhal, 2003). The CSM is a multidimensional framework that takes into account health beliefs, emotionality, and

cognition, which aids in the understanding of patients' health beliefs and behaviors and has been applied to patients with varying chronic diseases (Hale, Treharne, & Kitas, 2007) including hypertension (Hekler, Lambert, Leventhal, Leventhal, Jahn, & Contrada, 2008; de Ridder, Theunissen, & van Dulmen, 2007). Patients develop illness representations or "common sense" beliefs about their illness and treatment from both abstract/factual (such as from the medical provider) and experience-based information (such as changes in symptoms, e.g., with stress); the CSM places these beliefs into five domains: identity, cause, duration, consequence, and cure.

Identity refers to the symptom experience and the name of the condition (hypertension, flu, etc). Cause is what the patient believes to be the basis of the condition (internal/genetic and/or external/environmental causes). Timeline or duration connotes the temporal expectation of the disease, simply how long one can expect to have the condition (i.e. Will I have hypertension for the rest of my life?). Consequence is the expected outcome of what the condition means (what the condition means for me in the long term- I must watch my salt and take medicine every day). Lastly, the cure domain assesses patient's beliefs whether the treatment regimens will alleviate the condition. Patients' illness representations or CSMs are fluid in that they change with new information and new experiences, which in turn affect their health behaviors (for a review see Ogden, 2000).

The CSM has been used as a theoretical framework in evaluating adherence in hypertensive patients. Based upon abstract and factual/experiential information the CSM has shown how patients' manage their condition at different stages in treatment. More specifically, Meyer and colleagues (1985) interviewed patients at different stages in their

diagnosis of hypertension. 65% of the patients were only on a diuretic for their treatment, 60% of the patients were African American and 55% were female. Four groups were interviewed. The first group served as a control because they were visiting the doctor for a reason other than blood pressure ("normotensive clinic controls"). The second group was labeled the "newly treated" group and was at the clinic for the first time for the treatment of their hypertension. Third group, labeled "continuing treatment" had been in continuous treatment from three months to fifteen years. Lastly, the "re-entry" group had previously discontinued treatment and had returned to treatment. Patients' beliefs were elicited in a 45-minute structured interview and an open ended question to better ascertain the patients' beliefs compared to generally accepted views (what they thought they should say). Results suggest that patients in the "new to treatment" group were more likely to discontinue treatment if they indicated they experienced symptoms and told the doctor on their first visit in addition to believing their hypertension to be an acute condition. Patients in the "continuing treatment" group were more likely to stay in treatment if they believed their symptoms to be controlled. These patients also were more compliant to medication treatment and were more likely to have controlled blood pressure.

Leventhal and colleagues have illustrated that common-sense beliefs are related to medication adherence in hypertensive patients. Hekler and colleagues (2008) demonstrated in a sample of African American patients with hypertension that there are two prototypical common-sense models endorsed that affect patients' adherence behaviors. Endorsement of a "medical belief model" of hypertension showed that patients believed the disease to be caused and controlled by diet, exercise, age, and weight. The

second is the "stress belief model" in which patients endorse the belief that stress is the main contributor (control and cause) of their hypertension. The stress belief model demonstrates how the CSM has effectively identified a maladaptive strategy in understanding one's illness. While, chronic stress can be a contributing factor in the cause of hypertension or exacerbate the illness, (American Institute of Stress, n.d.) it is not the sole cause.

The notion that stress is a single cause has been shown to have important consequences for patients' adherence. This is demonstrated in Hekler et al (2008) who found that endorsement of the "medical belief model" was associated with lower systolic blood pressure and was mediated by lifestyle behaviors. Stress reduction was not associated with systolic blood pressure. Endorsing the "stress belief model" led to behaviors that decreased stress which did not lead to medication or lifestyle changes. Heckler et al. (2008) also found evidence that CSM-related factors may predict different kinds of adherence. Heckler and colleagues' findings suggest that lifestyle and medication adherence are different constructs and factors involved in each types of adherence may be different from each other. It is here that the present study seeks to expand the literature on hypertension treatment adherence and will explicitly evaluate the extent to which medication adherence and lifestyle adherence are distinct constructs. Additionally, this study will evaluate hypertension beliefs in a more representative sample. Moreover, the current study will appraise the extent to which CSM beliefs are associated to both lifestyle and medication adherence, respectively.

As previously stated, stress is not considered to be the sole cause of hypertension. That is not to say developing effective coping skills to aid in the management of stress

does not positively affect patient outcomes. Dusek and colleagues (2008) conducted a double-blind, randomized trial comparing stress management to lifestyle modification. The outcome variables were medication elimination and systolic blood pressure at eight weeks. Results suggest that the stress management group led to more elimination of their antihypertensive medication. Both groups had a reduction in systolic blood pressure, however, patients in the stress management group were significantly more likely eliminated antihypertensive medications The researchers address an important limitation in the present study that the antihypertensive medications that patients reported being on were not standardized. Thus patients who were on a certain type of medication may have been able to eliminate said medication easier compared to a different type of medication. Results point to the importance of providing patients with skills that will allow them to cope with stress (i.e. mindful meditation, etc) and their chronic conditions while effectively communicating the importance of lifestyle changes.

In understanding patient adherence, the evaluations of patient beliefs is critical. Leventhal and Cameron (1987) proposed that adherence is a function of the patient's belief about their medication. They posit that a patient who believes he/she lacks control over his/her illness will be less adherent because taking medication would have little effect on his/her disease outcome. Treatment efficacy belief is a strong predictor of adherence (DiMatteo, 2003).

As indicated above, the current study will look at both medication and lifestyle adherence. Research has evaluated medication adherence and specific CSM-related beliefs. Research has looked at CSM-related factor that may predict adherence based upon Medical or Stress Belief Model (Hekler et al, 2008). I will expand upon this

literature by further looking at functional limitations, self-assessed health, monitoring behavior, and CSM-related beliefs (e.g., "I will have hypertension for the rest of my life" and "The cause of my hypertension is clear to me") as they relate to medication and lifestyle treatment adherence. Factors related to medication and lifestyle treatment adherence behaviors will be evaluated separately and compared to each other in order to assess how the factors influence each type of adherence are related.

Based on the CSM model, three hypotheses have been formulated. The first hypothesis is that the ten specific CSM-related variables (Appendix 1) will be significantly related to medication adherence. The second hypothesis is specific CSM-related variables (self assessed health and physical function) will be significantly related to lifestyle adherence. Hypothesis three is that if there are common predictors to medication and lifestyle adherence, the predictors will account for more of one type of adherence versus the other. Due to the exploratory nature of this study, stepwise regression will be done on all of the predictors including age, race, and education on the criterion variables (lifestyle and medicine adherence) in separate analysis.

Methods

Participants and Recruitment

The present study is based on a larger study that was conducted between the summer of 2007 to the winter of 2008 in an internal medicine primary care practice at a university medical center. All patients who were seeing a physician in the primary care practice were approached by research personnel regardless of their reason for seeing their doctor.

Of those approached, 56 percent volunteered to participate and completed informed consent forms. There were 402 patients who agreed to participate. Of the 402 patients recruited for the larger study 129 were diagnosed with hypertension. 105 patients were prescribed both medication and lifestyle regimens for their hypertension. Informed consent and consent forms were completed and obtained prior to each patient's doctor visit. Patients who were recruited a second time were excluded.

The current study had 105 hypertensive patients with a mean age of 66.68 (table 2). 64.8% were female and 49.5% had less than or equal to a two year degree (associate degree). 54.3% were retired and 28.6% were working full time. 37.5% had private health insurance/HMO while 46.2% had Medicare with supplemental insurance. A majority of the sample were married (69.5%) and white/European American (73.1%).

Measures

As part of the protocol for the larger study, the following variables of interest were included in the current study: CSM-related beliefs including self-assessed health (SAH); physical functioning; condition-worry, timeline, control belief, monitoring behavior, as well as 4 medication belief items ("the prescribed treatment for my hypertension/high blood pressure keeps it under control", "I can actually feel the medicines working in my body", "the side effects of this treatment are manageable for me", "I have a good idea of how the medicines work"; and also lifestyle and medication adherence).

The predictor variables were SAH, physical functioning, condition-worry, timeline, control beliefs, monitoring behavior, and the four CSM medication items. Criterion variables were medication adherence and lifestyle adherence. Details describing all of these measures are presented in Appendix 1.

Criterion variables.

Both lifestyle and medication adherence were assessed using the Medication Adherence Report Scale (MARS), (Thompson, Kulkarni, & Sergejew, 2000). The medication adherence question was: "Do you ever accidently forget to use one of your medicines?". This question was a Likert scale item with possible answer choices: never, rarely, sometimes, often, or always. Lifestyle adherence was assessed using the item worded: "Do you ever accidentally forget to do one of your other treatments (diet, exercise, or others)?". The scaling was the same as for Medication Adherence: "never", "rarely", "sometimes", "often", and "always".

Predictor variables.

Self-assessed health (SAH) was assessed by the item "In general, would you say your health is…" with possible answer choices "poor," "fair," "good," "very good," "excellent." Physical functioning is a composite variable from patients' responses to two items from the Short Form 12 item survey (SF-12) (Ware, Kosinski, & Keller, 1996). "Does your health now limit you in moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?" and "Does your health now limit you in climbing several flights of stairs?". The possible answer choice to both items was: "yes, limited a lot," "yes, limited a little," or "no, not limited at all." A value of 1 was given to "yes, limited a lot," 2 was assigned to "yes, limited a little" and 3 was assigned to "no, not limited at all." The values were assigned to both items. The range of scores was between 2 and 6, with higher numbers corresponding to higher level of physical functioning (fewer limitations). (Appendix 1)

Several other CSM-related belief items used in the current study were Likert scale items (Appendix 1). Specifically, timeline belief was assessed using: "I will have HBP for the rest of my life"; Control belief: "My HBP is under control most or all of the time"; Condition-worry "How worried or concerned are you about you HBP?". These items had a possible answer choice of "not at all," "a little bit," "somewhat," "quite a bit," or "very much." Monitoring behavior was assessed with "How often do you use a monitor or instrument to keep track of your Hypertension/High Blood Pressure?" and the possible answer choices were "not at all," "less than once a month," "monthly," "weekly (1-2 times/week)," 2-3 times/week," or "daily."

Medication belief questions were: "The prescribed treatment for my Hypertension/High Blood Pressure keeps it under good control," "I can actually feel the medicines working in my body," "The side effects of this treatment are manageable for me," and "I have a good idea how the medicines work." These items had a possible answer choice of "not at all," "a little bit," "somewhat," "quite a bit," or "very much." Lastly, self-assessed health (SAH) was assessed by the item "In general, would you say your health is…" with possible answer choices "poor," "fair," "good," "very good," "excellent."

Age and education are continuous variables. Race was defined as White/European American and Minorities. This split was done because majority of the sample (73.1%) identified themselves as White (Table 2). Education and age was defined in years.

Procedure

After the consent forms were completed, patients filled out a one-page questionnaire while waiting to be called in for their appointment. Items that were assessed included the

reason for the visit, self-assessed health (SAH), and what they expected from the doctor visit. Patients separately consented to have their doctor visit audio-recorded. If the patients did not consent to have their visit audio-recorded they were still included in the study. After the patient was called into the physician's office a questionnaire was given to the physician that was to be filled out by the physician following the visit. The physician's questionnaire assessed patient's health, illness progression, and prescribed treatments. Patients were then contacted 24-48 hours after their doctor visit for a 1.5 to 2 hour phone interview. The interview consisted of assessment of doctor prescribed treatment plans, physical and mental functioning, general health appraisals, and the patient's common-sense model beliefs. One month after the 24-48 hour interview patients were contacted again by research personnel for a 30 minute phone interview. This phone interview consisted of assessment about presenting problem resolution, physical and mental functioning, general health assessment, and adherence to the presenting problem prescribed treatments.

All research personnel interviewers went through training prior to recruiting and interviewing. Additionally, interviewers had bi-weekly meetings to assess progress and to keep up with the training and protocols.

Analysis overview

In order to explore the relationships between the predictor and criterion variables, bivariate Pearson product moment correlations were computed for all 10 CSM related variables and the two criteria measures.

The first two hypotheses (The first hypothesis is that the ten specific CSM-related variables (Appendix 1) will be significantly related to medication adherence. The second

hypothesis is specific CSM-related variables (self assessed health and physical function) will be significantly related to lifestyle adherence.) were tested using bivariate Pearson correlations using SPSS 16. The predictors and criteria used in the analyses are continuous variables. A bivariate Pearson product-moment correlation coefficient was computed to assess the relationship between the 10 CSM predictors (SAH, physical functioning, monitoring; condition-worry; timeline; control belief; 4 medication belief items) and medication adherence (Hypothesis one). Additionally, bivariate Pearson product-moment correlation coefficients were computed to assess the relationship between two predictors (self-assessed health (SAH) and physical functioning (specific physical abilities)) and lifestyle adherence (Hypothesis two).

To further explore the relationship between the predictors and the criterion variables, two separate stepwise regression analyses were conducted using all of the CSM-related predictors (Appendix 1), plus age, race, and education. The criteria were medication adherence and lifestyle adherence, respectively.

Expected results

Expected results are shown on Table 1 and are for the bivariate correlations (hypotheses one and two). Plus sign (+) indicates a positive relationship. For example, individuals who use a blood pressure cuff will be more likely to be adherence to their medications. Since this is a preliminary analysis specific predictions on lifestyle adherence are only made for SAH and physical functioning. The other predictors have a question mark (?) indicating that there is no specific predictions made that can be supported by the existing literature or CSM theory. The results for the subsequent

analysis will depend on the findings of the bivariate analysis therefore no particular results are expected.

Results

The results of the correlation analysis between CSM-related predictors and medication adherence are presented in Table 3. A significant positive relationship was shown between "The side effects of this treatment are manageable for me" and medication adherence $r(95) = .232$, $p<.05$. As hypothesized, patients who indicated they were able to manage the side effects of their treatments were more likely to adhere to their medications. No other correlations were found to be significant (Table 3) with medication adherence.

To test hypothesis two, Pearson correlation was used to examine the relationship between SAH as well as physical functioning and lifestyle adherence (Table 3). A significant positive correlation was shown between SAH and lifestyle adherence $r (103)= .222$, $p<.05$. As hypothesized, patients who rated their health higher were more likely to adhere to their lifestyle treatments. Contrary to hypothesis two, a significant relationship was not found between physical functioning and lifestyle adherence $r(103)= .024$, $p=.81$. In addition, two non-hypothesized relationships were found. A significant negative relationship was revealed between condition-worry and lifestyle adherence $r(102)= -.197$, $p<.05$. Patients who worry about their hypertension were less adherent to their lifestyle treatments. Furthermore, a significant positive relationship was found between the medication belief item, "The prescribed treatment for my Hypertension/High Blood Pressure keeps it under good control" and lifestyle adherence $r(101)= .224$, $p<.05$.

Patients' beliefs that their treatment keeps their hypertension under good control are more likely to be adherent to lifestyle treatments.

Hypothesis three was tested by examining the pattern of correlations between the 10 CSM related predictors and the two outcome variables (see Table 3). These correlations showed that there were four variables that predicted either medication or lifestyle adherence. Only one of the medication belief items was significantly related to medication adherence. The correlation between "side effects of this treatment are manageable for me", and medication adherence ($r(95)= .232$, $p<.05$) was significant. For lifestyle adherence, Self-Assessed Health, condition-worry and one medication belief item ("the prescribed treatment for my hypertension keeps it under good control") were significantly correlated ($r(103)=.222$, $r=(102)= -.197$, $r=(101)=.224$, respectively; $p<.05$ for all correlations). This pattern of results indicates that there are no shared predictors between the 10 CSM beliefs and the two adherence variables. In addition, the pattern of correlations for each of the adherence variables is different from one another.

Finally, Pearson product moment correlation was used to evaluate the relationship between lifestyle and medication adherence. This analysis revealed that there is no significant correlation between medication adherence and lifestyle adherence $r(103)=.056$, $p=.572$.

Stepwise regression analysis was done with medication and lifestyle adherence as the criterion, in separate analyses. Due to the exploratory nature of this analysis, all predictors including age, race, and education were entered into a stepwise regression simultaneously. Moreover, a less stringent alpha (.05-.11) was set in order to allow the predictors to account for more of the variance. Results indicate that the overall model was

significant in predicting medication adherence $F(1,76)=5.368$, $p<.05$. A summary of the regression coefficients are presented in table 4 and shows that only one item ("The side effects of this treatment are manageable for me") of the ten CSM-related predictors significantly contributed to the model. This model accounts for 6.6% of the variance. Table 4.1 shows the predictors that were not significant to the overall model. However, physical function showed a trend toward significance, $p=.057$.

The same analysis (stepwise regression) was conducted with lifestyle adherence as the criterion. The overall model was significant $F(1,76)=4.707$, $p<.05$ and accounted for 5.8% of the variance. A summary of the regression coefficients are presented in table 5 and shows that one item ("The prescribed treatment for my hypertension keeps it under good control") out of the ten CSM-related predictors significantly contributed to the model. Item, "I have a good idea of how the medicines work" showed a trend toward significance, $p=.059$. Table 5.1 shows the predictors that were not significant to the overall model.

Discussion

This study was designed to evaluate the relationship between CSM-related predictors and medication as well as lifestyle adherence, respectively. Three hypotheses were tested. Hypothesis one was not well supported by the significant correlation between the predictor "The side effects of this treatment are manageable for me" and medication adherence (Table 3). Monitoring behavior (using a blood pressure cuff), physical functioning, condition-worry, hypertension duration beliefs, hypertension control belief, in addition to the other medication belief items ("The prescribed treatment for my Hypertension/High Blood Pressure keeps it under good control;" "I can actually

feel the medicines working in my body;" "I have a good idea how the medicines work") did not correlate with medication adherence. There are a number of reasons why my results were not supported which will be addressed in the limitations and further direction section.

Hypothesis two was narrowly supported with a significant positive relationship between SAH and lifestyle adherence. Contrary to my hypothesis, physical functioning did not significantly correlate with lifestyle adherence. A significant negative relationship was found between condition-worry and lifestyle adherence. Although this may be, on initial reflection, counterintuitive, this correlation actually suggests that individuals who do not adhere to their lifestyle treatments worry more about their hypertension. Patients who do worry about their condition would presumably be more likely to adhere to both medication and lifestyle treatments. Nevertheless, this relationship points to an interesting issue, in so much that individuals who adhere to their prescribed medications but not their lifestyle treatments may worry because they are cognizant of the discrepancy. Patients may worry about their hypertension which may reflect non-adherence in both medication and lifestyle adherence, although this is not supported by this study. Additionally, lifestyle adherence is particularly low because of the required behavioral change which many find to be a challenge for a variety of reasons including preference reversals and intention-behavior gap (Berns, Laibson & Loewenstein, 2007 and Sniehotta, Scholz & Schwarzer, 2005). Perhaps worrying about one's condition is an extension that the patient is mindful of the fact that they are not adhering to their lifestyle treatments.

A significant positive relationship was revealed between prescribed control-treatment belief ("The prescribed treatment for my Hypertension/High Blood Pressure keeps it

under good control") and lifestyle adherence. That is patients who believe the prescribed treatment keeps their hypertension under control are more likely to adhere to their lifestyle treatments. This correlation makes sense when considering that treatment efficacy belief is a strong predictor of adherence (DiMatteo, 2003). If a patient believes the treatment is effective than they are more likely to adhere.

Medication and lifestyle adherence did not correlate with each other. This has important implications for physicians. Patient adherence to medication or lifestyle treatments do not predict adherence to the respective other type of treatment. As Haynes et al (2005) demonstrates patients who admit to missing any dose of their medications for their chronic conditions of their non-adherent 60% of the time. What does this look like for patients in terms of lifestyle adherence? Further research is needed to tease out the extent to which patients differ in their medication and lifestyle adherence. This has important implications for physicians and health care providers as adherence between medication and lifestyle are not related, based upon this study. Thus, if a patient adheres to his/her medications, they may or may not be adherent to their lifestyle treatments.

The third hypothesis, which asserted that if there are common predictors to medication and lifestyle adherence, the predictors would account for more of one type of adherence versus the other was not confirmed. Since there were no shared predictors between medication and lifestyle adherence, the hypothesis was supported lending support that medication and lifestyle adherence predictors are distinct. What predicts one type of adherence may not predict the other type of adherence. Further research evaluating additional predictors would be useful. The current study still leaves open the question that there may be shared predictors that were not assessed in the present study.

Thus, there are in fact shared predictors between medication and lifestyle adherence that were just not assessed.

In light of the fact that medication and lifestyle adherence did not correlate, the two stepwise regression models also lend support that predictors for one type of adherence may be different compared to the other type of adherence. Further research should more explicitly evaluate the extent to which predictors are differentially related to medication and lifestyle adherence. It would prove useful for physicians and health care providers to be aware that not only is lifestyle and medication adherence different constructs but predictors for one may be different than for the other type of adherence

As indicated above, this analysis used the CSM as a theoretical guide; however another model that has had considerable attention in hypertension adherence research is the Health Belief Model (HBM).

> "The HBM is essentially a utility model. Its' perspective on adherence is that motivation emerges if an individual believes they are susceptible to a condition and that the condition is severe. Thus, individuals are motivated to avoid a health threat if the threat is believed likely (high probability of occurrence) and is seen to have a negative impact on function or life itself (high severity). The specific action selected depends upon its perceived benefits, access, likelihood of reducing threat) and costs (actual financial cost; side effects; negative views of action by family and friends, etc.). In addition, the concept of triggers to perceptions of vulnerability and severity, e.g., symptoms, observation of illness in proximal

others, etc., was added to HBM in 1957" (Rosenstock, Hochbaum & Leventhal, 1960). [1]

For additional review on the HBM please see Ogden (2007).

Middleton (2009) used the HBM framework and suggests that African Americans do not adhere to hypertension treatments because the understandings of lay beliefs diverge from the medical knowledge. For example, individuals believe they are not susceptible and consider the condition to not be serious. As an extension of Middelton's (2009) work, Brown and Segal (1996) found that temporal-orientation has an effect on HBM's susceptibility and medication beliefs. More specifically, African Americans compared to White Americans were more likely to be present-oriented which affected management of hypertension. Present-oriented individuals compared to future-orientated individuals considered themselves to be less susceptible to the outcomes of hypertension, believed in the efficacy of home remedies, and believed less in the efficacy of prescription medications.

The HBM has also been used to exclusively evaluate medication adherence in hypertensive patients. Hershey and colleagues (1980) used self-report to determine the extent to which medication compliance was related to the HBM components. There was a significant positive relationship with blood pressure and reported medication adherence when compliance was dichotomized between reporting not missing a dose of their medications and missing some of their pills. The researchers also found that three ("control over health matters, perceived barriers, and duration of treatment") of the five

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[1] The following section was prepared from a personal interview with H. Leventhal, an originator of HBM and close associate and colleague of Rosenstock, Hochbaum and Becker. (May 6, 2010)

variables ("perceived severity and perceived benefits") that contribute to the make up the HBM relate to medication adherence, independently.

When considering the HBM and the CSM it is important to note that the HBM and the CSM are not contradictions of one another. The CSM was developed as an extension of the HBM.

> "Both models consider patient beliefs as the driving force for behavior. However, with the exception of the "triggers" concept the variables in HBM are highly abstract (beliefs), stated as probabilities (likelihood of occurrence) and utilities (severity) and attend less to the factors that underlie and represent the experiential basis of these variables. The shift away from experience based perceptions (perceived triggers, symptoms and observations of illness in others) and perceived utilities (felt and observed changes in function, symptoms (pain) and cognitive and social activities) to probability and severity judgments occurred as investigators using HBM moved toward large scale survey research abandoning open ended questions. This shift was subtle, a source of contention with the original core of HBM investigators but solidified when the core empirical work was taken in hand by Dr. Marshall Becker, a highly competent medical sociologist. At a later date, HBM assimilated concepts from social learning theory (self efficacy) to improve its predictive power. The differences between HBM and CSM are primarily in the degree to which their measures focus on the abstract aspect of representations of illness threats and treatments versus the experiential basis of these abstractions, i.e., the perception, actual performance, and perception of outcomes, HBM tending to focus on the abstract features and

CSM on the experiential. The relative predictive power of these two levels of the same constructs will vary by context, i.e., the illness (the degree to which it is symptomatic and impacts function), the treatment and the patient population (verbal/conceptual fluency versus grounded in everyday experience)".[2]

"cure in HBM is the belief that the disease is no more, cure in CSM means I no longer experience the symptoms and dysfunction of the disease AND (because of that) believe that the disease is gone."[3]

The hypotheses of this study were confirmed and the goal of the study was attained, for it has provided a step toward much needed research that exclusively evaluates the extent to which medication and lifestyle adherence are not related and predictors for one are different from predictors for the other. This might affect patient management of hypertension.

This study was intended to be a beginning in evaluating how hypertension patients manage their chronic condition and to explicitly evaluate medication and lifestyle adherence, which have been to shown to be important to hypertension management (Appel et al., 2006). This study is however, exploratory and as such there are a number of limitations which may account for the inconclusive findings. Taking into consideration that this study was from a larger research project, the focus was on patient

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[2] The following section was prepared from a personal interview with H. Leventhal, an originator of HBM and close associate and colleague of Rosenstock, Hochbaum and Becker. (May 6, 2010)

[3] The following section was prepared from a personal interview with H. Leventhal, an originator of HBM and close associate and colleague of Rosenstock, Hochbaum and Becker. (May 6, 2010)

management and resolution of their (the patient's) presenting complaint. Thus, patients could have had any number of ailments that were the focus of the interview, therefore not responding to the inquiries in terms of their hypertension. Additionally, the hypertension questions were administered at the end of the interview and may have been subject to patient fatigue. Finally, the sample size was relatively small. Many of the constructs measured were assessed based upon single items which do not allow for generalizability as well as meaningful interpretations.

In order to gain insight into how patients manage their hypertension it would be ideal to have a study that exclusively researches hypertension management and the evaluation of lifestyle as well as medication adherence as separate constructs. As elaborated previously, medication adherence is particularly low when patients admit to missing a single dose (60%) (Haynes, McDonald, & Garg, 2002). Additionally, lifestyle adherence is low for a multitude of reasons including intention-behavior gap, preference reversals, conservation of energy in the elderly, and ratings of self assessed health (Sniehotta, Scholz, & Schwarzer, 2005; Berns, Laibson, & Loewenstein, 2007; Duke et al., 2002; and Idler, Leventhal, McLaughlin, & Leventhal, 2004). In designing a better study it would be imperative to have more items that assess the predictors as well as lifestyle and medication adherence more fully. For example, it would be beneficial to evaluate diet and exercise adherence separately. Perhaps the inconclusive findings in the present study were a function of the combined item which was used to evaluate lifestyle adherence ("Do you ever accidentally forget to do one of your other treatments (diet, exercise, or others)?"). The evaluation of CSM-related predictors should have multiple measures. For example, monitoring behavior has shown a positive relationship with

medication adherence (Feldman et al., 1998). Our null results may be due in part because of the single item that was used. It would be beneficial to use multiple items that assess blood pressure monitoring including blood pressure from the doctor's office and blood pressure from those patients who do monitor themselves.

Additionally, a focus group of hypertension patients would be useful to add qualitative data and to test the extent to which each item measures what is desired. In order to more fully tap into patient's adherence beliefs and behaviors it would be beneficial to use the same items as Hekler and colleagues (2008) did. As Leventhal and Cameron (1987) posit, a critical component in patient adherence is patient beliefs. Additionally, the experiential factors are important to consider when evaluating adherence. Assessing patients CSM beliefs can also assist health care providers and doctors in understanding patient adherence. The evaluation of each CSM domain (identity, consequence, cure, cause, and control) is important to explore especially as each domain relates to medication and lifestyle adherence.

A useful instrument is the Illness Perception Questionnaire (IPQ-R) which was derived from the CSM and addresses each of the five-domains (Moss-Morris R., Weinman J., Petrie K.J., Horne R., Cameron L.D., & Buick D., 2002). Findings would have theoretical relevance as well as applicability for physicians and health care providers. Lastly, funding permitting, it would be beneficial to implement a longitudinal design in order to evaluate the extent to which beliefs and behaviors change as related to the CSM over time (Interpretation, Coping and Appraisal stage).

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Table 1

CSM predicted correlations for hypothesis one and two

Predicted correlations

	Medication adherence	Lifestyle adherence
Monitoring behavior (use of blood pressure cuff)	+	?
Self Assessed Health (SAH)	+	+
Condition-worry	+	?
Physical functioning	+	+
CSM Timeline belief	+	?
CSM control belief	+	?
Medication beliefs: The prescribed treatment for my hypertension keeps it under good control.	+	?
I can actually feel the medicines working in my body.	+	?
The side effects of this treatment are manageable for me.	+	?
I have a good idea of how the medicines work.	+	?

Table 2

Characteristics of the Processes of Illness Management (PRIM) hypertension patients

Descriptives of hypertension patients (n=105)

Age (years), mean ± SD	66.68±12.06
Female (%)	64.8%
Education ≤ 2 year university degree (associate degree) (%)	49.5%
Employment	Retired: 54.3% Working full time: 28.6% Working part time: 7.9% Disabled/on disability: 7.9% Homemaker: 1.9%
Health insurance	Medicaid only: 1% Medicare only: 6.7% Private health/HMO: 37.5% VA: 1% Other insurance: 7.7% Medicare w/supplemental insurance: 46.2%
Marital Status	Married: 69.5% Divorced: 6.7% Widowed: 15.2% Single: 8.6%
Ethnicity	White: 73.1% Black/African American: 19% Asian/Pacific Islander: 2.9% South Asian: 1% Other: 3.8%

Table 3

Pearson Correlation Coefficient of predictors and medication/lifestyle adherence

Comparisons between medication and lifestyle adherence

Predictors (df)	Medication adherence (df)	Lifestyle adherence
Monitoring behavior	-.130(102)	.067(102)
Self Assessed health	-.014(103)	.222*(103)
Condition worry	-.168(102)	-.197*(102)
Physical functioning	.152(103)	.024(103)
Hypertension duration belief	.039(97)	-.059(97)
Hypertension control belief	.121(102)	.141(102
Medication belief: The prescribed treatment for my Hypertension keeps it under good control.	.021(101)	.224*(101)
I can actually feel the medicines working in my body.	-.135(101)	.109(101)
The side effects of this treatment are manageable for me.	.232*(95)	.053(95)
I have a good idea of how the medicines work.	-.106(101)	.128(101)

*p<.05

Table 4

Estimated coefficients from OLS stepwise regression of medication adherence by patient predictors from the Rutgers University PRIM study.

Model statistic	Coefficient	Standard Error	Beta	t-
"The side effects of this treatment are manageable for me"	-.205	.088	-.257	-2.317
Constant	2.778*	0.406		6.850
Adj R^2	0.054			

Source: Rutgers University, CSHBB PRIM study (2007-2008)

NOTE: N=77; Coefficient b =unstandardized regression coefficient. *p<.05

Table 4.1

Estimated coefficients from OLS stepwise regression of medication adherence by patient non- significant predictors from the Rutgers University PRIM study.

Model	t-statistic	Sig	Beta In
Age	1.113	.269	.123
Education	-.158	.875	-.018
Race	1.273	.207	.141
Monitor behavior	1.276	.206	.141
Self Rated Health	.662	.510	.074
Condition-worry	1.009	.316	.116
Physical Functioning	-1.936	.057	-.211
Duration hypertension belief	-.351	.727	-.039
Control hypertension belief	-.199	.843	-.024
"The prescribed treatment for my Hypertension keeps it under good control"	.416	.678	.049
"I can actually feel the medicines working in my body"	1.178	.243	.130
"I have a good idea how the medicines work".	837	.405	.094

Source: Rutgers University, CSHBB PRIM study (2007-2008), NOTE: N=77; Beta In = beta weight that would result if variable/item were entered back into the mode

Table 5

Estimated coefficients from OLS stepwise regression of lifestyle adherence by patient predictors from the Rutgers University PRIM study.

Model statistic	Coefficient	Standard Error	Beta	t-
"The prescribed treatment for my hypertension keeps in under good control"	-.369	.170	-.241	-2.170
Constant	4.274*	0.763		5.603
Adj R^2	0.046			

Source: Rutgers University, CSHBB PRIM study (2007-2008)

NOTE: N=77; Coefficient b =unstandardized regression coefficient. *p<.05

Table 5.1

Estimated coefficients from OLS stepwise regression of lifestyle adherence by patient non- significant predictors from the Rutgers University PRIM study.

Model	t-statistic	Sig	Beta In
Age	-1.412	.162	-.157
Education	1.527	.131	.170
Race	-.183	.855	-.021
Monitor behavior	-1.472	.145	-.163
Self Rated Health	-.790	.432	-.095
Condition-worry	.528	.599	.066
Physical Functioning	.798	.428	.093
Duration hypertension belief	.232	.817	.026
Control hypertension belief	.495	.622	.077
"I can actually feel the medicines working in my body"	-1.661	.101	-.184
"The side effects of this treatment are manageable for me"	.397	.692	.047
"I have a good idea how the medicines work"	-1.918	.059	-.211

Source: Rutgers University, CSHBB PRIM study (2007-2008), NOTE: N=77; Beta In = beta weight that would result if variable/item were entered back into the model.

Appendix 1

CSM items from current study

Variable	Survey Question	Possible choices
Medication adherence	"do you ever accidently forget to use one of you medicines?"	"never," "rarely," "sometimes," "often" or "always"
Lifestyle adherence	"do you ever accidently forget to do one of your other treatments (diet, exercise, or other)?	"never," "rarely," "sometimes," "often" or "always"
Monitoring Behavior	"how often do use a monitor or instrument to keep track of your hypertension?	"not at all," "less than Once a month," "monthly," "weekly (1-2 times/week)," "2 -3 times/week," "daily"
Self Assessed Health	"in general, would you say your health is:"	"poor," "fair," "good" "very good," "excellent"
Condition-worry	"how worried or concerned are you about Your hypertension?"	"not at all," "a little bit," "somewhat," "quite a bit," or "very much"
Physical Functioning	SF-12 composite of: "does your health now limit you in moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing gold?" "does your health now limit you in climbing several flights of stairs?"	"yes, limited a lot," "yes, limited a little," "no, not limited at all"
CSM Beliefs	"I will have hypertension for the rest of my life?	"not at all," " a little bit," "somewhat," "quite a bit" or "very much"
	"My hypertension is under control most or	"not at all," "a little bit," "somewhat," "quite a bit," or "very much"

Appendix 1 (continued)

CSM items from current study

Variable	Survey Question	Possible choices
Medication belief	"the prescribed treatment for my hypertension keeps it under good control"	"not at all," "a little bit" "somewhat" "quite a bit," "very much"
	"I can actually feel the medicines working in my body."	"not at all," "a little bit," "somewhat," "quite a bit," or "very much"
	"the side effects of this treatment are manageable for me."	"not at all," "a little bit," "somewhat" "quite a bit," or "very much"
	"I have a good idea of how the medicines work."	"not at all," " a little bit," "somewhat," "quite a bit," or "very much"
Age	What is your age?	Patient's Age
Education	What is your highest degree from school?	Primary; High school; Associate degree (2 Years); Bachelors Degree (BA/BS) Doctorate
Race	What race do you identify most with?	White, Black/African American, Asian/ Pacific Islander, Other