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## Prevalence of Blood Pressure Self-Monitoring, Medication Adherence, Self-Efficacy, Stage of Change, and Blood Pressure Control Among Municipal Workers With Hypertension

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### Abstract

Despite the availability of effective medications, hypertension remains inadequately managed in the United States. It has been established that medication adherence is a major strategy for controlling blood pressure. Combined interventions to promote adherence are promising, but further research is needed to understand which behaviors to target. The frequency of self-monitoring of blood pressure among municipal workers is unknown, and the literature is limited regarding assessing individuals' readiness and confidence to engage in medication adherence. The purpose of this study was to determine the prevalence of medication adherence, readiness, self-efficacy, self-monitoring of blood pressure, and blood pressure control among hypertensive municipal workers. The study population was enrolled in a wellness program established more than 20 years ago to promote health and safety for a work force in a large southeastern U.S. city. The majority of the study participants (75.7%) demonstrated controlled blood pressure, reported adherence to antihypertensive medication (70%), and self-monitored blood pressure (70%).

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Government agencies (e.g., Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [JNC]), private medical societies (e.g., European Society of Hypertension-European Society of Cardiology [ESH-ESC]), and professional societies (e.g., American College of Cardiology, American Heart Association) agree that high blood pressure is a major independent risk factor for cardiovascular disease. Other major risk factors for cardiovascular disease include smoking, hyperlipidemia, diabetes, male gender, and older age. Results of clinical trials have indicated that target blood pressure control, as recommended by *The Seventh Report of the Joint National Committee*

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on *Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)*, can be maintained with medication adherence (Chobanian et al., 2003; Hynes & Sackett, 1976). Controlling individuals' blood pressures at the target goals recommended by JNC 7 and the World Health Organization-International Society of Hypertension (WHO-ISH) prevents target organ damage and reduces cardiovascular morbidity and mortality. Uncontrolled hypertension is defined as a systolic blood pressure greater than 140 mmHg or a diastolic blood pressure greater than 90 mmHg (Chobanian et al., 2003). For adults with diabetes and kidney disease, hypertension is defined as a systolic blood pressure greater than 130 mmHg or a diastolic blood pressure greater than 80 mmHg (Chobanian et al., 2003).

Findings from evidence-based studies led to the recommendation of home monitoring of blood pressure as a supplement to usual care in the guidelines developed by JNC 7 and the ESH-ESC (American College of Physicians, 1993; Chobanian et al., 2003; Fahey, Schroeder, & Ebrahim, 2005). For many years, office blood pressure readings have been the standard for diagnosing and managing hypertension, despite evidence that this method has limitations (Pickering, 2008). High readings taken in the provider's office do not usually constitute an emergency and repeated measurements on more than one occasion are needed for an accurate diagnosis. Frequent blood pressure monitoring away from the provider's office can be used to confirm a diagnosis or to monitor an individual's response to treatment; measurements can be taken with an inexpensive semi-automatic device or an expensive ambulatory blood pressure device (Chobanian et al., 2003). Although blood pressure management has been found to be positively influenced by additional self-monitoring of blood pressure at home, providers may not routinely recommend self-monitoring of blood pressure. Nevertheless, monitoring blood pressure outside of providers' offices is increasing among individuals with hypertension.

According to the JNC 7 (Chobanian et al., 2003), individuals are likely to have poor blood pressure control if they lack motivation to take their medication and if their providers are not aggressive in hypertension treatment. Krousel-Wood, Hyre, Muntner, and Morisky (2005) identified two barriers to treatment adherence for hypertensive patients. First, hypertension is a silent disease that often has no associated symptoms; therefore, adults with hypertension may not perceive themselves as sick and, as a result, may find medication adherence difficult. Second, hypertension is a chronic disease that usually requires long-term use of medication. These two factors combined may negatively affect hypertensive clients' motivation or confidence to continue a routine hypertensive regimen for the rest of their lives.

Self-efficacy supports behavior change (Kakudate et al., 2010) and has been reported to decrease symptoms of chronic diseases (Wattana, Srisuphan, Pothiban, & Upchurch, 2007). Few published studies have focused on this psychosocial variable as applied to medication adherence. The purpose of this study was to determine the prevalence of medication adherence, readiness, self-efficacy, self-monitoring of blood pressure, and blood pressure control in a sample of hypertensive municipal workers.

## METHODOLOGY

A cross-sectional, correlational design was used to examine the prevalence of self-monitoring of blood pressure, medication adherence, self-efficacy, stage of change, and blood pressure control among municipal workers with hypertension in a large southeastern U.S. city. These city workers participate at least every other year in health risk appraisal screening and are provided education about lifestyle modifications to reduce risk factors for cardiovascular disease and death as part of a worksite wellness program. After Institutional Review Board approval was secured for the project, city workers who reported having been

diagnosed with hypertension and who attended the screening for their health risk assessment were invited to participate in this study. As part of the screening, participants complete a standard questionnaire on current health behaviors and use of preventive health services. Additional questionnaires needed for this study were distributed to workers with hypertension who participated in the fall 2009 health screening, who met inclusion criteria, and who agreed to participate in the study.

Medication adherence was measured by the self-reported Morisky Medication Adherence Scale (Morisky, Ang, Krousel-Wood, & Ward, 2008). A score of less than 6 indicated poor medication adherence (Morisky, Green, & Levine, 1986). Medication self-efficacy was measured by the revised 13-item Medication Adherence Self-Efficacy Scale (MASES-R), for which a total score is computed by adding each item score (Fernandez, Chaplin, Schoenthaler, & Ogedegbe, 2008). Stage of change was measured via a four-item questionnaire that has been useful in determining motivational readiness to change or the stage of change (Prochaska, Norcross, & DiClemente, 1994).

A modified questionnaire was used to assess the frequency of self-monitoring of blood pressure at home and in the provider's office. Specific questions were selected from the Behavioral Risk Factor Surveillance Survey (BRFSS) (Centers for Disease Control and Prevention, 2008) for blood glucose monitoring because this instrument is widely used to collect data on health risk behaviors. Additional questions concerning the nature and knowledge of target blood pressure levels were included to measure self-monitoring of blood pressure:

- “Are you using a blood pressure monitor at home (to help monitor your blood pressure)?”
- “About how often do you check your blood pressure?”
- “About how many times in the past 12 months have you had your blood pressure measured by a doctor, nurse, or other health professional within your doctor's office?”

Three additional questions based on the literature were added to the BRFSS:

- “How long have you had high blood pressure?”
- “How many times a day do you take your blood pressure medication?”
- “What are your target (normal) blood pressure numbers?”

At the screening, participants were fitted with the appropriate size cuff and blood pressure was measured after 5 minutes of rest with a validated, automated, upper-arm digital instrument. The device automatically takes two measurements, 3 minutes apart, which are recorded. The lower measurement was used as the blood pressure reading for this study. Blood pressure less than 140/90 mmHg was categorized as controlled.

## RESULTS

A total of 149 municipal workers were enrolled as participants in the study. As shown in Table 1, most participants were male (85%), Black (71%), and married (69%), with an average age of 47 years ( $SD = 8.42$ ) and some college education (49%). More than one third of the sample (35%) had graduated from college. About one third of the participants had been diagnosed with hypertension less than 1 year (36%), and approximately half had been prescribed two antihypertensive medications combined into one pill (50%).

In the current study, low medication adherence self-efficacy was found for 40 participants (29.4%), 31 (22.8%) had medium medication self-efficacy, and 65 (47.8%) had high medication adherence self-efficacy. More than one third of the participants (34.9%;  $n = 52$ ) were classified in the low medication adherence category, the same number (34.9%) were in the medium medication adherence category, and 45 participants (30.2%) were classified in the high medication adherence category. More than 75% of the participants had controlled blood pressures.

Self-monitoring of blood pressure (Table 1) was used to describe a participant's use of blood pressure monitoring outside of the provider's office, including home blood pressure monitoring. Home blood pressure monitoring was examined separately to determine its use by the current study participants (Table 2). The findings indicated that more than 70% of the participants ( $n = 103$ ) self-monitored their blood pressures at places other than their providers' offices, but less than half (41.6%) monitored their blood pressures at home. Almost half of the participants reported monitoring their blood pressures at the pharmacy (48.0%), and nearly one third of the participants monitored their blood pressures at a fire station (32.4%). Approximately 1 in 4 participants (24.8%) used blood pressure monitors at a large retail store, and 1 in 5 participants (20.9%) monitored their blood pressures at a family member's home. Other locations for monitoring were reported less frequently.

More than 75% of participants had their blood pressures controlled (Table 3). All of these participants self-reported that they were told that they had hypertension and that they were taking antihypertensive medication. The majority of participants (42.3%) selected less than 130/80 mmHg as their target blood pressure. Most participants denied being diabetic (87.8%) or taking diabetic medication (89.2%). The most frequently reported selections for number of antihypertensive medications and frequency of medication regimen were one pill (71.1%) and once-a-day dosing (87.2%). A majority of the participants (93.2%) self-reported a family history of hypertension.

## DISCUSSION

Despite the availability of effective medications, the JNC 7 treatment guidelines, and increased awareness, hypertension remains inadequately managed in the United States (Chobanian et al., 2003) and other countries (Whelton, He, & Muntner, 2004). The blood pressure control rate of 75.7% in this study population exceeded the goal of *Healthy People 2010*, which was to decrease uncontrolled blood pressure rates to 50% or less (U.S. Department of Health and Human Services, 2000). This finding was also consistent with the most recent trend in the United States (Egan, Yumin, & Axon, 2010). Furthermore, the blood pressure control rate for the current study also exceeded the blood pressure control rate in a study conducted by Sinsuesatkul (2008) several years earlier, who found a blood pressure control rate of 51.9% in the same population of workers. One potential reason for the hypertension control rate in the current study is that the study participants have access to insurance and participate in a workplace wellness program, which includes an annual health screening. In addition, these workers have the support of workplace wellness staff, including a nurse case manager, a nurse coordinator, and a nutritionist.

Self-monitoring of blood pressure produces more accurate blood pressure readings because it avoids "white coat"-related hypertension and blood pressure variability (Baguet & Mallion, 2002; Yarows, Julius, & Pickering, 2000). In addition, findings from a previous meta-analysis suggested that, self-monitoring of blood pressure may modestly improve blood pressure control and decrease the costs of hypertension treatment (Cappuccio, Kerry, Forbes, & Donald, 2004). A high rate of self-monitoring of blood pressure, particularly at home and the pharmacy, was found in the current study. Whereas other studies have

reported that 50% of their participants used home blood pressure monitoring (Cuspidi et al., 2003; Knight et al., 2001), the current study findings indicated that 70.5% of the participants self-monitored their blood pressures and 40% monitored their blood pressures at home. This high rate may be due to the popularity of home blood pressure monitoring and the availability of self-monitoring of blood pressure in the community, especially at local pharmacies and grocery stores. In addition, it is possible that the greater than 20-year history of a worksite wellness program and resulting wellness culture influenced these participants to monitor their blood pressures. Another possibility is that participants may have provided the socially desirable response (i.e., to report that they were self-monitoring).

Overall, only 22.8% of the current study participants were aware of the target blood pressure goal recommended by the national guidelines. On examination of participants' stage of change and self-monitoring of blood pressure, the majority of the participants in the maintenance stage of change (93.7%) used self-monitoring of blood pressure. However, only 3.25% of the participants in the precontemplation and preparation stages used self-monitoring of blood pressure. A large percentage of the participants had been diagnosed with hypertension for 1 year or less (36.2%) and 25.5% and 32.9% were diagnosed with hypertension for less than 5 years and for more than 5 years, respectively. Educational programs targeting workers newly diagnosed with hypertension may assist them in developing readiness for behavioral changes associated with disease management, including self-monitoring. Exploring options for self-monitoring in the community is a potentially promising alternative to requiring each client to purchase a blood pressure monitor (McManus et al., 2005).

Previous researchers have identified key barriers to medication adherence (e.g., lack of access to care, expense of medications, high co-payments, and medication side effects) and report that some clients simply forget to take their medications (American Society on Aging and American Society of Consultant Pharmacists Foundation, 2006; Osterberg & Blaschke, 2005; WHO, 2003). In the current study, 27% of the participants reported forgetting to take their medication yesterday and 40.9% had missed their medication in the past 2 weeks. These findings should be incorporated into targeted blood pressure control interventions. Almost half (47.8%) of the participants in the current study had high medication self-efficacy and 22.8% had medium medication self-efficacy.

Suboptimal treatment with medication may be a potential reason for uncontrolled blood pressures in this group. Findings indicated that only 7.5% of the study participants were taking diuretics. The most recent national guidelines by the JNC 7 recommend that the majority of clients with uncomplicated hypertension receive a diuretic in combination with another antihypertensive medication, preferably in a combination pill, to adequately control blood pressures. Yet, only 50.1% of the study participants were taking a combination pill to treat blood pressure, and 71.1% were taking only one medication.

## IMPLICATIONS FOR OCCUPATIONAL HEALTH NURSES

The occupational health nurse may consider assessing hypertensive individuals' stage of change and self-efficacy to determine their readiness for and confidence toward medication adherence, and provide interventions to move them to the maintenance stage of change and the belief that they can take their medications routinely. Employees should be aware of their blood pressure, target goal, and actions needed to address high readings. They should also be aware of reliable sites in the community where they can measure their blood pressure free of charge.

Motivational interviewing and health coaching are useful interventions to guide clients through the stages of change (Rubak, Sandbaek, Lauritzen, & Christensen, 2005). The



occupational health nurse should use the stage of change short survey to identify employees' stages of change. Using motivational interviewing and coaching techniques, specific interventions can be offered based on each employee's stage of change. For example, in the precontemplation stage, the occupational health nurse must ask the employee about medication adherence and blood pressure control, reflect the employee's response, and offer additional information on medication adherence and blood pressure control.

National guidelines recommend self-monitoring of blood pressure at home as a mechanism for individuals to achieve blood pressure control. In this study, less than half of employees used self-monitoring of blood pressure at home. Occupational health nurses should encourage employees to self-monitor their blood pressures and bring a record of the measurements to their primary care visit. Blood pressure monitors placed in convenient locations, such as break or lunch rooms, may encourage employees to self-monitor their blood pressures. In addition, the occupational health nurse should consider using self-monitoring as a routine intervention for hypertensive employees in the employee health clinic and offer home monitoring devices as incentives. Home blood pressure monitors can be displayed in the clinic with available prices. The occupational health nurse can offer instructions for correct cuff size and placement and monitor use.

## CONCLUSION

The vast majority of the study participants demonstrated controlled blood pressure, reported adherence to antihypertensive medications at least 80% of the time, and were in the maintenance stage of change. A high proportion of the study participants reported self-monitoring of blood pressure and believed they could routinely adhere to their blood pressure medication. Blood pressure control, medication adherence, and self-monitoring of blood pressure were higher than rates reported in the general population. Few study participants knew the target blood pressure goal recommended by the national guidelines. Focus groups with employees who had uncontrolled blood pressures and who were not self-monitoring blood pressure might be useful to ascertain barriers related to obtaining or maintaining blood pressure goals. Although the vast majority of the participants who self-monitored their blood pressure were in the maintenance stage of change, only a small percentage of the participants in the precontemplation and preparation stages self-monitored. Questionnaires to assess stage of change, medication adherence, and self-efficacy may be useful to health care providers as they implement interventions to improve blood pressure control. Self-monitoring in the community is potentially promising without requiring clients to purchase blood pressure monitors. Although antihypertensive medications have demonstrated efficacy in the treatment of hypertension, not all medications are effective for all clients. Therefore, individuals' blood pressures must be monitored closely to precisely adjust the most effective dose and medication.

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### Applying Research to practice

Self-report instruments may be useful to assess employees' stage of change, medication adherence, and medication adherence self-efficacy. Motivational interviewing may be an effective strategy to move employees through the stages of change, and barriers should be assessed to improve readiness, self-efficacy, and medication adherence. Sharing hypertension control success stories in the workplace may encourage self-efficacy for workers with hypertension. Blood pressure target goals and actions to address elevated readings should be provided routinely to workers with hypertension. Occupational health nurses should encourage employees to self-monitor their blood pressures and keep accurate blood pressure readings journals to routinely share with their health care providers during office visits. Number and dose of medications and the inclusion of a diuretic should be assessed for workers with hypertension to determine optimal treatment.

**Table 1**

Demographic and Clinical Characteristics of the Sample (N=149)

	n <sup>a</sup>	% <sup>b</sup>
Age (years)		
20–29	3	2.0
30–39	23	15.5
40–49	62	41.9
50–59	50	33.8
60	10	6.8
Marital status		
Married	102	69.4
Single	45	30.6
Race		
Black	103	71.0
White	37	25.5
Other	5	3.4
Education		
High school graduate	23	15.5
Some college	73	49.3
College graduate	52	35.1
Gender		
Male	126	85.1
Female	22	14.9
Length of time diagnosed with hypertension		
< 1 month	9	6.0
1–3 months	12	8.1
4–6 months	19	12.8
7–12 months	14	9.4
< 5 years	38	25.5
> 5 years	49	32.9
Don't know	8	5.4
Family history of hypertension		
Yes	138	93.2
No	4	2.7
Not sure	6	4.1
Told have diabetes		
Yes	18	12.2
No	130	87.8
Class of antihypertensive		
Diuretic	11	7.5
Beta-blocker	9	6.2
Calcium channel blocker	7	4.8

	<i>n</i> <sup><i>a</i></sup>	% <sup><i>b</i></sup>
Angiotensin-converting enzyme inhibitor	22	15.1
Combination	72	50.1
Angiotensin receptor blocker	16	11.0
Other	1	0.7
Don't know	7	4.8
Cut back medication due to side effects		
Yes	123	82.6
No	26	17.4
Number of medications		
1	106	71.1
2	31	20.8
3	12	8.1
Medication frequency		
Never	7	4.7
One or more times a week	2	1.3
One time a day	130	87.2
Two or more times a day	7	4.7
Not sure	3	2.0
Target blood pressure (mmHg)		
< 140/90	34	22.8
< 130/80	63	42.3
Some other value	11	7.4
Not sure	41	27.5

*Note.*

<sup>*a*</sup>Numbers may not total 149 due to missing data.

<sup>*b*</sup>Percentages may not total 100 due to rounding.

**Table 2**Location of Self-Monitoring of Blood Pressure Among Municipal Workers ( $N=103$ )

Location <sup>a</sup>	%
Pharmacy	48.0
Home	41.6
Fire station	32.4
Retail store	24.8
Family's home	20.9
Church	3.4
Friend's home	2.7

*Note.*

<sup>a</sup>Participants had the option to select more than one location.

**Table 3**

Key Categorical Variables (N= 149)

	n <sup>a</sup>	% <sup>b</sup>
<b>Blood pressure status</b>		
Controlled	112	75.7
Uncontrolled	36	24.3
Stage of change		
Precontemplation	9	6.5
Contemplation	0	-
Preparation	7	5.0
Action	0	-
Maintenance	123	88.5
Self-monitoring of blood pressure		
Yes	103	70.5
No	43	29.5

Note.

<sup>a</sup>Numbers may not total 149 due to missing data.

<sup>b</sup>Percentages may not total 100 due to rounding.