Hypertension Guideline Adherence Among Nursing Home Patients

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BACKGROUND: Adherence to hypertension guidelines in the outpatient setting is low.

OBJECTIVE: To evaluate adherence to JNC VII guidelines in nursing home patients.

DESIGN: Data were obtained from the 2004 National Nursing Home Survey (NNHS), a nationally representative sample of US nursing homes. Patients with hypertension were identified using ICD-9 codes. Adherence to JNC VII guidelines was defined as the use of a thiazide diuretic in patients without a compelling indication for a different class of antihypertensive medication, such as diabetes, chronic kidney disease, coronary artery disease, congestive heart failure, or a history of stroke.

PARTICIPANTS: There were 13,507 patients in the 2004 NNHS survey, of whom 7,129 had hypertension.

MAIN RESULTS: Of these 7,129 hypertensive patients, only 12.6% were on a thiazide. Out of the 7,129 hypertensive patients, 3,113 did not have diabetes, chronic kidney disease, coronary artery disease, congestive heart failure, or a history of stroke. Of these 3,113 patients, only 13.9% were on a thiazide. After excluding patients with a potential contraindication to a diuretic, such as hospice care or incontinence, only 18% were prescribed a thiazide. Of the 3,113 patients, 1,148 were on a single class of antihypertensive and more were prescribed a beta blocker, ACE inhibitor, calcium channel blocker, loop diuretic, and ARB than a thiazide diuretic.

CONCLUSIONS: Adherence to hypertension guidelines among nursing home patients is low. The appropriate use of thiazide diuretics could reduce costs and improve blood pressure control and patient outcomes.

KEY WORDS: hypertension; guideline adherence; nursing homes.

J Gen Intern Med 24(4):499-503

DOI: 10.1007/s11606-009-0920-1

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INTRODUCTION

Hypertension is increasingly prevalent and is a major risk factor for cardiovascular disease, stroke, kidney disease, and death.¹ Hypertension is especially prevalent in the elderly; over 1/2 of patients 60 to 69 years old and 3/4 of patients aged 70 and older have hypertension.¹ Given the high prevalence, morbidity, and mortality, numerous large randomized controlled trials have been conducted and provide evidence for optimal treatment of patients with hypertension.

Several guidelines exist for the treatment of hypertension, but the most widely accepted is the Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII).^{1,2} Based in part on the results of the ALLHAT trial, JNC VII recommends thiazide and thiazide-like diuretics, hereafter referred to as "thiazides," as the first-line antihypertensive agent in all patients without a compelling indication for another medication, such as diabetes, chronic kidney disease, coronary artery disease, congestive heart failure, or a history of stroke.¹⁻³

Despite the availability of JNC VII and other well-defined guidelines, only 40-60% of patients are prescribed antihypertensive medications in accordance with these recommendations.⁴⁻⁸ Asch et al. reported that blood pressure control was directly related to guideline adherence.⁹ Given the low rate of adherence, it is not surprising that only 30 to 60% of patients are at goal blood pressure.^{4,6,10-13} These data come from studies that evaluated hypertensive management in the outpatient setting. No study has evaluated adherence to hypertension guidelines or blood pressure control rates among nursing home residents. Adherence to hypertension guidelines among nursing home patients is important given the high prevalence of hypertension among the elderly and a recent study showing reduced mortality with treatment of hypertension in a group of patients over 80 years of age.¹⁴ Evaluating adherence in this high-risk group is also important because the elderly may be less likely to receive guideline-adherent care.¹³ The goal of this study was to evaluate adherence to JNC VII guidelines among nursing home residents.

METHODS

Data were obtained from the 2004 National Nursing Home Survey (NNHS), conducted between August and December of 2004. The NNHS is a nationally representative sample of US

Received October 10, 2008

Revised January 14, 2009

Accepted January 21, 2009

Published online February 7, 2009

nursing homes, their services, staff, and residents conducted by the Centers for Disease Control. The survey provides patient information, including demographic characteristics, ICD-9 diagnoses, medication use, services received, and sources of payment. Specifically, the survey includes ICD-9 codes for each subject's primary diagnosis and up to 15 secondary diagnoses. The medication file lists all medications taken the day before the survey as well as all regular medications not taken the day before the survey. The data were obtained through personal interviews with facility administrators and staff who used medical records to answer questions about patients. Nursing home patients were not interviewed.

Nursing homes were stratified by geographic location (state, county, and ZIP code), number of beds, and ownership status (profit versus not-for-profit). Nursing homes were selected by systematic sampling with the probability proportional to their bed size. Out of a total of 16,600 nursing homes, 1,500 were selected for the NNHS.

ICD-9 diagnosis codes between 401.x and 405.99 were used to identify all nursing home patients with a diagnosis of hypertension. Patients with a compelling indication for a different class of medication, such as diabetes, chronic kidney disease, coronary artery disease, congestive heart failure, or a history of stroke, were also identified using ICD-9 codes (see Table 1). Antihypertensive medications were classified according to JNC VII guidelines.¹ Each component of combination antihypertensives was considered separately. While JNC VII contains numerous recommendations, the measurable component within the NNHS data is medication use. Therefore, adherence to JNC VII guidelines was defined as the use of a thiazide diuretic in patients with hypertension. Adherence was evaluated in all patients with hypertension and separately in those without a compelling indication for a different class of medication.

Statistics

Adherence and overall frequencies of drug use, as well as drug use within certain diseases, are reported using percentages. Characteristics in adherent and non-adherent subjects were compared using Student's *t* test and chi-square test as appropriate. Results were adjusted for sample methodology that included stratification, clustering, and weighting.

A multivariate logistic regression model was developed to evaluate whether adherence was related to any facility or patient characteristics. Variables were selected on the basis of statistical significance on univariate analyses ($p \leq 0.25$) and

biological plausibility. Multivariate logistic regression was used to calculate adjusted odds ratios and 95% confidence intervals on predictors of interest. Our model included gender, ability of residents to walk and transfer, ability to perform activities of daily living (ADLs), bladder continence, presence of an indwelling catheter, number of total medications prescribed, nursing home size, and ownership status (profit versus not-for-profit). Walking ability was approximated by the degree of assistance received by the residents while ambulating in the room or hallway (none, received help, activity did not occur). Ability to transfer was assessed according to the degree of independence with transfers (independent, supervised, limited assistance, extensive assistance, total dependence). Ability to perform ADLs was examined as a binary outcome (5 ADLs vs. <5 ADLs). Patients were categorized either as "fully continent" or "incontinent." Patients with a Foley catheter were compared to those who did not have a catheter. Nursing homes were considered "small" if they had fewer than 100 beds and "large" otherwise. Finally, we compared guideline adherence in "for-profit" vs. "non-profit/government" owned nursing homes. Residents for whom survey information was missing were included in the analysis. Missing data points were replaced with the mode value for each variable. Nonlinearity of continuous variables was assessed using restricted cubic splines with knots at the 25th, 50th, and 75th percentiles. Interactions and confounding were examined by likelihood ratio tests comparing models with and without the covariate of interest. Model fit was evaluated through Pearson residuals, deviance statistics, and plots of deviance influence statistics.

The study was approved by the institutional review board of MetroHealth Medical Center in Cleveland, Ohio. All analyses were conducted using SAS, version 9.1 (SAS Institute Inc., Cary, NC).

RESULTS

For the 2004 NNHS, 1,500 nursing homes were selected. Of these, 283 refused to participate and 43 were considered out of scope. Within the 1,174 remaining nursing homes, 14,017 residents were sampled, of whom 8 were considered out of scope and 502 refused to participate. The final 2004 NNHS survey included 13,507 patients (overall response rate 78%), of which 7,129 had a diagnosis of hypertension. Out of the 7,129 with hypertension, 3,113 did not have diabetes, chronic kidney disease, coronary artery disease, congestive heart failure, or a history of stroke (see Fig. 1). Baseline demographic characteristics of the 7,129 patients with hypertension are shown in Table 2.

At least one antihypertensive was prescribed to 84% of the 7,129 patients with hypertension, and 52% of the patients were on more than one class of antihypertensive medication. Adherence to the JNC VII recommendation for a thiazide was low in all groups. Among all patients with hypertension ($n = 7,129$), only 12.6% were prescribed a thiazide diuretic. Of the 3,113 patients with hypertension without a compelling indication for another medication, only 13.9% were prescribed a thiazide diuretic.

The most common class of antihypertensive medication was beta blockers, followed by angiotensin-converting enzyme inhibitors (ACE-I), loop diuretics, calcium channel blockers, and then thiazide diuretics (see Table 3). Among hypertensive patients without a compelling indication for another medication,

Table 1. ICD-9 Codes Used to Identify Comorbid Conditions

Condition	ICD-9 codes
Diabetes	250.x through 250.99
Congestive heart failure	402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.x through 428.99
Coronary artery disease	410.x through 414.99 and 429.2
Stroke	433.x through 435.99
Chronic kidney disease	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, V42.0, V45.1, V56.0, V56.2, V56.31, V56.32, V56.8, and 585.x through 585.99

Figure 1. Flow diagram for patients in the 2004 National Nursing Home Survey (NNHS).

beta blockers were again most prescribed, followed by ACE-I, calcium channel blockers, loop diuretics, and then thiazide diuretics. Among hypertensive patients without a compelling indication for another medication on only one class of antihypertensive medication, beta blockers were most prescribed, followed by ACE-I, calcium channel blockers, loop diuretics, angiotensin receptor blockers, and finally thiazide diuretics.

Patients in a nursing home may have perceived contraindications to a thiazide diuretic, such as difficulty using the toilet independently. Therefore, we also examined adherence among hypertensive patients without a compelling indication for another medication who, according to survey responses, could independently use the toilet, required limited or no assistance with bed mobility, were at least usually continent, were not comatose, were not in hospice, were without medication restrictions, were not in a bladder training or continence management program, and did not have an external catheter. Among these 486 patients, only 18% were on a thiazide diuretic.

Factors associated with adherence to the thiazide recommendation among hypertensive patients without a compelling indication for another medication on multivariate analysis were female gender [odds ratio (OR) 1.30, 95% confidence interval (CI) 1.02 to 1.65; $p=0.03$], total number of medications (OR 1.09 for each increase in total medications, 95% CI 1.06 to 1.12; $p<0.001$), and being at a for-profit facility (OR 1.25, 95% CI 1.02 to 1.54; $p=0.007$).

DISCUSSION

Prior research has shown poor adherence to hypertension guidelines in the outpatient setting. Our study is the first to show low rates of adherence to JNC VII guidelines among nursing home patients. Adherence, defined as the use of a thiazide diuretic, was poor in all hypertensive patients, hypertensive patients without a compelling indication for another class of medications, and in a subset of the latter group even after excluding patients with other factors that might make a diuretic relatively contraindicated, such as incontinence and hospice care.

This study examined adherence to the thiazide recommendation among all nursing home residents with hypertension. As expected, the population was elderly and mostly female,

with a slightly higher percent of blacks than the general population. There was no difference in age between those on a thiazide and those not treated with a thiazide. However, a greater percentage of patients on a thiazide were female and black. The increased percentage of blacks on a thiazide may be explained by the known benefits of thiazides in blacks.^{1,3} The increased percentage of females on thiazides is puzzling given the higher risk of hyponatremia among women on thiazides.¹ Thiazide use was associated with an increasing number of overall medications, an association likely related to trends in polypharmacy. That is, patients on more medications are more likely to be on a thiazide. Finally, patients at for-profit nursing homes were more likely to receive thiazides, perhaps due to more aggressive cost reduction efforts at these facilities.

Our study has a number of strengths. First, the data come from a large nationally representative survey of nursing home patients. Therefore, the results are robust and likely to represent actual care received by nursing home patients in the US. Second, we accounted for patient comorbidities, which may affect recommended antihypertensive regimens.^{15,16} Finally, we clearly defined adherence as use of a thiazide diuretic.

There are a few limitations that must be recognized prior to interpreting our findings. First, blood pressures were not available, making it impossible to assess the percent of patients achieving guideline-recommended blood pressures. Second, our definition of adherence was based on medication use and comorbidities and did not account for other aspects of hypertension guideline adherence such as the initial diagnostic workup, follow-up care, and laboratory monitoring (e.g., lipid panel, creatinine, electrolytes).¹⁵ Another limitation is the cross-sectional nature of the data—the data lack information on prescription history and response to current treatment. Finally, we did not have access to information regarding allergies and adverse reactions to recommended medications.

It should also be noted that many of the nursing home patients in the survey had likely been treated for hypertension for many years. Therefore, the medications they were taking at the time of the survey may reflect continuation of medications prescribed under previous JNC recommendations, which

Table 2. Baseline Characteristics by Adherence Status for 7,129 Hypertensive Patients

Variable	On a thiazide (n=982)	Not on a thiazide (n=6,147)	P value
Age (mean)	81.1	81.7	0.12
Female (%)	76.5	72.2	0.02
Race (%)			0.01
White	80.4	84.1	
Black	18.3	13.9	
Other	1.3	2.0	
Past medical history (%)			
Diabetes	28.2	28.9	0.72
Congestive heart failure	16.2	22.0	<0.001
Coronary artery disease	18.8	23.3	0.01
Stroke	5.1	3.2	0.01
Chronic kidney disease	2.3	3.0	0.26
Any of the above	50.9	56.5	0.01

Table 3. Medication Use by Class of Antihypertensive Medication

Patient group	Class of antihypertensive medication						
	Thiazide diuretic	Loop diuretic	ACE-I*	ARB*	Calcium channel blocker	Beta blocker	Other†
	Percent (standard error)						
All hypertensive patients (n=7,129) ‡	12.6 (0.5)	32.3 (0.7)	32.6 (0.7)	8.9 (0.4)	26.9 (0.7)	37.2 (0.7)	11.6 (0.5)
Hypertensive patients without a compelling indication for another medication (n=3,113)‡	13.9 (0.7)	20.8 (0.9)	27.1 (0.9)	7.8 (0.6)	25.8 (1.0)	33.2 (1.0)	11.5 (0.7)
Hypertensive patients without a compelling indication on one class of antihypertensive (n=1,148)	4.7 (0.7)	12.9 (1.2)	21.6 (1.4)	4.9 (0.7)	20.6 (1.4)	30.9 (1.6)	3.8 (0.6)

*ACE-I indicates angiotensin-converting enzyme inhibitor; ARB indicates angiotensin receptor blocker

†Other includes potassium sparing diuretics, alpha blockers, centrally acting drugs, and vasodilators

‡Percentages in the first two rows total to greater than 100% as patients may be on more than one class of antihypertensive medication

included diuretics and beta blockers as first-line therapy.¹⁷ However, data collection for the 2004 NNHS occurred more than 1 year after publication of the JNC VII guidelines. Finally, while we observed adherence to guidelines within the nursing home population, the low rate of adherence might be reflective of adherence in elderly patients with hypertension who are not in a nursing home.

Despite guidelines being well published and easily available, adherence to guidelines is poor, with clinicians often overestimating their own adherence.^{18,19} Poor adherence to hypertension guidelines is likely multifactorial, including patient, system, and physician factors. Patient factors that contribute to poor adherence may include contraindications or allergies to recommended medications, prior non-response, and preferences for alternative approaches to treatment. Systems issues could include lack of availability or increased costs associated with recommended medications, albeit unlikely in the case of thiazide diuretics. Among nursing home patients, poor adherence could be related to the transition of care from the primary care physician to the nursing home physician and the resultant lack of continuity.

Physician factors leading to poor adherence may include simple lack of awareness of guidelines, disagreement with guidelines, and clinical inertia.²⁰ Physicians caring for the elderly may disagree with JNC VII recommendations and may be hesitant to treat hypertension because most are based on trials in younger populations. However, recent guidelines specific to the vulnerable elderly recommend treatment of hypertension, albeit without suggestion of a first-line agent in patients without comorbidities.²¹ Also, recent evidence suggests that treatment with a thiazide-like diuretic in subjects over 80 years of age reduces all-cause mortality.¹⁴

Improving adherence to hypertension guidelines may decrease morbidity and mortality, and reduce costs. A recent study in patients over 80 years of age showed a reduction in all-cause mortality with a thiazide-like diuretic as compared to placebo.¹⁴ With regard to cost, while the majority of patients with hypertension live in the community, more than 15 percent of patients with hypertension older than 85 years reside in nursing homes.²² Thiazides cost less than 20 cents per day, while more expensive ACE-I, beta blockers, and calcium channel blockers often cost well over 1 dollar per day. Given the clinical benefits of thiazides and the prevalence of hypertension, this difference represents a significant potential cost savings.

Methods to improve adherence to guidelines have been evaluated. Simon et al. performed a cluster-randomized controlled trial of a method borrowed from the pharmaceutical industry—academic detailing.²³ At 1 year, practices randomized to group detailing increased rates of recommended antihypertensive medications by 13.2% compared to a 12.5% increase in practices randomized to individual detailing with only a 6.2% increase observed in the usual care practices.²³ Other methods shown to improve guideline adherence range from national guideline development and dissemination programs to patient-specific advisories to physicians.^{24–26}

Conclusion

Hypertension is a leading cause of morbidity and mortality, especially among the elderly. Guidelines have been developed for the diagnosis and treatment of hypertension. Despite the availability of these guidelines, numerous studies have shown that patients receive suboptimal care in the outpatient setting. We are the first to report poor adherence among nursing home patients, a group of patients that, despite their advanced age, is likely to benefit from appropriate treatment of hypertension.¹⁴ The poor adherence to JNC VII guidelines within this cohort may reflect the use of more expensive antihypertensive medications in non-nursing home patients of similar demographics.

Acknowledgements: The authors would like to thank Mahboob Rahman, MD, MS, for critical review of the manuscript.

Author Contributions: Study concept and design: Drawz, Bocirnea, Greer, Kim, Rader, Murray

Acquisition of data: publicly available data

Analysis and interpretation of data: Drawz, Bocirnea, Greer, Kim, Rader, Murray

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Funding: The study was funded in part through NIH training grant 5T32DK007470-23 (P.E.D.) and NIH award K23 CA109115-01A2 (J.A.K.). The data have not been previously presented.

Conflict of Interest: None disclosed.

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