

# An Educational Program to Enhance Blood Pressure Control and Medication Adherence

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Can a group program that is designed around patients' readiness for change provide a positive behavioral outcome and tangible health benefits?

In the United States today, the number of people with hypertension is increasing. Between 1994 and 2004, the age-adjusted prevalence rose from 24% to 29%.<sup>1</sup> Yet discouragingly few of these patients—only 35% of adults aged 18 and older with hypertension between 1999 and 2004<sup>1</sup>—have the disease under control.

Uncontrolled hypertension has significant adverse health effects, including myocardial infarction, stroke, heart failure, and premature death.<sup>2</sup> One major factor influencing hypertension control is medication adherence. With one in three U.S. adults not adhering to a prescribed medication regimen,<sup>3</sup> medication adherence certainly is an essential component to the success of efforts by health care providers to control hypertension. Unfortunately, there is a lack of knowledge regarding the efficacy of interventions designed to promote health by addressing behavioral risk problems,<sup>4</sup> such as nonadherence to medications.

Applying a group intervention, guided by the transtheoretical model of health behavior change (TTM), may be an important tactic in achieving medication adherence and, ultimately, blood pressure (BP) goals. The concept of the TTM is embedded in the belief that behavioral change is a process that unfolds over time.<sup>5</sup> The TTM has been applied in numerous research settings to instigate behavior change in a variety of patient populations. For example, it has been applied to encourage economically disadvantaged black adolescents to eat more fruits and vegetables<sup>6</sup> and to improve the exercise habits of telecommunication workers<sup>7</sup> and patients with type 2 diabetes.<sup>8</sup> The TTM also has been applied to interventions designed to encourage adults recruited from health maintenance organizations to adhere to prescribed lipid lowering<sup>9</sup> and antihypertensive<sup>10</sup> medications, with positive results.

In recent years, hypertension has been targeted as a major, ongoing problem for patients enrolled in primary care at our large, metropolitan VA medical center. We responded by initiating a group educational program that would utilize the TTM. We felt that applying the TTM to im-

prove adherence to antihypertensive medication in a veteran population would offer a unique opportunity to study the model's effectiveness in a multiracial group of patients who share a particular cultural experience (military service). We decided to use a group process because this type of strategy has been found to be effective in various settings, including nursing models to assist patients in BP control<sup>11</sup>; provider and patient education on hypertension and BP control<sup>12,13</sup>; efforts to assist patients with type 2 diabetes in achieving hemoglobin A<sub>1c</sub> goals<sup>14</sup>; and efforts to help patients with hepatitis C understand their disease's symptoms, transmission, and treatment.<sup>15</sup>

Through our own research, we strove to answer two questions: (1) Do veterans enrolled in primary care who participate in a small-group educational and counseling program guided by the TTM have improved BP control as established by the seventh report of the Joint Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)?<sup>16</sup> and (2) Will this group TTM program lead to improved antihypertensive medication adherence among these same

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veterans? Before describing our research design and results, we provide some background information on the TTM.

### THE TTM

The two main constructs involved in the TTM are the stages of change and the processes of change.<sup>5</sup>

### Stages of change

Each of the stages of change (precontemplation, contemplation, preparation, action, maintenance, and termination) represents a period of time and involves a specific set of tasks that are required for progression to the next stage.<sup>5</sup> Precontemplation is the stage at which people do not intend to take action in the foreseeable future. People in this stage usually avoid reading, talking, or thinking about changing their behavior. Contemplation is the stage at which people intend to make a change within the next six months. Individuals in this stage are more aware of the pros and cons of the intended change. This awareness can produce ambivalence, however, and can keep a person stuck in the contemplation stage for a long period of time. Preparation is the stage at which individuals intend to take action, usually within the following month. Individuals in this stage have thought about change and usually have done some reading or talked with a health care provider about the intended change. Action is the stage at which people have made specific, overt modifications in lifestyles within the past six months. The maintenance stage is when individuals work to prevent relapse. The change process is not applied as frequently in this stage as compared to the action stage. Finally, termination is the stage in which the new behavior is fully incorporated as a consistent behavior.<sup>5</sup>

**Table 1. The experiential and behavioral processes of change<sup>5,17</sup>**

#### Experiential processes

- **Consciousness raising:** Increasing information about self and problem/observations, confrontations, interpretations, bibliotherapy
- **Dramatic relief:** Experiencing and expressing feelings about one's problems and solutions (psychodrama, grieving losses, role playing)
- **Environmental reevaluation:** Assessing how one's problems affect physical environment (empathy training, documentaries)
- **Social liberation:** Increasing alternatives to problem behaviors available in society (advocating for rights of repressed, empowering, policy interventions)
- **Self-reevaluation:** Assessing how one feels and thinks about oneself with respect to a problem (value clarification, imagery, corrective emotional experience)

#### Behavioral processes

- **Stimulus control:** Avoiding or countering stimuli that elicit problem behaviors, restructuring one's environment (removing alcohol or fattening foods), avoiding high risk cues
- **Helping relationship:** Therapeutic alliance, social support, self-help groups
- **Counter conditioning:** Substituting alternatives for problem behaviors (relaxation, desensitization, assertion, positive self-statements)
- **Reinforcement management:** Rewarding oneself or being rewarded by others for making changes
- **Self liberation:** Choosing and committing to action or believing in one's ability to change (decision making therapy, New Year's resolutions)

### Processes of change

Each stage has different processes within it that optimally will produce the desired change. These processes are the experiential and behavioral activities that people employ in order to move themselves through the stages of change (Table 1).<sup>5,17</sup> Most research regarding the TTM and the stages of change emphasizes process of change interventions as the best tools to instigate change in people who are striving to overcome problem behaviors that pose a threat to their health. The processes of change may be important predictors of medication adherence, and research specifically supports using consciousness raising, dramatic

relief, stimulus control, reinforcement management, self liberation, and a helping relationship (as provided by health care providers).<sup>9,10,18</sup>

### METHODS

The design for this study was quasi-experimental using a pretest-posttest model. This particular design facilitated our research objectives and allowed us to examine causality in a situation in which complete control of the dependent variables was not possible. The dependent variables were medication adherence and BP measurements. The independent variables were the stage-specific interventions.

For the duration of the study, participants attended a monthly, two-hour group session facilitated by a nurse practitioner (NP) for a maximum of four months. When patients reached their BP goal, their participation in the study was complete. With this fluid format, new members came into the group when space became available.

## Participants

A power analysis was completed to identify the number of participants needed to achieve statistical significance. For this analysis, we used a standard power of 80%, an alpha level of .05, and a moderate effect size of 50%. The results indicated that a total of 27 participants were needed for this research.

Veterans obtaining their primary health care at a single, metropolitan VA medical center between May and August 2007 comprised this non-probability convenience sample. A sampling pool of all patients with an *International Classification of Diseases, Ninth Revision (ICD-9)* code for hypertension (401.0) and at least one BP measurement greater than 140/90 mm Hg (which is above the goal defined in the JNC 7 report<sup>16</sup>) was used to recruit participants. In total, 42 patients who met the inclusion criteria were identified, and 26 consented to participate.

## Data collection

Data collection commenced once we obtained approval from our institutional review board and informed consent from participants. A demographic form was used to record each participant's identification number, age, marital status, education level, ethnicity, and number of years with hypertension. Medication adherence was evaluated by accessing participants' electronic medical records

before and after the study, and BP measurements were recorded at each group session (with some patients using home monitors to take additional measurements).

Prior to the first group session, each participant's current stage of change was assessed using the University of Rhode Island Change Assessment (URICA)—a 32-item Likert-type scale with four eight-item subscales, which is used to categorize individuals into one of the six stages of change and has been validated extensively.<sup>19</sup> Cronbach's coefficient alpha values for the four scales ranged from .88 to .89. The Flesh-Kincaid Grade Level for readability for the URICA is 2.9.

At each group session, the NP obtained a seated BP measurement for each participant once he or she had been seated quietly for five minutes. Following the session, the NP escorted each participant to an examination room for a review of the participant's BP measurements and antihypertensive medication adherence. For those participants who had home BP monitors, home BP measurements were included in this review. At this time, the NP also made any necessary adjustments in the antihypertensive medication regimen.

## The interventions

URICA testing completed prior to the start of the group meetings revealed that the participants were in three stages of change: precontemplation, contemplation, and action. Based on this finding, four interventions—which have been indicated by prior research to be appropriate for these stages<sup>9</sup>—were applied during each group meeting: (1) consciousness raising, (2) self-reevaluation, (3) a helping relationship, and (4) reinforcement management.

Consciousness raising was accomplished by focusing on increasing

participants' knowledge of hypertension and the consequences of untreated disease. During the group session, the NP assessed participants' current knowledge of the dangers of uncontrolled hypertension. The NP practiced supportive confrontation by showing each participant his or her BP measurements and medication filling history. (A graphing section in the electronic medical record allows medication fills and BP measurements to be displayed simultaneously.)

Self-reevaluation consisted of assessing participants' feelings about having hypertension—a chronic disease that requires lifelong medication adherence for control. Participants verbalized their feelings regarding hypertension to the NP, with some not understanding that medication would be required for the rest of their lives.

A helping relationship, or therapeutic alliance, was established by the NP being open and trusting regarding the participants' problem of uncontrolled hypertension. The group dynamic facilitated this strategy. The NP supported participants by verbally acknowledging that adherence to medication regimens is a difficult and challenging task. Suggestions for improving adherence were offered, including taking medications at the same time every day (to reinforce the action as a habit) and placing medications in an area where they would be seen easily (to provide a visual reminder). The NP's one-on-one meeting with participants following the group session also helped to reinforce the therapeutic alliance by demonstrating the NP's openness about the participant's BP problems and commitment to the participant's health and well-being.

Reinforcement management consisted of the NP verbally recognizing a participant in front of the group when he or she attained his or her

**Table 2. Demographic characteristics of the study sample (N = 26)**

Characteristic	No. (%) of participants
Ethnicity	
Black	15 (58)
White	10 (8)
Asian	1 (4)
Education	
Some high school	1 (4)
High school graduate	21 (81)
Bachelors degree	2 (8)
Masters degree	2 (8)
Marital status	
Single	8 (31)
Married	11 (42)
Separated	1 (4)
Divorced	1 (4)
Widowed	5 (19)
Employed	
Yes	4 (15)
No	22 (85)

BP goal and achieved positive anti-hypertensive medication adherence. Positive feedback was used liberally in this capacity.

## RESULTS

### Demographics

Of the 26 participants, 15 were black, 10 were white, and one was Asian (Table 2). The mean (SD) age was 69 (11) years, with a range of 44 to 93 years. Age characteristics were different between the black participants, who had a mean (SD) age of 70 (13) years, and the white participants, who had a mean (SD) age of 61 (24) years. Eleven (42%) of the participants reported being married, eight (30%) were single, five (19%) were widowed, and two (4%) were separated or divorced.

### BP

The overall mean (SD) reported duration of hypertension was 13.6 (11) years, with most participants having hypertension from six to 10 years (Figure 1). The black participants had a higher mean (SD) hypertension duration than the white participants (15.3 [12] versus 12.95 [6], respectively).

Prior to the group interventions, participants' mean (SD) BP measurements were 170/86 (12/11) mm Hg. After the intervention, the mean (SD) was 136/77 (11/9) mm Hg. A two-tailed paired *t* test comparing the preintervention and postintervention BP measurements showed significant improvements in both systolic BP ( $P < .0001$ ) and diastolic BP ( $P = .0004$ ) before and after the intervention for all participants ( $t = -12.19$ , degrees of freedom = 1).

### Medication adherence

Adherence before and after the interventions were compared using a  $\chi^2$  test (Yates correction). Six (23%) of the 26 participants were adherent to their antihypertensive medication regimen preintervention (Figure 2)—all of whom were white. Postintervention, the overall adherence rate increased to 73% ( $n = 19$ ), with 11 (73%) of the 15 black participants and seven (70%) of the 10 white participants achieving adherence. By the end of the study, the one Asian participant, who had not been adherent to his antihypertensive medication preintervention, achieved adherence.

Four (36%) of the 11 married participants demonstrated medication adherence preintervention, and this number increased to seven (64%) postintervention. Medication adherence rates increased from 25% to 75% for the eight single participants and from 0% to 80% for the five widowed participants.

### Stages of change

According to the URICA, before the study's initiation, four of the participants were in the precontemplation stage and nine were in the contemplation stage. Nearly half (13) of the participants were in the action stage.

In relation to BP control,  $\chi^2$  analysis of stage of change (precontemplation versus contemplation versus active) showed significance ( $\chi^2 = 9.9$ ,  $P < .01$ ). The four participants in the precontemplation stage had a mean preintervention BP of 176/90 mm Hg, and the two who subsequently completed the study had a mean postintervention BP of 145/82 mm Hg. The nine participants in the contemplation stage had a mean preintervention BP of 172/86 mm Hg, and the seven who completed the study had a mean postintervention BP of 138/82 mm Hg. The 13 participants in the action stage had a mean preintervention BP of 168/84 mm Hg, and the 11 who completed the study had a mean postintervention BP of 132/74 mm Hg.

Systolic and diastolic BP before and after the interventions were compared individually, using the paired *t* test, in relation to the stage of change into which participants were classified. For precontemplation participants, both systolic and diastolic BP were significantly improved postintervention ( $-5.87$ ;  $P < .009$  and  $-2.43$ ;  $P < .093$ , respectively). Among contemplation participants, systolic BP was significantly improved postintervention ( $-6.74$ ;  $P < .0001$ ), while diastolic BP was not ( $-1.27$ ;  $P = .243$ ). Significant improvements were noted in both systolic BP ( $-8.3$ ,  $P < .00001$ ) and diastolic BP ( $-3.5$ ,  $P < .00002$ ) in action patients. Thus, while systolic BP improved significantly for participants in all three stages, improvement in diastolic BP was not so uniform.

Stage of change constructs also were analyzed with regard to medi-

cation adherence. Overall adherence comparisons before and after the interventions showed significant improvement postintervention ( $\chi^2$  [Yates correction] = 11.1;  $P < .0001$ ). While none of the four precontemplation participants demonstrated medication adherence preintervention, one (25%) did postintervention. Three (34%) of the contemplation participants demonstrated medication adherence preintervention, and eight (89%) demonstrated such adherence postintervention. Three (23%) of the action participants demonstrated medication adherence preintervention, and 10 (77%) demonstrated such adherence postintervention.

## DISCUSSION

The stages of change–matched TTM interventions improved medication adherence and BP control significantly in all of the participants. It is important to point out, however, that medication adjustment was ongoing in this study. As such, it is unclear whether taking medication as prescribed, getting the appropriate dose of the medication, participating in the interventions, or some combination thereof had an impact on the overall decrease in BP measurements observed.

Some of the characteristics of the final sample were congruent with research regarding factors that positively influence medication adherence, which may have contributed to the improvements we observed. For example, people with a chronic health condition are less likely to adhere to their prescribed medications if they: are younger than 45 years, have a noncardiac diagnosis, have high levels of distress over their health, have been told to split their pills, believe that their BP is high, have been discharged from the hospital recently, or have not graduated from high school.<sup>20–24</sup> Additionally, patients who

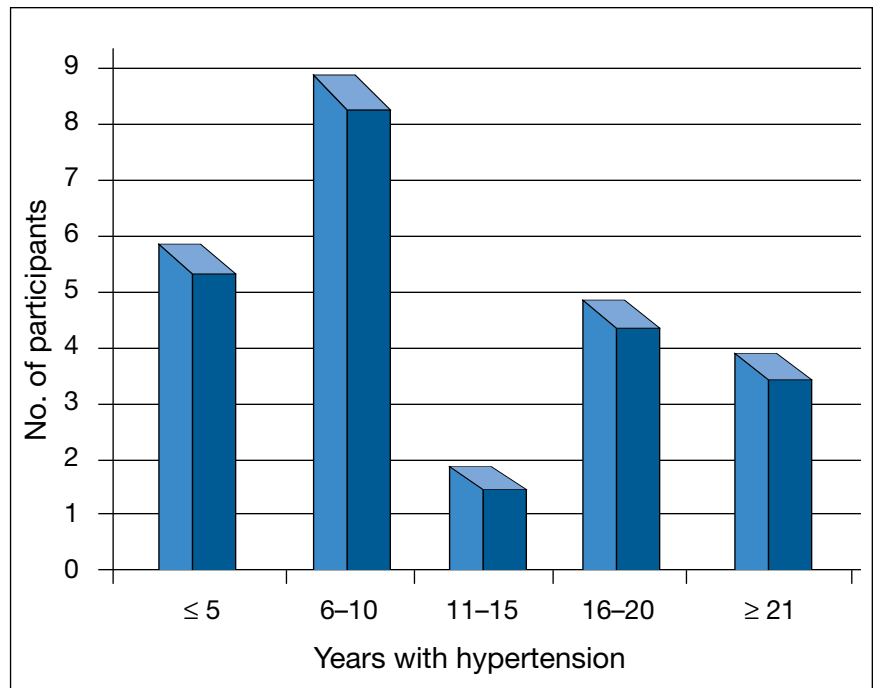


Figure 1. Participants' reported number of years with hypertension.

are younger than age 18 can be influenced by social stigma.<sup>25</sup> Our study sample included only older participants (all older than 44 years), and all but one of these had a high school diploma.

Patients' medication adherence can be improved by health care providers who are trained in effective prevention and management strategies for the particular health condition being treated and who are culturally and linguistically sensitive to patients.<sup>23</sup> In this study, the NP practiced these sensitivity traits according to the TTM's helping relationship intervention. Other characteristics that positively influence medication adherence include a patient's confidence in his or her ability to take medication as prescribed, simplified doses, and such motivational strategies as telephone contact.<sup>20–22,25</sup> The NP observed that the majority of the study participants had the proper confidence to take

their medications as prescribed—although this was not measured formally. Interestingly, while simplified doses are preferred to encourage medication adherence, and splitting pills is cited as a contributing factor to nonadherence, the VA routinely encourages pill splitting by patients as a cost saving measure.

Of all the participants, those who were categorized into the precontemplation stage at the beginning of the study had the least improved BP by study's end. This finding is congruent with the TTM in that people in the precontemplation stage are expected to display the least amount of behavior change. Perhaps this means that patients with uncontrolled hypertension who are in the later stages of change (such as the contemplation or action stages) are more likely to benefit from a TTM-guided intervention.

Notably, widowed and single veterans displayed poorer medication



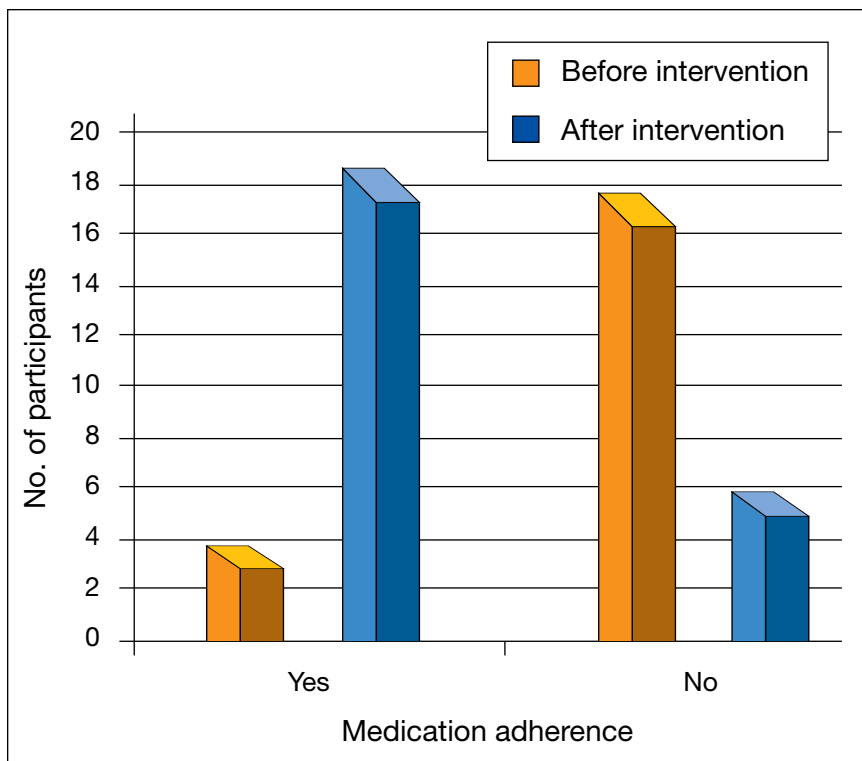


Figure 2. Participants' medication adherence before and after the group intervention.

adherence than married veterans preintervention—but showed the greatest improvement in adherence postintervention. These results were not due to complications or attrition, as none of the participants displayed complications related to uncontrolled hypertension and there was no attrition during the study. Although we did not evaluate whether the non-married participants had a significant long-term partner, applying the helping relationship process of change may have been more effective with those participants who lacked such a partner.

**STUDY LIMITATIONS**

Several limitations are noted in this study. For one, the use of a convenience sample produced a group of mostly unemployed, older, male veterans with fairly high levels of edu-

cation. Importantly, the number of study participants needed for significance was not obtained; thus, our findings cannot be generalized.

Selection bias also may have occurred as the sample may not have been representative of participants with uncontrolled hypertension in our VA medical center. There is approximately a 15% no-show rate to appointments in primary care, and it is speculated that those who comprise this number may have higher rates of uncontrolled hypertension than those who routinely keep appointments. In addition, an unknown percentage of veterans who obtain their health care at our institution are homeless or move frequently and, therefore, may not have been included in our study. Moreover, the patients who consented to participate may have been more inclined to improve their medication

adherence than patients found in a reference population.

Construct validity problems also are a concern with regard to the definition of medication adherence used. Filling prescriptions does not mean that patients are necessarily taking the medication as prescribed. As participants' electronic medical records were reviewed to assess medication adherence, there was a potential for misclassification bias regarding medication use.

Future research on TTM stages of change-guided interventions for antihypertensive medication adherence should include both veteran and non-veteran participants of both genders whose employment status and education level are varied. A more comprehensive study also would classify patients' stage of change both before and after the interventions. Doing so may further validate the stages of change in the TTM—as would comparisons between group and individual interventions and the use of a control group in addition to an intervention group.

**IN SUMMARY**

Although limited, our results suggest that a TTM-guided, small-group format, enforced by timely medication adjustment, can bring about significant behavioral change related to antihypertensive medication adherence and improved BP control. As the HHS strives to increase the proportion of patients with controlled BP to at least 50% by 2010,<sup>26</sup> we feel TTM interventions could play a role in reaching this goal in a cost-effective manner. ●

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**Author disclosures**

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