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Commonsense illness beliefs, adherence behaviors, and hypertension control among African Americans

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Abstract Hypertension, particularly among African Americans, has been increasing in importance in the past 10 years. One aspect of this problem is poor disease management. This study examined illness beliefs, behaviors, and hypertension control among 102 African American outpatients. Participants were interviewed about their commonsense beliefs concerning hypertension and its management in accordance with Leventhal's commonsense model of self-regulation (CSM). Also assessed were medication adherence, stress-reducing behaviors, and lifestyle behaviors recommended for blood pressure control. Blood pressure was measured at about the time of interviewing. Results indicated that endorsement of a medical belief model of hypertension (i.e., caused and controlled by factors such as diet, age, and weight) was cross-sectionally associated with lower systolic blood pressure, a relationship that was statistically mediated by lifestyle behaviors (e.g., cut down salt, exercise). Endorsement of a stress belief model (i.e., stress is the main factor in hypertension cause and control) was associated with engagement in stress-related behaviors but not with blood pressure. These results further support the utility of the CSM for understanding patients' disease management behaviors.

Keywords Hypertension · African American · Illness beliefs · Disease management

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Introduction

Hypertension is a serious problem in the United States with prevalence rates increasing in the past 10 years (for review see: Hajjar et al. 2006). Hypertension is particularly problematic for African Americans, whose prevalence rates are among the highest in the world (Cushman et al. 2002; Hajjar et al. 2006; Stamler et al. 1976). Although there have been significant advances in treatment of hypertension, the number of diagnosed hypertensive patients with controlled hypertension (i.e., at or below prehypertensive levels of 140/90) remains troublingly low (Chobanian et al. 2003), with more recent trends suggesting increases in the number of uncontrolled hypertensive cases (Center for Disease Control and Prevention 2005). This is particularly true for older adults (Center for Disease Control and Prevention 2005) and African Americans (Cushman et al. 2002).

A variety of treatment options have been found to reduce or control blood pressure, including medications (Hajjar et al. 2006), improved diet (i.e., restriction of sodium and fat), exercise, and weight loss (Blumenthal et al. 2005; Dickinson et al. 2006). Evidence of clinical effectiveness is mixed for other treatments, such as stress management/relaxation (Blumenthal et al. 2005; Dickinson et al. 2006). Although behavioral strategies have been developed to improve adherence to effective treatments for hypertension, many of them are not being utilized (Chapman et al. 2005; Osterberg and Blaschke 2005). The problem is particularly pronounced with lifestyle behaviors such as diet, exercise, and weight loss, as opposed to medication usage (Denton et al. 2003). Research is needed to advance understanding of factors that influence adherence to behaviors that have an impact on blood pressure.

The commonsense model of self-regulation

The guiding theoretical framework for this study was Leventhal's commonsense model of self-regulation (CSM) (Diefenbach and Leventhal 1996; Leventhal et al. 1984). Central to CSM are five constructs that form the elements of the lay person's commonsense disease models: identity, causes, consequences, time-line, and controllability/cure. Identity involves the labeling of a condition (e.g., I have a heart problem) and the experience of symptoms the patient believes are linked to this label (e.g., chest pain). Consequences refers to the perceived outcomes of an illness (e.g., disability, death), timeline refers to the perceived chronicity of the illness (e.g., acute, chronic, episodic), and controllability/cure involves the perception that various factors (e.g., patient behavior; physician behavior) influence the disease and its course. These constructs have been examined with regard to a number of different illnesses and have been found to be associated with disease management behaviors (for meta-analysis see: Hagger and Orbell 2003).

When the CSM was first examined among hypertension patients, identity (symptoms) was a particular focus because hypertension is largely an asymptomatic condition. Meyer et al. (1985) found that patients had increased adherence if they believed their medications affected symptoms. Meyer et al. (1985) also found that patients new to treatment were more likely to drop out when they construed their disease to be acute, rather than chronic. Perceived consequences have also been found to be positively associated with medication adherence (Balazovjech and Hnilica 1993). Belief in the effectiveness of treatment (control) has been associated with better management of blood pressure (Kirscht and Rosenstock 1977; Nelson et al. 1978; Ross et al. 2004). Finally, cause beliefs have been shown to influence engagement in health behaviors among patients with coronary heart disease (de Valle and Norman 1992).

Other research suggests that cause and control beliefs tend to cluster together as cause-control lay-models of hypertension among African Americans (Kleinman 1980). These studies identified primarily two cause-control models: one views hypertension primarily as a stress-related illness (e.g., promoted by stress and controlled by stress reduction), whereas in the other hypertension involves biomedical factors and lifestyle behaviors (e.g., caused by heredity and poor diet and treated by diet, medications, and exercise) (Heurtin-Roberts and Reisin 1990). Patients that endorsed the stress lay model have shown less medication adherence than those endorsing the biomedical/lifestyle lay model (Heurtin-Roberts and Reisin 1990). This research also suggested that a significant subsample of African American patients tend to believe hypertension is primarily a stress-related illness. This belief system is potentially problematic if patients that endorse it rely mainly on stress-management to the relative neglect of adherence to medications and recommended changes in lifestyle behaviors (e.g., diet, exercise).

The goal of our research was to describe and interpret lay models of hypertension within an exclusively African-American clinic sample and to relate those models to adherence and blood pressure control. We believe that studies that focus on black-white differences in hypertension beliefs emphasize ethnic differences and are complemented by research that examines variation within the African American population. This study examined lay beliefs of hypertension in a health center sample and tested the following hypotheses:

1. Factor analysis was expected to indicate that cause and control beliefs cluster into two domains: a stress belief model (i.e., belief that stress is the primary factor in hypertension causation and control) and a medical belief model (i.e., hypertension is caused and controlled by factors more consistently endorsed within the medical community).
2. Endorsement of a medical belief model (MBM) was expected to be associated with engagement in both medication adherence and lifestyle behaviors (i.e., exercise, reduce salt and fat intake, lose weight, have regular check-ups) recommended for blood pressure control.
3. Endorsement of a stress belief model (SBM) was expected to be associated with engagement in stress-reduction behaviors (i.e., stress reduction, prayer) and not medication adherence or lifestyle behaviors.
4. All other illness beliefs (i.e., identify, consequences, and chronic timeline) were expected to be associated with adherence to medication adherence, lifestyle behaviors, and stress-reduction behaviors as in previous research.
5. Medication adherence and lifestyle behaviors were expected to be associated with systolic and diastolic blood pressure levels.
6. Commonsense beliefs (i.e., MBM, identity, consequences, and chronic timeline) were expected to be associated with blood pressure, with those effects sta-

tistically mediated by medication adherence and lifestyle behaviors but not by stress-reduction behaviors.

Method

Participants

Participants were 102 African American hypertensives, age $M = 61.8$, $SD = 10.2$; 65.7% female, undergoing outpatient treatment at the Chandler Center in New Brunswick, NJ. Chandler is a federally funded health center that provides comprehensive primary and subspecialty care to the medically indigent. Participants met the following criteria: (1) African American (by self-identification); (2) aged 45 or older; (3) diagnosed with high blood pressure based on readings of 140/90 mmHg or higher obtained on three separate occasions (Chobanian et al. 2003); and (4) absence of any condition that would preclude interview assessment (i.e., severe mental illness, dementia, language barriers). All participants were paid $10.00 for their participation.

Recruitment

A list of 232 patients who met inclusion criteria for the study was obtained from Chandler. Recruitment followed several steps: (1) patients were contacted by phone, the study was described, and they were asked to participate; (2) patients not reached by phone were approached and recruited at Chandler at the time of scheduled appointments; (3) patients not contacted by phone or approached at Chandler were visited at home and asked if they would like to participate.

From the original list of 232 eligible patients, 93, 44%, could not be contacted. Of these, 3 had died, 13 had moved, and 77 could not be reached by phone (no answer or disconnections), visits to the home, or mail. Of the 139 who were contacted, 17 refused to participate, 4 could not due to scheduling difficulties, 8 were too sick, 2 no longer attended the Chandler Center, and 2 claimed to be normotensive. In addition, two patients were unable to finish the interview, one due to time constraints, and the other due to illness. Interview data were therefore available for 104 participants. Of these, two were missing a response to a categorical variable, leaving a final sample of 102 participants (73% of the 139 contacted).[1]

[1] There were nonsystematic missing data values for some interview items. In these instances, the sample mean for that variable was substituted. If the data were missing for a categorical variable (i.e., the patient's belief that the disease is chronic, acute, or cyclical) then the subject was dropped from all analyses. All analyses were repeated with the subsample of participants that had complete data, N = 79. The results did not differ from those obtained for the full sample, N = 102.

Assessment

An hour long interview was administered to each participant by trained African American interviewers, either at Chandler or at a mutually agreed upon alternate location such as the patient's home or a public facility. Additional data were taken from medical charts.

Demographics

Gender, age, and marital status were ascertained by interview. Level of education was obtained from medical charts.

Medical data

Information regarding the year of diagnosis of hypertension and number of anti-hypertensive medications was obtained by interview. Data taken from patient charts included: current systolic and diastolic blood pressure level (SBP and DBP; based on a single reading taken with a mercury sphygmomanometer during a routine health center appointment), height, and weight. Readings used to estimate current blood pressure had been recorded in patient charts within an average of 64 days before or after the date of the interview, with 8% taken prior to the day of the interview, 35% on the day of the interview, and the remaining 53% taken after the interview.[2]

Commonsense beliefs

An interview was developed specifically for this project. All items were worded so as to solicit participants' CSM beliefs specifically about their own blood pressure, rather than about hypertension in general. This framing has been shown to be important, particularly for causal beliefs, as discussed by French et al. (2004). The interview contained items representing the five major elements of illness representations: identity, time-line, causes, consequences, and control. All responses were given on a 5-point scale (not at all–very much) except for the timeline item, which was categorical. All scales, excluding timeline, were examined using factor analysis. To minimize the problem of factor indeterminancy (items loading on more than one factor) (Steiger 1979), factor

[2] In initial regression analyses, elapsed time between blood pressure reading and interview was entered in the regression models and it did not influence the results. It was dropped from subsequent analyses.

analyses were done using principal components extraction with varimax rotation. This generally results in items having a large loading on only one factor, making the solution more readily interpretable. Initially, all factors with eigenvalues greater than 1.0 were extracted for rotation (Kaiser 1960). Inter-item reliability was then assessed for each factor using Cronbach's alpha. Items for scales with an acceptable alpha (>0.60) were summed to create scale scores.

Disease management behaviors

Behaviors were categorized into three domains: medication adherence, lifestyle behaviors, and stress-reduction behaviors. Medication adherence was assessed by asking the patient to quantify how many times in total he/she missed taking his/her hypertension medications for any reason in the past two weeks. Evaluation of the data, suggested a bimodal distribution in which approximately 50% of participants prescribed hypertension medications, 45 of 90, reported taking their medications every time within the past two weeks. Medication adherence therefore was dichotomized to form adherent and nonadherent patient groups. All patients not prescribed any medications at the time of the interview were assigned a value of 0 for the total number of times medications were missed, 88% were taking antihypertensive medications at the time of the interview. All analyses of medication adherence were conducted using both the full sample in which 0 was imputed for participants not prescribed any medications, $N = 102$ and for the subsample of patients prescribed medications, $n = 90$. Results did not differ between samples. Accordingly, the full sample measure was used to increase statistical power in the regression models presented in this paper.

Behaviors were assessed using self-report items with the following format, "Do you engage in ____ as a way to control your blood pressure?" Participants were given a 5-point response-set from 1—never to 5—always. Initial analyses of these variables suggested a bimodal distribution for several items. Based on this, all behavioral responses were dichotomized. Participants who responded with "never," "rarely," or "sometimes" were identified as not engaging in the behavior. Those that responded with "often" or "always" were identified as engaging in the behaviors. These dichotomous responses were then aggregated into two scales. Stress-reduction behaviors (SRB) were aggregated into a dichotomous variable indicating if participants endorsed engagement in either stress reduction or prayer. The lifestyle behavior scale is an aggregate score in which five dichotomous items were summed: (1) reduce salt intake; (2) reduce fat intake; (3) exercise; (4) lose weight; (5) get regular check-ups.

Results

Descriptive statistics

Means, standard deviations, and/or frequency distributions of demographic and medical history data are provided in Table 1. The average length of time since initial hypertension diagnosis was 19.2 years, range 1–59. Eighty-eight percent were on antihypertensive medication at the time of the interview. Blood pressure was uncontrolled (SBP > 140 mmHg and/or DBP > 90 mmHg) in 69% of the patients. The majority of our sample, 83.3%, were overweight (BMI $= 25$–30: 30.4%) or obese (BMI > 30: 52.9%). There were no sex or age differences for demographic and medical history variables except for BMI; women had higher BMIs, $t = -3.18$, $df = 100$, $p < .05$, $M_m = 29.21$, $M_f = 33.95$.

Factor analysis

Cause/Control lay models

Initial analysis of the cause and control items produced 6 factors. However, inspection of the factor loadings and scree plot indicated only two large factors, eigenvalues = 3.0 and 2.0, with the smaller factors reflecting item pairs or single items, all eigenvalues ≤ 1.6. The final solution was generated by re-analysis in which 2 factors were extracted and items with low loadings (between −0.30 and +0.30) were eliminated. We chose to use 0.30 loading as a cut-off for inclusion rather than the conventional 0.50 to increase the breadth of each scale. In addition, a 0.30 minimum loading resulted in several scales that fit with a priori theoretical expectations (see Table 2). Factor 1 (7-items) was interpreted as reflecting individual differences in the endorsement of a medical belief model (MBM) because it was defined by items involving conventional biomedical risk factors (e.g., family history, age) and treatments for high blood pressure (e.g., medication, diet) that largely conform with medical practice guidelines. Factor 2 (4-items) was interpreted as reflecting a stress belief model (SBM) because it was defined by causal beliefs related to stress and control beliefs related to stress-reduction. Scales constructed from the items loading on each of the two factors had Cronbach alphas of .64 and .63 respectively. The two scales were virtually orthogonal, $r = .19$, $df = 100$, *ns*.

Table 1 Descriptive statistics

	Number	Percent	Mean	*SD*	Min	Max
Demographic variables						
Age			61.84	10.21	47.00	88.00
Gender						
Female	67	65.7				
Male	35	34.3				
Marital status						
Married/living with someone	24	23.5				
Single/divorced/separated	78	76.5				
Education (years)			10.20	2.61	1.00	17.00
Biomedical variables						
Body mass index			32.32	8.53	19.79	66.79
Number of years with hypertension			19.20	14.09	1.00	59.00
Systolic blood pressure			146.18	24.31	106	260
Diastolic blood pressure			85.70	11.10	60	120
Commonsense beliefs						
Identity			3.02	1.20	1	5
Medical belief model			3.49	0.71	1.86	5
Stress belief model			3.56	0.92	1	5
Consequences			3.27	0.95	1	5
Timeline (endorsed chronic response)	63	61.8				
Timeline (endorsed cyclical response)	28	27.5				
Disease management indices						
Lifestyle behaviors			2.94	1.21	0	5
Stress-reducing behaviors	79	70.6				
Medication Adherence ($n = 90$ taking BP meds)	45	50.0				

Identity

Principal-components factor analysis was conducted to examine the dimensionality of the four items asking patients their beliefs about their ability to detect high blood pressure. As predicted, the items formed a single factor, eigenvalue = 1.9. Internal consistency was marginal, Cronbach's $\alpha = 0.59$, but was improved slightly be deleting the item concerning medication and symptoms, Cronbach's $\alpha = 0.64$, and was better still when the item concerning situational determinants of blood pressure was deleted, Cronbach's $\alpha = 0.74$. Therefore, a measure of identity was generated by averaging the values on the first two items only ("Can people tell" and "Can you tell").

Consequences

Principal-components factor analysis of the four consequences items produced a single factor, eigenvalue = 2.2. Therefore, all four items were averaged together to create a consequences scale, which was found to have acceptable internal consistency, Cronbach's $\alpha = .66$. Table 2 lists all items and subsequent factor analysis results.

Bivariate correlations

Older age was associated with greater medication adherence, $t = -2.4$, $df = 100$, $p < .05$, $M_{adh} = 64.0$, $M_{nonadh} = 59.1$, and lower scores for SBM, $r = -.22$, $df = 100$, $p < .05$, and consequences, $r = -.22$, $df = 100$, $p < .05$. Age was not associated with any other belief or behavior, or with blood pressure, $ps > .19$. Education was inversely associated with identity, $r = -.21$, $df = 100$, $p < .05$, and was not correlated with other beliefs, behaviors, or blood pressure, $ps > .06$. Body mass index was positively associated with the MBM, $r = .24$, $df = 100$, $p < .05$, and consequences, $r = .26$, $df = 100$, $p < .01$, but not with other beliefs, behavior, or blood pressure, $ps > .23$. Number of years with diagnosis was not associated with beliefs, behaviors, or blood pressure, $ps > .09$. Gender was associated with the MBM, $t = -2.26$, $df = 100$, $p < .05$, $M_m = 3.27$, $M_f = 3.60$, SBM, $t =$

Table 2 Factor analysis of commonsense beliefs

Items	MBM $\alpha = 0.64$	SBM $\alpha = 0.63$	Cons $\alpha = 0.64$	Ident $\alpha = 0.74$
Medical belief cause/control model				
Do you feel that consuming less salt helps your hypertension?	0.79			
Do you feel that consuming less fat helps your hypertension?	0.56			
Do you feel losing weight is or was helpful for your hypertension?	0.42			
Do you think hypertension runs in your family?	0.40			
Do you think your hypertension is caused by the kinds of food you eat?	0.38			
Do you think your age explains why you have developed hypertension?	0.34			
Do you feel that medication has helped your hypertension?	0.33			
Stress belief cause/control model				
Do you feel reducing stress helps your hypertension?		0.69		
Do you think emotional stress contributes to your blood pressure?		0.69		
Do you feel prayer or meditation helps your hypertension?		0.57		
Do you think your personality explains why you have developed hypertension?		0.44		
Consequences				
Do you think high blood pressure increases your chances of having a stroke?			0.81	
Do you think high blood pressure increases your chances of developing problems with your heart, such as having a heart attack?			0.66	
Do you think high blood pressure increases your chances of developing kidney problems?			0.63	
How do you think high blood pressure affects you? That is, how much do you think it affects the rest of your body?			0.34	
Identity				
Can you tell when your blood pressure is up?				0.81
In general, can people tell when their blood pressure is up?				0.68

Response set is from 1—not at all to 5—very much for all items; principal component with varimax rotation factor analysis was used; MBM, medical belief model; SBM, stress belief model; Cons, perceived consequences; Ident, identity

-4.00, $df = 100$, $p < .001$, $M_m = 3.09$, $M_f = 3.81$, and consequences, $t = -3.18$, $df = 100$, $p < .05$, $M_m = 2.87$, $M_f = 3.47$. Gender was not associated with any other belief, behavior, or blood pressure, $ps > 0.12$. Being married/living with someone was associated with lifestyle behaviors, $t = -2.25$, $df = 100$, $p < .05$, $M_{mar} = 3.42$, $M_{sin} = 2.79$, and no other belief, behavior, or blood pressure, $ps > 0.18$.

Table 3 is a matrix of correlations between beliefs, behaviors, and blood pressure. The MBM was associated with lifestyle behaviors, $r = .34$, $df = 100$, $p < .01$. The SBM was associated with the stress-reduction behaviors, $r = .34$, $df = 100$, $p < .01$. The MBM was the only belief variable that was associated with SBP, $r = -.21$, $df = 100$, $p < .05$; for all other beliefs, $ps > .73$. No beliefs were associated with DBP, $ps > .44$.

Lifestyle behaviors were inversely associated with SBP, $r = -.29$, $df = 100$, $p < .01$ and marginally associated with DBP, $r = -.17$, $df = 100$, $p = .08$. Neither the stress-reduction behaviors (SRB) nor medication adherence was associated with SBP or DBP, $ps > 0.12$.

Regression analysis

Multiple regression analysis was used to examine commonsense beliefs as multivariate predictors of lifestyle behaviors (LB). Logistic regression was used to predict SRB and medication adherence. In all models, demographic (i.e., age, gender, education, marital status) and biomedical (i.e., BMI, number of years with diagnosis) factors were controlled. Results indicated that the MBM was the only belief variable that predicted LB, $\beta = 0.36$, $p < .01$; for all other beliefs and control variables, $ps > .05$. The SBM and consequences belief variables were both associated with SRB, $OR = 3.16$, CI 1.44–6.94, $p < .01$ and, $OR = 0.30$, CI 0.13–0.67, $p < .01$ respectively; for all other beliefs and control variables, $ps > 0.15$. Age was the only variable that significantly predicted medication adherence, $OR = 1.07$, CI 1.01–1.13, $p < .05$; associations for all other variables were nonsignificant $p > 0.20$.

Results for the multiple regression analysis predicting SBP are presented in Table 4. The MBM was inversely

Table 3 Correlations among beliefs, behaviors, and blood pressure

Measure	2	3	4	5	6	7	8	9	10
Commonsense beliefs									
1. Medical belief model	0.19	0.25*	0.24*	0.03	0.34**	−0.01	0.03	−0.21*	−0.01
2. Stress belief model	–	0.37***	0.34**	0.08	0.09	0.33**	−0.09	−0.01	0.08
3. Consequences		–	0.19	0.20*	−0.01	0.04	−0.10	0.04	0.04
4. Identity			–	0.06	0.04	−0.03	−0.14	0.01	−0.03
5. Timeline[a] (Chronic)				–	−0.08	−0.03	0.06	0.01	−0.03
Disease management									
6. Lifestyle					–	0.21*	0.02	−0.29**	−0.17
7. Stress[a]						–	−0.05	−0.11	0.03
8. Medication adherence[a]							–	0.11	0.10
Blood pressure									
9. Systolic blood pressure								–	0.65***
10. Diastolic blood pressure									–

[a] Because timeline, stress behavior, and medication adherence variables are dichotomous variable, *r* values were entered into the table to give an estimate of effect size, whereas statistical significance was evaluated using a *t*-test. *$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 4 Multiple regression analysis—DV: systolic blood pressure

	B	SE	*β*	sr^2	*p*
Step 1: Demographic & biomed					
Age	0.350	0.257	0.147	0.019	0.177
Education	0.19	0.998	0.02	0.000	0.846
Marital status	−3.816	5.852	−0.067	0.004	0.516
Gender	−3.661	5.472	−0.072	0.005	0.505
Body mass index	0.047	0.302	0.017	0.000	0.876
Number of years with diagnosis	−0.043	0.191	−0.025	0.001	0.823
Step 2: Commonsense beliefs					
Identity	1.687	2.314	−0.026	0.006	0.468
Medical belief model	*−9.268*	*3.740*	*−0.270**	*0.065*	*0.015*
Stress belief model	1.484	3.296	0.056	0.002	0.654
Consequences	3.582	3.055	0.140	0.015	0.244
Timeline (chronic)	−7.109	8.482	0.404	0.008	0.404
Timeline (cyclical)	−8.840	9.115	−0.163	0.010	0.335
Step 3: Disease management					
Lifestyle behaviors	*−4.790*	*2.289*	*−0.238**	*0.048*	*0.039*
Stress behaviors	−4.887	6.554	−0.084	0.006	0.458
Medication adherence	4.023	5.094	0.083	0.007	0.432

Note: *B* and *β* are reported for the step in which the corresponding predictor was entered into the model. SE is the standard error for *B*. sr^2 is the semi-partial correlation squared. For gender, 0 = male, 1 = female; marital status, 0 = single/divorced/separated, 1 = married/cohabitation. Step 1 $R^2 = 0.027$; Step 2 $R^2 = 0.107$; Step 3 $R^2 = 0.160$. * $p < .05$

associated with SBP when behavior variables were not entered into the model, $\beta = -0.27$, $p < .05$; for all other beliefs and control variables, $ps > .05$. When disease management behaviors were added to the model, LB was the only variable that significantly predicted SBP, $\beta = -0.24$, $p < .05$; for all other beliefs and control variables $ps > .07$. No variable was significantly predictive of DBP, $ps > .10$.

In these analyses, endorsement of the MBM predicted lifestyle behaviors, and these behaviors, in turn, predicted SBP and reduced the effect for the MBM to nonsignificance, $\beta_{step2} = -0.27$, $p_{step2} = .02$ to $\beta_{step3} = -0.19$, $p_{step3} = .09$. This suggests that lifestyle behaviors statistically mediated the effect of the MBM on SBP, satisfying the causal steps approach to mediation analysis recommended by Baron and Kenny (1985). Statistical mediation was also in evidence using MacKinnon et al.'s intervening variable approach, which calculates confidence limits for the estimate of the magnitude of the indirect (mediated) effect of a predictor on an outcome. This technique has the advantage of reducing the probability of Type I error and improving statistical power compared to other tests of mediation (MacKinnon et al. 2002, 2007). A result with 0 within the confidence limits indicates a nonsignificant mediational pathway. In our data, the indirect pathway linking MBM with SBP via lifestyle behaviors was statistically significant, $CI_l = -6.51$ to $CI_u = -0.23$.

Discussion

Results supported our first three hypotheses by indicating that control beliefs and cause beliefs clustered into stress and medical belief models, endorsement of the medical belief model was associated with lifestyle behaviors, and endorsement of the stress belief model was associated with stress-reduction behaviors. Hypothesis 4 received only partial support in that greater perceived severity of the consequences of hypertension was positively associated with stress-reduction behaviors, but neither identity nor chronic time line were associated with any behaviors. There also was only partial support for Hypothesis 5; performance of appropriate lifestyle behaviors was associated with lower systolic blood pressure, but medication adherence was not, and none of the variables showed a significant relationship with diastolic blood pressure. Finally, Hypothesis 6, too, was partially supported. As expected, endorsement of a medical belief model was associated with lower systolic blood pressure, and this effect was statistically mediated by lifestyle behaviors. However, all other commonsense belief measures, medication adherence, and stress-reduction behaviors were not associated with systolic blood pressure, and no variable predicted diastolic blood pressure.

The present results are in accord with previous studies highlighting the importance of a patient's commonsense beliefs for predicting behaviors among chronic disease patients (Cooper et al. 1999; de Valle and Norman 1992; Gump et al. 2001; Heurtin-Roberts and Reisin 1990; Ross et al. 2004). However, to the best of our knowledge, this is the first study that has linked commonsense beliefs with blood pressure through their effects on behaviors. In addition, this study underscores the importance of focusing on the cause and controllability aspects of patients' illness models among African Americans (Heurtin-Roberts and Reisin 1990; Kleinman 1980).

Limitations

This study had several limitations. First, the design was cross-sectional and therefore cannot support causal interpretations. This is potentially problematic as research examining causal beliefs and health behaviors among myocardial infarction patients indicates that causal beliefs may only be associated with behaviors cross-sectionally (French et al. 2005). This suggests that it may be the causal beliefs that are influenced by the behaviors. However, our study assessed cause/control belief models. It is plausible to hypothesize that cause/control models may be more useful for predicting subsequent behaviors than causal beliefs alone. Longitudinal data will be required to evaluate this line of thought. Demographic data are not available for patients who could not be contacted for recruitment into the study, limiting our ability to determine generalizability of our sample; nonetheless our sample is likely to be somewhat representative of those contacted as 73% of them participated in the study. Regarding measurement issues, behaviors were assessed by interview. Thus we cannot be certain if patients were actually engaging in the behaviors to a degree that corresponds with their self-report. Self-report measures tend to over-estimate the degree to which a person engages in behaviors such as adherence to medications (Osterberg and Blaschke 2005). Nonetheless, self-report measures of adherence are simple, inexpensive, reflect what clinicians rely upon in clinical practice, and have been found to be useful in previous research (e.g., Thompson et al. 2004). Reliance on a single reading to assess blood pressure control was another limitation. However, such readings have practical utility in the clinic setting and, to the degree that this introduced measurement error, the reported findings most likely underestimated the magnitude of associations.

Implications

These results have potentially important implications for improving disease management among African American hypertensives. As suggested earlier, African American patients appear to vary in their endorsement of two different lay models of hypertension. One largely conforms with a conception of hypertension that includes biomedical and lifestyle related factors generally accepted within the medical community (i.e., caused by factors like genetics and high sodium diet; controlled by exercise, diet, and medications), whereas the other more closely resembles the folk disease concept of "hyper-tension" characterized by a belief the disease is primarily related to stress. As expected, patients who more strongly endorsed the MBM were more likely to engage in lifestyle behaviors for reducing blood pressure, whereas patients who strongly endorsed the SBM were more likely to engage in stress-reducing behaviors. This is an important finding as previous research suggests the effectiveness of lifestyle behaviors but not necessarily stress-reducing behaviors for influencing hypertension (Blumenthal et al. 2005; Dickinson et al. 2006).

This study should be replicated using a longitudinal design and more objective measures of behaviors (e.g., an accelerometer for exercise) to allow for stronger inferences regarding pathways of mediation. In addition, future research should determine whether these illness beliefs have construct and predictive validity in other ethnic groups. Finally, interventions should be developed to alter patients' illness models both to test the theoretical model and as a possible means of improving behavioral control of hypertension.

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