Understanding Racial Disparities in Treatment Intensification for Hypertension Management

Meredith Manze, MPH^{1,2}, Adam J. Rose, MD, MSc^{3,1}, Michelle B. Orner, MPH³,
Dan R. Berlowitz, MD, MPH^{3,2}, and Nancy R. Kressin, PhD^{4,3,1}

¹Section of General Internal Medicine, Boston University School of Medicine, Boston, MA, USA; ²Health Policy & Management Department, Boston University School of Public Health, Boston, MA, USA; ³Center for Health Quality, Outcomes, and Economic Research, Bedford VA Medical Center, Bedford, MA, USA; ⁴VA Boston Healthcare System, Boston, MA, USA.

BACKGROUND: Disparities in blood pressure (BP) control may be a function of disparities in treatment intensification (TI).

OBJECTIVE: To examine racial differences in TI, understand modifiable factors that may mediate this relationship, and explore the relative effects of TI and race on blood pressure.

DESIGN: Prospective cohort study.

PARTICIPANTS: Participants were 819 black and white patients with hypertension from an urban, safety-net hospital

MAIN MEASURES: We sequentially explored the effects of patient race, sociodemographic and clinical characteristics, beliefs about BP/medications, perceptions of provider/discrimination, sodium intake, medication adherence, and provider counseling on TI, performing a series of random effects analyses. To assess the effects of race and TI on BP, we performed linear regressions, using systolic BP (SBP) as the outcome.

KEY RESULTS: Unadjusted analyses and those including sociodemographic and clinical characteristics revealed that black patients had less TI than whites (-0.31 vs. -0.24 , $p < 0.001$), but adjustment for patient beliefs and experiences eliminated the effects of race ($\beta = -0.02$, $p = 0.5$). Increased patient concerns about BP medications were related to lower TI, as was more provider counseling ($\beta = -0.06$, $p = 0.02$ and $\beta = -0.01$, $p = 0.001$, respectively). In the unadjusted analysis, black race was a significant predictor of SBP (134 mm/Hg for blacks vs. 131 mm/Hg for whites, $p = 0.009$), but when both race and TI were included in the model, TI was a significant predictor of SBP (final SBP 2.0 mm/Hg lower for each additional therapy increase per 10 visits, $p < 0.001$), while race was not (Blacks 1.6 mm/Hg higher than whites, $p = 0.17$).

CONCLUSIONS: Improved patient-provider communication targeted towards addressing patient concerns

about medications may have the potential to reduce racial disparities in TI and ultimately, BP control.

KEY WORDS: disparities; treatment intensification; hypertension.

J Gen Intern Med 25(8):819-25

DOI: 10.1007/s11606-010-1342-9

© Society of General Internal Medicine 2010

BACKGROUND

Racial disparities in hypertension control and hypertension-related outcomes persist despite efforts to improve control and reduce disparities.¹⁻⁵ Approximately 34% of non-Hispanic blacks have hypertension, the highest prevalence of any racial/ethnic group.⁵ Black individuals also have more severe hypertension with an earlier age of onset, compared to non-Hispanic whites.⁶ For these reasons, blacks have an increased rate of adverse hypertension-related health outcomes and mortality.^{6,7} Identifying contributing factors responsible for this disparity is crucial in improving health outcomes.

We have only a limited understanding of the reasons why blood pressure (BP) control is worse in blacks. Increasingly, clinical inertia, the phenomenon by which providers do not always initiate or intensify therapy in response to uncontrolled BP, is recognized as a major barrier to BP control.⁸⁻¹⁰ Treatment intensification (TI) for hypertension occurs when providers initiate and intensify therapy for patients with elevated BP. TI has been linked to improved BP control.^{9,11,12} TI is complex and often involves discussions between patients and providers. Patient beliefs about hypertension and their medications, as well as their adherence to antihypertensive medications and their experiences with care, are likely to be critical factors in these decisions to intensify therapy. TI is best viewed as something that patients and providers accomplish in collaboration. Therefore, addressing insufficient TI is likely to involve factors related to patient-provider communication, and patients' experience of the process of care, including perceptions and experiences of discrimination. A more complete understanding of relational determinants of TI may help in designing interventions to increase TI and thus improve BP control.

Few studies have examined the issue of racial disparities in TI, or whether this disparity may also explain racial disparities in BP control.^{13,14} Therefore, our objectives are to 1) explore the extent of racial disparities in TI in hypertension care, 2)

Poster Presentation: AcademyHealth Annual Research Meeting, Chicago, IL, June 28-30th, 2009

Received September 23, 2009

Revised January 29, 2010

Accepted March 18, 2010

Published online April 13, 2010

elucidate the contributions of patient characteristics, beliefs and behaviors, and patient-provider interactions to racial disparities in TI, and 3) examine the relative effects of race and TI on BP control.

METHODS

Study sample

We identified all white and black patients ages 21 and older with primary care clinic visits at an urban safety-net hospital, diagnosis of hypertension, and prescribed at least one antihypertensive medication. (The term “black” includes patients of black race born in Africa, Caribbean or U.S.A.) We enrolled 869 patients, as part of a larger study, and collected baseline data on BP control and patient beliefs and attitudes about and experiences with BP care and medications. We then implemented an intervention where providers were randomized to receive an educational workshop aimed at improving communication about hypertension care. Patients were approached for participation during their regular clinic visit. After consenting, recruited participants completed a survey, and clinical information was abstracted from the medical record.¹⁵ Of the patients enrolled in the parent study, 50 were excluded from the present analysis because they had ≤ 2 BP values, too few to characterize TI. Therefore, 819 patients with hypertension constituted our study population. This study was approved by our Institutional Review board.

Measures

Independent Variables.

Sociodemographic and Clinical Characteristics. Patient sociodemographic characteristics including race, education and income were obtained through self-report. Patients' clinical data was extracted from the electronic medical record (EMR), including age, gender, height, weight, number of BP medications and diagnosis of hypertension. The EMR was also used to obtain diagnoses of comorbid conditions which pertain to hypertension management, including benign prostatic hypertrophy, cerebrovascular disease, chronic kidney disease, congestive heart failure, coronary artery disease, diabetes mellitus, hyperlipidemia, nicotine dependence, obesity, and peripheral vascular disease.⁶ A patient was considered obese if s/he had either a diagnosis of obesity in the EMR or a body mass index of at least 30.

Health Beliefs and Illness Perceptions. We examined patient beliefs and perceptions about high BP and antihypertensive medications, using the Beliefs about Medicines Questionnaire (BMQ-specific). The BMQ-specific includes ten items to evaluate patients' concerns about potential adverse effects from their BP medications and eight items to measure patients' beliefs regarding the necessity of their medications (five point scale ranging from Strongly Agree to Strongly

Disagree).^{16,17} Scores were summed within each of these scales to create an overall scale score ('necessity' scale $\alpha=0.81$ and 'concerns' scale $\alpha=0.80$). Each score was divided by the number of items to obtain a mean summary score, where a higher number indicated either greater concerns about or beliefs in the necessity of medications. Scale scores were created only if 75% of the items were answered.

To assess the degree of seriousness with which patients perceived hypertension and its sequelae, we utilized four additional items (Table 2; ranging from “extremely serious” to “not at all serious”). We used five separate dichotomous items to assess patients' beliefs about BP medications. These items were first created and utilized in our prior work with a similar patient population.¹⁸

We included ten items from the “cause” scale of the Illness Perception Questionnaire. These items were analyzed separately to examine patients' subjective beliefs about the etiology of their high BP (five point scale ranging from Strongly Agree to Strongly Disagree).¹⁹

Perceptions of Provider and Experiences of Discrimination. To assess patients' perceptions of their providers, we used three items from the Commonwealth Fund 2001 Health Care Quality Survey²⁰. We created an additional question about the patients' perception of their providers' understanding of their cultural background and how it affects their health. Each item was scored individually.

To measure perceived discrimination in health care, we included the seven item measure developed by Bird and Bogart,²¹ creating a dichotomous variable for anyone who answered 'yes' to any question compared to patients who responded 'no' to all questions.

Sodium Intake. Because dietary sodium is an important contributor to BP, we assessed patients' sodium intake using the three-item subscale within the previously validated Hill-Bone Compliance to High Blood Pressure Therapy Scale, with responses ranging on a four point Likert scale from “None of the time” to “All of the time”,²² summing the items to create one sodium intake score.

Medication Adherence. We assessed medication adherence because better adherence to antihypertensive medications is associated with improved BP control. Patients used an electronic recording device (MEMS cap), that recorded each time a patient opened the medication bottle to take his/her BP medication, for approximately 90 days following their enrollment into the study. We calculated the proportion of days in this period on which the patient took at least the number of doses prescribed. We used this data to categorize patients as having “poor adherence” (defined as less than 50% adherent), “fair adherence” (50–80% adherent), “excellent adherence” (greater than 80% adherent), or having missing MEMS cap data.

Provider Counseling. We assessed the content of the patient-provider discussion regarding hypertension care and management, following earlier work from Kressin and Pbert.^{18,23} We included a series of 12 dichotomous items that assessed whether or not the provider asked or advised patients about various issues related to antihypertensive medication adherence.

We summed the items from this measure to create a summary scale score, where higher scores indicate more discussion of hypertension related issues. Scale scores were created only if 75% of the items were answered ($\alpha=0.86$).

Dependent Variable.

Treatment Intensification. TI was our main dependent variable. One author (AJR) performed a manual chart review to measure TI scores. A subset of patients, representing 5% of all clinic visits, were randomly selected for blind reabstraction by another author (DRB). Agreement between the reviewers was good ($k=0.93$ [95% CI, 0.87 to 0.98]).¹⁵ We used the following formula to measure TI: (visits with medication changes—visits with elevated BP) / number of clinic visits.^{12,15} A TI score of zero signifies that treatment was intensified once for each visit with elevated BP. A score greater than zero signifies that treatment was intensified at more visits than there were visits with elevated BP, while a score less than zero signifies that there were more visits with elevated BP than episodes of TI. A unit of 0.1 on this scale indicates one more or less TI than expected per 10 visits. This definition of TI, known as the Standard-Based method, is the preferred measurement of TI in hypertension care.¹⁵

The expected number of medication increases was the number of occasions on which the recorded BP was elevated, defined as 140/90 mm/Hg or higher. BP values were taken from the medical record at the clinic visit. In prior work using this data set, we found that using the threshold of $\geq 130/80$ for uncontrolled BP, for patients with diabetes or chronic kidney disease, yielded similar results as using the same threshold ($\geq 140/90$) for all patients.¹⁵ Therefore, we used the single threshold of $\geq 140/90$ mm/Hg for all patients in our sample. TI for each subject was calculated using BP values from visits between their respective dates of enrollment until December 2007.

Statistical Analyses. We first assessed distributions for each variable by racial group, performing univariate analyses (t-tests and chi-square, as appropriate). Next, we investigated the effect of race upon TI with and without controlling for patient-level covariates. In these analyses, we used random effects analyses to account for clustering of patients-within-providers. Our multivariate model also included patient race, age, gender, education level, income, number of BP medications and comorbid conditions. For the final model, we added the variables for health beliefs and illness perceptions, perceptions of providers and experiences of discrimination, medication adherence, sodium intake, and provider counseling, keeping only variables that had been significant at the $p \leq 0.10$ level in Model 2. We also performed these regressions without eliminating any variables and found similar results.

To assess the effects of race and TI score on BP, we performed two linear regressions, using systolic BP (SBP) (at the final clinic visit) as the dependent variable. Because uncontrolled BP is mostly a problem of poorly controlled SBP, we used this as our outcome (supplemental analyses found that there were only 166 (1.3%) visits in which patients had a SBP greater than or equal to 140 and diastolic BP less than or equal to 60).²⁴ The first model included only patient race and

the second model also included TI score. All analyses were conducted using SAS 9.1.3 (SAS Institute, Cary, NC).

RESULTS

Black patients were significantly younger, more likely to be female, less educated, had a lower income, prescribed more BP medications compared to white patients, and were more likely to have diabetes, chronic kidney disease, congestive heart failure, and obesity (Table 1). Black patients had significantly more concerns about their BP medication (mean score 2.5 vs. 2.1, $p<0.001$; Table 2), and believed their BP was more serious, given their current use of medication (mean scores 2.8 vs. 3.3, $p<0.001$; lower scores indicate greater seriousness). More black patients believed that taking their BP medication would help them to feel better ($p<0.001$), but fewer of them believed that it would help them live longer, compared to whites ($p=0.001$).

In the bivariate analyses, important racial differences were noted with regard to almost every hypertension-related belief that we examined, with blacks having less accurate or more negative perceptions (Table 2). For example, black patients were more likely to report that a germ or virus, chance, other people, and poor medical care in the past contributed to causing their high BP. While all patients generally agreed that their provider understood their background and values, black patients agreed less strongly ($p=0.03$). Also, while all patients disagreed that their provider looks down on them and the way they live their life, white patients disagreed more strongly ($p<0.001$). Blacks were more likely to have missing adherence data, generally due to failure to return MEMS caps. They were also more likely to have fair or poor adherence and less likely to have excellent adherence.

Table 1. Sociodemographic and Clinical Characteristics

Patient Characteristics	All patients (n=819)	Black (n=476)	White (n=343)	p-value
Mean age	59.6	58.3	61.4	<0.001
Gender (% male)	33.9	26.7	44.0	<0.001
Education (% less than 12th grade completed)	54.2	65.1	39.2	<0.001
Income (% less than \$20,000/year)	48.4	57.4	36.1	<0.001
Mean number of blood pressure medications	2.3	2.4	2.3	0.003
Benign Prostatic Hypertrophy	3.7	1.7	6.4	<0.001
Cerebrovascular Disease	5.6	4.4	7.3	0.08
Chronic Kidney Disease	6.7	8.4	4.4	0.02
Congestive Heart Failure	3.5	5.0	1.5	0.006
Coronary Artery Disease	12.8	9.2	17.8	<0.001
Diabetes	33.2	39.1	25.1	<0.001
Hyperlipidemia	53.6	48.3	60.9	<0.001
Nicotine Dependence	7.5	8.6	5.8	0.14
Obesity	58.9	63.9	52.2	<0.001
Peripheral Vascular Disease	5.3	3.9	7.0	0.057

Table 2. Patient Beliefs and Experience Variables by Race

Patient Variables	Total	Black	White	p-value
Health Beliefs & Illness Perceptions				
Concerns about BP Medication (mean) ^a	2.3	2.5	2.1	<0.001
Beliefs about necessity of BP Medication (mean) ^b	3.7	3.7	3.7	0.15
Patient Beliefs about Blood Pressure (mean) ^c				
How serious is your high BP, in general?	1.5	1.5	1.5	0.28
How serious is your high BP, given your current use of medication?	3.0	2.8	3.3	<0.001
If no BP meds over the next year, would BP get worse?	1.5	1.5	1.4	0.18
If no BP meds over the next year, would develop other health problems?	1.7	1.7	1.7	0.27
Do you believe that taking BP medications will...(yes)				
make you feel worse?	2.1	2.3	1.8	0.57
help you feel better?	93.7	96.2	90.3	<0.001
help you live longer?	93.8	91.3	97.1	0.001
improve the quality of your life?	93.1	92.6	93.8	0.5
prevent future high BP related illnesses?	93.6	92.9	94.6	0.33
Illness Perception Questionnaire ^d				
Germ or virus caused my high BP	3.9	3.7	4.2	<0.001
Diet played major role in causing my high BP	2.2	2.1	2.4	0.005
Pollution of environment caused my high BP	3.7	3.6	3.8	<0.001
My high BP is hereditary	2.0	1.9	2.1	0.01
It was just by chance that I became ill with high BP	3.5	3.3	3.7	<0.001
Stress was major factor in causing my high BP	2.4	2.4	2.4	0.97
My high BP is largely due to my own behavior	2.7	2.8	2.7	0.27
Other people played large role in causing my high BP	3.4	3.3	3.5	0.005
My high BP caused by poor medical care in the past	3.9	3.7	4.1	<0.001
My state of mind played a major part in causing my high BP	3.2	3.2	3.2	0.82
Perceptions of Provider (mean scores) ^d				
Provider treats me with respect and dignity	1.3	1.3	1.3	0.1
Provider understands my background and values	1.5	1.5	1.4	0.03
Often feel provider looks down on me and the way I live my life	4.4	4.3	4.5	<0.001
Provider understands my cultural background and how it affects my health	1.8	1.8	1.8	0.38
Experiences of Discrimination (% reported any discrimination)	19.9	28.5	7.9	<0.001
Sodium intake score (mean) ^e	5.5	5.5	5.5	0.96
Medication Adherence (%) ^f				
missing	18.1	23.5	10.5	<0.001
poor	6.9	8.2	5.3	
fair	12.8	15.1	9.6	
excellent	62.2	53.2	74.6	
Provider Counseling (mean) ^g	6.6	7.2	5.7	<0.001
Treatment Intensity score (mean) ^h	-0.28	-0.31	-0.24	<0.001
Baseline Systolic BP (mean)	133.6	135.1	131.4	0.002
Final Systolic BP (mean)	132.9	134.2	131.0	0.009

^a High score indicates more concerns; range from 1–5

^b High score indicates greater beliefs in necessity of medications; range from 1–5

^c High score indicates less serious or less likely; range from 1–5

^d Higher score indicates more disagreement with statement; range 1–5

^e Higher score indicates worse diet (more sodium, fast food); range 1–12

^f Poor adherence: <50%, fair: 50–80%, excellent: >80%, measured by MEMS caps for 90-day use

^g Higher score indicates more discussion; range from 0–12

^h Higher score indicates more treatment intensity

Black patients reported more provider counseling about BP (7.2 vs. 5.7, $p<0.001$), and were much more likely to report at least one experience of discrimination in the health care setting than whites (29% vs. 8%, $p<0.001$). Finally, black patients had significantly higher baseline and final systolic BP compared to whites (135.1 mm/Hg vs. 131.4 mm/Hg, $p<0.01$; 134.2 mm/Hg vs. 131.0 mm/Hg, $p=0.009$, respectively).

In unadjusted analyses, black patients had less TI than whites, equivalent to approximately one fewer therapy increase per 14 clinic visits (-0.31 vs. -0.24 , $p<0.001$) (Table 2). After including patient sociodemographic variables and clinical characteristics in our regression model, black patients had significantly lower TI, equivalent to approximately one fewer therapy increase per 17 clinic visits (Model 2, $\beta=-0.06$, $p=0.01$; Table 3). In the final model, after adding patient beliefs, perceptions of

provider, experiences of discrimination, sodium intake, provider counseling and medication adherence, race was no longer a significant predictor of TI (Model 3, $\beta=-0.02$, $p=0.5$).

This final model revealed several determinants of TI. Patients with hyperlipidemia had increased TI, equivalent to approximately one more therapy increase per 13 clinic visits ($\beta=0.08$, $p<0.001$). Increased patient concerns about BP medications and more provider counseling were each related to lower TI, equivalent to approximately one fewer therapy increase per 17 clinic visits for each unit increase on the concerns scale and one less therapy increase per 100 visits for each unit increase on the provider counseling scale ($\beta=-0.06$, $p=0.02$ and $\beta=-0.01$, $p=0.001$, respectively). Two marginally significant findings indicated that more BP medications were associated with reduced TI ($\beta=-0.02$, $p=0.054$) and more disagreement with the item about

Table 3. Factors Associated with Treatment Intensification

Patient Variables	Model 1		Model 2		Model 3	
	Parameter estimate	p-value	Parameter estimate	p-value	Parameter estimate	p-value
Sociodemographic & Clinical Characteristics						
Black Race	-0.08	<0.001	-0.06	0.01	-0.02	0.51
Male	-	-	-0.006	0.81	-	-
Age	-	-	<-0.001	0.98	-	-
Education	-	-	0.02	0.39	-	-
Income	-	-	-0.001	0.96	-	-
Benign prostatic hypertrophy	-	-	0.02	0.70	-	-
Cerebrovascular disease	-	-	-0.08	0.09	-0.07	0.19
Chronic kidney disease	-	-	0.06	0.23	-	-
Congestive heart failure	-	-	0.09	0.18	-	-
Coronary artery disease	-	-	-0.02	0.65	-	-
Diabetes mellitus	-	-	0.02	0.51	-	-
Hyperlipidemia	-	-	0.07	0.002	0.08	<0.001
Nicotine dependence	-	-	0.01	0.75	-	-
Obesity	-	-	-0.03	0.14	-	-
Peripheral vascular disease	-	-	0.03	0.60	-	-
Number of BP medications	-	-	-0.04	<.001	-0.02	0.054
Health Beliefs & Illness Perceptions						
Concerns about BP Medication	-	-	-	-	-0.06	0.02
Beliefs about necessity of BP Medication	-	-	-	-	0.02	0.41
Patient Beliefs about Blood Pressure						
How serious is high BP, in general?	-	-	-	-	-0.01	0.68
How serious is your high BP, given your current use of medication?	-	-	-	-	0.02	0.09
If no BP meds over the next year, would BP get worse?	-	-	-	-	0.02	0.33
If no BP meds over the next year, would develop other health problems?	-	-	-	-	-0.01	0.42
Do you believe that taking BP medications will...						
make you feel worse?	-	-	-	-	0.14	0.10
help you feel better?	-	-	-	-	-0.03	0.51
help you live longer?	-	-	-	-	0.07	0.19
improve the quality of your life?	-	-	-	-	0.01	0.78
prevent future high BP related illnesses?	-	-	-	-	-0.07	0.17
Illness Perception Questionnaire						
Germ or virus caused my high BP	-	-	-	-	-0.004	0.75
Diet played major role in causing my high BP	-	-	-	-	<-0.001	0.98
Pollution of environment caused my high BP	-	-	-	-	-0.005	0.72
My high BP is hereditary	-	-	-	-	-0.007	0.57
It was just by chance that I became ill with high BP	-	-	-	-	-0.002	0.84
Stress was major factor in causing my high BP	-	-	-	-	-0.001	0.97
My high BP is largely due to my own behavior	-	-	-	-	<0.001	0.95
Other people played large role in causing my high BP	-	-	-	-	0.003	0.79
My high BP caused by poor medical care in the past	-	-	-	-	-0.008	0.56
My state of mind played a major part in causing my high BP	-	-	-	-	-0.001	0.94
Perceptions of Provider						
Provider treats me with respect and dignity	-	-	-	-	0.04	0.18
Provider understands my background and values	-	-	-	-	0.02	0.34
Often feel provider looks down on me and the way I live my life	-	-	-	-	0.04	0.05
Provider understands my cultural background and how it affects my health	-	-	-	-	-0.002	0.91
Experiences of Discrimination	-	-	-	-	0.004	0.91
Sodium intake score	-	-	-	-	-0.003	0.66
Medication Adherence						
Missing	-	-	-	-	-0.03	0.34
Poor	-	-	-	-	.01	0.77
Fair	-	-	-	-	-0.06	0.10
Excellent	-	-	-	-	ref	ref
Provider Counseling	-	-	-	-	-0.01	0.001

feeling one's provider looks down on them was associated with increased TI ($\beta=0.04$, $p=0.05$).

To assess the effects of race and TI on BP, we performed two linear regressions, using the final systolic BP as the outcome. When race was examined alone as a predictor, black patients had a higher final systolic BP (134 mm/Hg for blacks vs.

131 mm/Hg for whites, $p=0.009$; Table 2). In a model containing race and TI as independent variables, TI was a significant predictor of final BP (final SBP 2.0 mm/Hg lower for each additional therapy increase per 10 visits, $p<0.001$; Table 4), but race was no longer significant (blacks 1.6 mm/Hg higher than whites, $p=0.17$).

Table 4. Factors Associated with Systolic BP

	Model 1		Model 2	
	Parameter estimate	p-value	Parameter estimate	p-value
Black race	3.15	0.01	1.59	0.17
Treatment	–	–	–2.03	<0.001
Intensity score				

DISCUSSION

In this effort to understand racial disparities in BP control, we found that black patients had significantly lower rates of TI compared to whites, even after accounting for differences in their clinical and sociodemographic status. However, racial disparities in TI were explained by the inclusion of patient characteristics, health beliefs, and provider counseling. This finding differs from prior work finding that African Americans were treated more intensively for their hypertension,^{14,25} but which did not account for patient health beliefs or interactions with providers. One study defined TI as the number of classes of BP medications,¹⁴ a measure which is likely to be confounded by disease severity.¹⁵

In our study, having hyperlipidemia was the only significant predictor of increased TI. Patient concerns about BP medications and more provider counseling were associated with reduced TI, suggesting that providers may hesitate to intensify treatment when patients express concerns, or that providers may substitute counseling for TI. This conclusion is consistent with other findings indicating that more discussion between providers and patients about medication issues was associated with a lower likelihood of changing treatment.²⁶ Patient concerns may be related to being on an increased number of BP medications or lack of trust in providers whom patients may feel look down on them. The racial differences in BP control in our sample suggest that substituting counseling for TI is not an effective strategy to minimize disparities in BP control.

Black patients had a higher systolic BP in unadjusted analyses, but this effect was much attenuated and no longer significant after controlling for TI, suggesting that increasing TI may help to resolve disparities in uncontrolled BP. This notion is partly consistent with prior findings that TI was associated with increased odds of having controlled BP; however, in that study, no interactions were found between race and TI.¹³ Our results add to this literature by revealing determinants of TI by race and demonstrating that patient concerns and beliefs about BP and provider counseling are associated with differential rates of TI, and thus are a target for intervention, along with increasing provider awareness about intensifying hypertension therapy.

Our findings should be interpreted within the limitations of our study. As part of the parent study, a subset of providers received an educational intervention, which may have affected provider-patient communication and, in turn, patient beliefs about BP medication. However, our analyses adjusted for nesting of patients-within-providers and thus controlled for differential practice styles that may have been associated with providers' exposure to the intervention. In addition, separate analyses indicated no significant effect of the intervention on counseling or BP (not shown). Our sample is comprised of only white and black patients receiving care at a single urban, safety-net hospital and our findings may therefore not be

generalizable to other populations. We do not have information about provider attitudes and beliefs, which have also been shown to also be a key factor in clinical inertia.^{26,27} Again, our analysis may account for some of this variability, but not all.

Disparities in hypertension control can be minimized by identifying and addressing modifiable factors that contribute to these differential rates in health outcomes. This study found that patient concerns about antihypertensive medications play a significant role in reducing necessary TI. These results provide some support for a model to explain disparities in BP outcomes. In this model, race contributes to racial differences in beliefs and experiences, which contributes to racial differences in TI, which contributes to racial differences in BP control. Future qualitative research to determine the causes of concerns about BP medications and how those concerns impact TI may be helpful.²⁸ Such findings could be incorporated into a patient or provider intervention, to help address patient concerns about BP medication. In the ongoing struggle to diminish racial disparities in health outcomes, this study offers insight to potential targets for interventions. Improved patient-provider communication and patient health education may have the potential to reduce racial disparities in TI and ultimately, BP control.

Acknowledgements: The authors thank Mark Glickman, PhD for his advice regarding statistical analyses.

Funding sources: This work was supported by the NIH/National Heart, Lung and Blood Institute grant R01 HL072814 (N. Kressin, PI). Dr. Kressin is supported in part by a Research Career Scientist Award from the Department of Veterans Affairs Health Services Research and Development Service. Dr. Rose is funded by a career development award from the Department of Veterans Affairs Health Services Research and Development Service.

The views expressed in this article are those of the authors and do not necessarily represent the official views and policies of the Department of Veterans Affairs.

Conflict of Interest: None disclosed.

Financial Disclosure: No authors have identified any financial conflicts of interest.

Corresponding Author: Meredith Manze, MPH; VA Boston Health-care System, Boston, MA, USA (e-mail: meredith.manze@bmc.org).

REFERENCES

1. Hertz R, Unger A, Cornell J, Saunders E. Racial disparities in hypertension prevalence, awareness, and management. *Arch Intern Med*. 2005;165:2098–104.
2. Smedley B, Stith A, Nelson A. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. Washington, DC: National Academy Press; 2002.
3. Cutler JA, Sorlie PD, Wolz M, Thom T, Fields LE, Rocella EJ. Trends in hypertension prevalence, awareness, treatment, and control rates in United States adults between 1988–1994 and 1999–2004. *Hypertension*. 2008;52:818–27.
4. Nesbitt SD. Hypertension in black patients: special issues and considerations. *Curr Hypertens Rep*. 2005;7:244–8.
5. Hajjar J, Kotchen T. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988–2000. *J Am Med Assoc*. 2003;290:199–206.
6. Chobanian A, Bakris G, Black H, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treat-

- ment of High Blood Pressure: The JNC 7 Report. *J Am Med Assoc*. 2003;289:2560-72.
7. **Wong M, Shapiro M, Boscardin W, Ettner S.** Contributions of major diseases to disparities in mortality. *N Engl J Med*. 2002;347:1585-92.
 8. **Phillips LS, Branch WT, Cook CB, et al.** Clinical inertia. *Ann Intern Med*. 2001;135:825-34.
 9. **Berlowitz D, Ash AA, Hickey EC, et al.** Inadequate management of blood pressure in a hypertensive population. *N Engl J Med*. 1998;339:1957-63.
 10. **Rose AJ, Shimada SL, Rothendler JA, et al.** The accuracy of clinician perceptions of "usual" blood pressure control. *J Gen Intern Med*. 2007.
 11. **Selby JV, Uratsu CS, Fireman B, et al.** Treatment intensification and risk factor control: toward more clinically relevant quality measures. *Med Care*. 2009;47:395-402.
 12. **Okonofua EC, Simpson KN, Jesri A, Rehman SU, Durkalski VL, Egan BM.** Therapeutic inertia is an impediment to achieving the Healthy People 2010 blood pressure control goals. *Hypertension*. 2006;47:345-51.
 13. **Hicks LS, Fairchild DG, Horng MS, Orav EJ, Bates DW, Ayanian JZ.** Determinants of JNC VI guideline adherence, intensity of drug therapy, and blood pressure control by race and ethnicity. *Hypertension*. 2004;44:429-34.
 14. **Safford MM, Halanych JH, Lewis CE, Levine D, Houser S, Howard G.** Understanding racial disparities in hypertension control: intensity of hypertension medication treatment in the REGARDS study. *Ethn Dis*. 2007;17:421-6.
 15. **Rose A, Berlowitz D, Manze M, Orner M, Kressin N.** Comparing methods of measuring treatment intensification in hypertension care. *Circulation Cardiovascular Quality and Outcomes*. 2009;2:385-91.
 16. **Horne R, Weinman J, Hankins M.** The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. *Psychol Health*. 1999;14:1-24.
 17. **Horne R, Buick D, Fischer M, Leake H, Cooper V, Weinman J.** Doubts about the necessity and concerns about adverse effects: identifying the types of beliefs that are associated with non-adherence to HAART. *Int J STD AIDS*. 2004;15:38-44.
 18. **Kressin N, Wang F, Long J, et al.** Hypertensive patients' health beliefs, process of care, and medication adherence: is race important? *J Gen Intern Med*. 2007;22:768-74.
 19. **Weinman J, Petrie KJ, Moss-Morris R, Horne R.** The illness perception questionnaire: a new method for assessing the cognitive representation of illness. *Psychol Health*. 1996;11:431-45.
 20. **Johnson RL, Saha S, Arbelaez JJ, Beach MC, Cooper LA.** Racial and ethnic differences in patient perceptions of bias and cultural competence in health care. *J Gen Intern Med*. 2004;19:101-10.
 21. **Bird ST, Bogart LM.** Perceived race-based and socioeconomic status (SES)-based discrimination in interactions with health care providers. *Ethn Dis*. 2001;11:554-63.
 22. **Kim MT, Hill MN, Bone LR, Levine DM.** Development and testing of the hill-bone compliance to high blood pressure therapy scale. *Prog Cardiovasc Nurs*. 2000;15:90-6.
 23. **Pbert L, Adams A, Quirk M, Hebert J, Ockene J, Luippold R.** The patient exit interview as an assessment of physician-delivered smoking intervention: a validation study. *Health Psychol*. 1999;18:183-8.
 24. **Hyman DJ, Pavlik VN.** Characteristics of patients with uncontrolled hypertension in the United States. *N Engl J Med*. 2001;345:479-86.
 25. **Umscheid CA, Gross R, Weiner MG, Hollenbeak CS, Tang SS, Turner BJ.** Racial disparities in hypertension control, but not treatment intensification. *Am J Hypertens*. 2010;23:54-61.
 26. **Kerr EA, Zikmund-Fisher BJ, Klamerus ML, Subramanian U, Hogan MM, Hofer TP.** The role of clinical uncertainty in treatment decisions for diabetic patients with uncontrolled blood pressure. *Ann Intern Med*. 2008;148:717-27.
 27. **Ferrari P.** Reasons for therapeutic inertia when managing hypertension in clinical practice in non-Western countries. *J Hum Hypertens*. 2009;23:151-9.
 28. **Bokhour B, Long J, Berlowitz D, Kressin N.** Assessing patient adherence in medical encounters: How do providers talk with patients about antihypertensive medication taking? *J Gen Intern Med*. 2006;21:577.