

WORKING P A P E R

Quality Indicators of Hypertension for Vulnerable Elder Persons

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**QUALITY INDICATORS OF HYPERTENSION
FOR VULNERABLE ELDER PERSONS**

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Introduction

Approximately 35 percent of community dwelling people over 65 years of age are hypertensive.(1,2) A similar prevalence is found among nursing home residents.(3) Hypertensive older adults experience cardiovascular events at a rate 2-3 times higher than that of younger individuals with the same systolic and diastolic blood pressure.(4) Among older adults with mild hypertension, nonpharmacologic therapies are effective in lowering blood pressure, and may eliminate the need for pharmacotherapy.(5-12) Among those who require pharmacologic therapy, these agents reduce cardiovascular morbidity and mortality.(13-15) However, only 53% of the hypertensive population is treated with anti-hypertensive medications, and blood pressure control is achieved in just over 40% of these patients.(16) The hypertension treatment received by older patients often does not conform to treatment recommendations.(17) This suggests that improving quality of care for the vulnerable elderly population could lead to substantial reductions in morbidity and mortality.

Methods

The methods for developing these quality indicators, including literature review and expert panel consideration, are detailed in a preceding paper.(18) For hypertension, the structured literature review identified 13,671 titles, from which abstracts and articles were identified that were relevant to this report. Based on the literature and the authors' expertise, 18 potential quality indicators were proposed.

Results

Of the 18 potential quality indicators, 8 were judged valid by the expert panel process (Table 1), one was merged with another indicator and 9 were not accepted. The evidence that supports each of the indicators judged to be valid by the expert panel process is described below.

Quality Indicator #1

Electrocardiographic testing for New Hypertension

IF a vulnerable elder is newly diagnosed with hypertension, **THEN** within 4 weeks of the diagnosis an electrocardiogram should be performed **BECAUSE** this will assess for the presence of left ventricular hypertrophy, which will risk stratify the patient and suggest the need for further evaluation.

Supporting Evidence: We identified no studies that assessed the relationship between the performance of an electrocardiogram (ECG) and the success of antihypertensive therapy. However, an indirect line of evidence links the performance of an ECG with better outcomes from hypertension treatment. Left ventricular hypertrophy is an important prognostic factor for patients with hypertension.(19,20) This finding can guide the aggressiveness of hypertensive therapy. Treatment of hypertension can lead to improvement in ventricular hypertrophy.(21) Though insensitive compared to an echocardiogram,(22) an ECG is an inexpensive, non-invasive method of identifying left ventricular hypertrophy. An ECG at the time of a new hypertension diagnosis is recommended by the Sixth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC VI),(23) the National High Blood Pressure Education Program Working Group on Hypertension in the Elderly (NHBPEP),(24) and the World Health Organization (WHO) Expert Committee Report on Hypertension Control.(25)

Other historical queries and diagnostic tests are suggested for the patient newly diagnosed with hypertension in order to identify secondary hypertension or to guide therapy. History items include alcohol use.(23) Laboratory testing includes a urinalysis, and blood tests for creatinine, potassium, glucose, thyroid stimulating hormone, and cholesterol.(23,24,25) However these evaluations were not accepted as an essential part of the work-up of newly discovered hypertension among vulnerable elders by the expert panel.

Quality Indicator #2

Cardiovascular Risk Stratification for Patients with New Hypertension

IF a vulnerable elder is newly diagnosed with hypertension, **THEN** there should be documentation regarding the presence or absence of other cardiovascular risk factors **BECAUSE** knowledge regarding the presence or absence of these risk factors will allow for stratification of the patient's risk for developing cardiovascular disease.

Supporting Evidence: There is no direct evidence that documentation of cardiovascular risk factors will result in risk stratification and/or improved patient outcomes. However, hypertensive patients are at increased risk of having additional risk factors for cardiovascular disease. Clusters of three or more cardiovascular risk factors (glucose intolerance, obesity, left ventricular hypertrophy, and dislipidemia) occur in hypertensive patients at four times the rate that would be expected by chance.(26) In a study of a Japanese cohort of outpatients, hypertension was independently associated with the number of cardiovascular risk factors after adjusting for age, sex, alcohol consumption, cigarette smoking and physical exercise.(27) The odds ratio (95% confidence interval) for the relationship between a patient having three risk factors and hypertension was 8.7 (6.5-11.7). The JNC VI suggests assessing six major risk factors for cardiovascular disease: smoking, dyslipidaemia, diabetes, older age, male gender and a family history of cardiovascular disease.(23) Only if risk factors are assessed, can targeted preventive or diagnostic interventions be instituted to decrease the chance of cardiovascular events. The NHBPEP (24) and the WHO Expert Committee Report on Hypertension Control (25) recommend addressing risk factors for cardiovascular disease among older patients with hypertension.

Quality Indicator #3

Ascertaining the Hypertension Diagnosis

IF a vulnerable elder is diagnosed with hypertension and the blood pressure is below 170/90, **THEN** there should be evidence that 3 or more blood pressure measures of $\geq 140/90$ were obtained prior to the diagnosis **BECAUSE** treatment of vulnerable elders who are not actually hypertensive may have adverse effects, contribute to polypharmacy and unnecessary costs, and may have a negative “labeling” effect.

Supporting Evidence: Single office blood pressure readings may provide false-positive hypertension results. One study of 292 patients diagnosed with mild to moderate hypertension (diastolic blood pressure 90 – 104) in a clinic found that one-fifth were normotensive when out-of-clinic blood pressure monitoring was performed.(28) Consistent with the term “white coat hypertension,” this effect was more common when the blood pressure was taken by a physician. However, errors in blood pressure monitoring can occur for several reasons, including errors in the instrument, observer and patient.(29) Thus, the JNC VI recommends that hypertension not be diagnosed until more than one elevated blood pressure reading is obtained on each of three separate visits over a period of one to several weeks.(23) Three prospective studies have found office blood pressure readings to be higher than home digital, sphygmomanometer or 24-hour ambulatory blood pressure readings in patients with hypertension.(30-32)

Older persons are especially vulnerable to the side effects of antihypertensive medication. They may develop orthostatic hypotension, which may lead to falls and significant morbidity, and they are more likely to develop adverse end organ responses to pharmacologic agents. In addition, many of the non-pharmacologic treatments, such as sodium restriction and weight loss, may have adverse effects in the elderly. Unneeded medications added for an inaccurate diagnosis of hypertension may interact with other medications taken by older patients. Furthermore, the effect of labeling an individual as hypertensive, apart from any treatment effect, can have a deleterious impact on perceived health.(33)

Quality Indicator #4

Nonpharmacologic Management of Hypertension

IF a vulnerable elder is diagnosed with hypertension, **THEN** nonpharmacologic therapy with lifestyle modification for treatment of hypertension should be recommended, including:

- dietary sodium restriction, and
- weight loss if patient is > 10% over ideal body weight

BECAUSE successful nonpharmacologic therapy can lower blood pressure with little cost and minimal risk.

Supporting Evidence: Randomized clinical trials have shown that nonpharmacologic therapy is effective in lowering blood pressure, although it has not been shown to reduce cardiovascular morbidity or mortality. Consensus statements from the JNCVI,(23) the NHBPEP,(24) and the WHO Expert Committee (25) all recommend lifestyle changes including sodium restriction and weight loss for the control of mild to moderate hypertension.

Sodium Restriction

Salt restriction has been extensively studied in randomized clinical trials and in cross-sectional population studies. These show statistically significant, small clinical effects of sodium on blood pressure. A large meta-analysis of the dietary effect of sodium on blood pressure evaluated 56 randomized clinical trials that included 2035 normotensive and 986 hypertensive patients.(5) The median ages of the hypertensive and normotensive groups were 47 and 26 years, respectively. The mean length of intervention was 29 days in the hypertensive group and 14 days in the normotensive group. On average, hypertensive patients experienced a 3.7 mmHg decrease in systolic blood pressure per 100 mmol decrease in urinary sodium and normotensive patients experienced a 1.0 mmHg decrease in blood pressure per 100 mmol of urinary sodium reduction. A greater reduction in systolic pressure was noted for hypertensive persons over age 45 (6.3 mmHg decrease in blood pressure per 100 mmol of urinary sodium). Likewise, a cross-sectional analysis of 52 population samples across 32 countries including 10,074 subjects age 20 to 59 found that

for every increase of 100 mmol of urinary sodium/day, there was an increase in blood pressure of 4.5 mmHg systolic and 2.3 mmHg diastolic for all ages, with a greater rise in older individuals.(6)

More recent randomized clinical trials have assessed the effects of sodium restriction on blood pressure. The Trial of Nonpharmacologic Intervention in the Elderly (TONE) (7) studied secondary prevention, while the Trial of Hypertension Prevention, phase II (TOHP II) (8) studied primary prevention. The TONE assessed the effects of sodium restriction to < 1800 mg/day on 875 patients age 60 to 80 with mild hypertension, who were treated with a single agent. This medication was withdrawn and dietary therapy was instituted. After an average follow-up of 29 months, 38% of the patients assigned to sodium restriction maintained blood pressures of less than 150/90 mmHg without pharmacologic agents with a mean drop in blood pressure of 3.4 mmHg systolic and 1.9 mmHg diastolic. The TOHP II studied the effect of sodium restriction on the incidence of hypertension among 2382 overweight individuals age 30 to 54 that were followed for three to four years. The prescribed diet limited sodium to less than 80 mmol/day. The results showed a statistically significant, though clinically small, reduction in systolic blood pressure of 2.9 mmHg at six months and 1.2 mmHg at 36 months.

Since the development of these indicators, additional support for lowering sodium intake to control blood pressure comes from the DASH-Sodium Collaborative Trial, in which 412 participants with and without hypertension were randomized to eat either a typical American diet or the DASH diet that emphasizes fruits, vegetables, and low-fat dairy products. Further, each group was randomized to eat foods with high, intermediate, and low sodium content. Whether eating an American diet or the DASH diet, there was a graded decrease in blood pressure associated with decreasing sodium intake, which was greater in participants with hypertension than in participants without hypertension. Compared to hypertensive participants eating an American high sodium diet, hypertensive patients eating a DASH low sodium diet had a decrease in mean systolic blood pressure of 11.5 mmHg.(34)

Weight Loss

Three randomized, controlled clinical trials have focused on the effects of weight loss on hypertension. The TONE assessed the role of weight loss in hypertensive elderly patients.(7) Of the 875

patients enrolled in TONE, 585 were obese, with a body mass index >27.8 for men and > 27.3 for women. Over the 30 months of the trial, 39% of patients with an average of 3.5 kg of weight loss remained off of hypertensive medication with a blood pressure < 150/90. The average blood pressure reduction was modest: 4.0 mmHg systolic and 1.1 mmHg diastolic.

Quality Indicator #5

Pharmacologic Management of Hypertension

IF a vulnerable elder remains hypertensive after non-pharmacologic intervention, **THEN** pharmacologic anti-hypertensive treatment should be initiated **BECAUSE** pharmacologic treatment will reduce cardiovascular morbidity, cardiovascular mortality, and overall mortality.

Supporting Evidence: A number of large, randomized, placebo controlled trials demonstrate that treatment of hypertension with pharmacologic agents reduces overall mortality among elders. In general, the blood pressure lowering effects in these trials are much larger than the effects achieved with non-pharmacologic treatment. A meta-analysis of nine randomized clinical trials including 15,559 patients assessed the effect of pharmacologic treatment of hypertension on morbidity and mortality in healthy patients age 60 and older (13) with an average blood pressure of 180/98 mmHg. All of the trials included stepped care (sequential use of one or more drugs), except for one that used only methyldopa. All the stepped care trials included diuretics, and five included beta blockers. Treated patients showed significant reductions in morbidity and mortality. Overall, the meta-analysis found that mortality was reduced by 12%. There was a 36% reduction in stroke-related mortality and a 35% reduction in stroke-related morbidity. Cardiac morbidity and mortality were reduced by 25% and 15%, respectively. For patients in the six trials that reported data on blood pressure, the average reduction in blood pressure at 5 years was 17 mmHg systolic and 8.7 mmHg diastolic.

In another meta-analysis, five placebo-controlled trials of 12,483 patients over 60 years of age were pooled to assess the effect of pharmacologic treatment of hypertension on blood pressure and cardiovascular disease.(14) Mean age at study entry was 72 years and mean blood pressure was 181/88 mmHg. After a mean duration of 4.7 years, patients treated with either diuretics or beta blockers alone, or a combination of the two, achieved a reduction in blood pressure of 14 mmHg systolic and 6 mmHg diastolic. Treatment with antihypertensive agents was associated with a reduction in stroke incidence of 34% and a reduction in coronary heart disease incidence of 19%. Vascular deaths were reduced by 23% and overall mortality was reduced significantly by 11%. The proportional reductions were similar to those seen in trials of younger patients, but the absolute reductions were greater. The Systolic Hypertension in the Elderly Program trial (SHEP), enrolled 4736 subjects 60 years and older with isolated systolic hypertension in a randomized, double-blind, placebo controlled trial. Over five years, subjects were treated with pharmacologic regimens consisting of chlorthalidone and atenolol and evaluated for cardiovascular events. Antihypertensive treatment was associated with a 5-year reduction in the incidence of stroke (relative risk (RR) = 0.64, 95% confidence interval (CI) 0.50, 0.82) and the combined end point of nonfatal myocardial infarction or coronary death (RR = 0.73, 95% CI 0.57, 0.94). Overall, major cardiovascular events were reduced by 55 per 1000 persons over the 5 years. Patients over age 80 responded in a fashion similar to younger patients.(15)

Since these indicators were developed, two clinical trials have been published with important implications for elderly patients. The INSIGHT trial randomized 6321 hypertensive men and women age 55-80 to receive nifedipine or a diuretic. Persons over the age of 70 comprised about 28% of the enrolled population. There was no difference between groups in all-cause mortality or the primary endpoints of cardiovascular death, myocardial infarction, heart failure, or stroke.(35) This study establishes that nifedipine has cardiovascular and mortality outcomes equivalent to diuretics.

The other report with important implications for elders is the ALLHAT study.(36) This trial assessed the effectiveness of a variety of antihypertensive regimens in more than 25,000 patients. The average age of patients was 67. On the basis of interim analyses, the Data Safety and Monitoring Board

recommended the premature termination of the trial for those patients randomized to doxazosin monotherapy due to an increase in combined cardiovascular events, particularly heart failure, when compared to patients treated with diuretics. This study suggests that doxazosin is inappropriate monotherapy for patients with hypertension.

Despite the fact that older patients clearly benefit from pharmacologic hypertension control, this benefit appears to diminish among the very old. Attenuated benefit of hypertension treatment in patients over age 75-80 has been shown in subgroup analyses of three randomized clinical trials.(37-39) Overall, the trials tended to show significant reductions in cardiovascular mortality for the oldest old. However these reductions in cardiovascular and cerebrovascular death and morbidity were less statistically significant for those over 75-80 years of age compared to younger cohorts.

The JNC VI,(23) the NHBPEP,(24) and the WHO Expert Committee (25) all advocate the treatment of hypertension with pharmacologic agents if non-pharmacologic measures were unsuccessful, regardless of age.

Quality Indicator #6

Avoiding Short-Acting Antihypertensive Medications

IF a vulnerable elder requires pharmacotherapy for treatment of hypertension in the outpatient setting, **THEN** a longer acting once daily or twice daily medication should be used unless there is documentation regarding the need for agents that require more frequent dosing **BECAUSE** this will enhance patient adherence and decrease abrupt increases in the blood pressure in the morning, when patients are at increased risk of stroke or myocardial infarction.

Supporting Evidence: Adherence to antihypertensive medications is critical for achieving long-term blood pressure control. However, many studies show that adherence to antihypertensive agents is inadequate. A study based on pharmacy data evaluated medications dispensed to 4608 patients over age

65 with newly diagnosed hypertension.(40) Only 23% of the patients achieved good levels of medication adherence (80% or better) as measured by refill records. The average patient had antihypertensive medication available for only 179 (49%) days of the year. An observational study of older patients demonstrated that poor medication adherence was associated with inadequate blood pressure control.(41) In this study, the oldest old had worse adherence than younger patients. These findings are consistent with nationally representative data showing that only about one quarter of patients with hypertension have controlled blood pressure.(16)

Many studies have demonstrated that medications taken fewer times per day have better levels of adherence.(42) This was shown among patients with hypertension in a retrospective analysis of 105 patients.(43) In this study, patients demonstrated 84% adherence with once daily dosing, 75% with twice daily dosing and 59% with medications taken 3 times daily. The JNC VI recommends the use of long acting antihypertensive agents to improve patient compliance.(23)

Quality Indicator #7

ACE Inhibitors for Hypertension with Nephropathy

IF a vulnerable elder has hypertension and has renal parenchymal disease with a serum creatinine >1.5 mg/dL or >1 gram of protein/24 hours of collected urine, **THEN** therapy with an ACE inhibitor should be offered **BECAUSE** ACE inhibition may delay progression toward end stage renal disease and dialysis.

Supporting Evidence: A meta-analysis of ten randomized controlled trials demonstrated that ACE inhibitors delay progression of nephropathy in nondiabetic patients.(44) The analysis included all randomized clinical trials with at least one year of follow-up that compared the effectiveness of ACE inhibitors with other antihypertensive agents in delaying the progression of nondiabetic renal disease. A total of 1,594 patients ages 44 to 65 were included. Nephropathy was mild in three studies (serum creatinine = 1.0 to 1.8 mg/dL), moderate in five studies (serum creatinine = 2.1 to 3.0 mg/dL) and severe

in two studies (serum creatinine = 4.2 to 4.4 mg/dL). Eight hundred six patients received ACE inhibitors and 788 patients received other antihypertensives. Overall, ACE inhibitors were associated with a greater reduction in blood pressure than the other agents studied (mean difference 4.9 mmHg systolic and 1.2 mmHg diastolic). ACE inhibitors also significantly decreased the risk of progression to end stage renal disease as compared to other antihypertensives, with a relative risk of 0.7 (95% CI 0.51, 0.97). Studies in vulnerable elders are not yet available.

Quality Indicator #8

Avoid Beta Blockers for Patients with Asthma

IF a vulnerable elder has hypertension and asthma, **THEN** beta blocker therapy for hypertension should not be used **BECAUSE** these agent may induce bronchoconstriction and exacerbate asthma.

Supporting Evidence: Four small randomized, prospective trials have demonstrated that beta-blocker therapy may induce bronchoconstriction in patients with asthma and chronic obstructive pulmonary disease.(45-48) None of these trials included older adults. Among patients with asthma or COPD, those receiving a cardioselective beta antagonist have less bronchoconstriction and a greater response to inhaled beta-agonists than do patients treated with nonselective beta antagonists. The effect of beta blockers on asthma and COPD is poorly studied because of the ethical dilemmas in treating patients with reactive airway disease with beta-blocker therapy.

DISCUSSION

This paper presents indicators of the quality of hypertension care for vulnerable elders. Hypertension is very common in older persons and easily treated. However, it is under-diagnosed and often inadequately treated. Thus, hypertension is responsible for substantial morbidity and mortality among older persons.

Improvements in processes of care for hypertension may lead to substantial improvements in patient outcomes. Eight indicators of these care processes were judged sufficiently valid for use as measures of quality of hypertension management for vulnerable elders. These indicators can potentially serve as a basis to compare the care provided by different health care delivery systems and for comparing the change in care over time.

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**Table 1. Quality Indicators Judged by the Expert Panel as Valid
for the Assessment of Hypertension in Vulnerable Elders**

<p>Quality Indicator #1 IF a vulnerable elder is diagnosed with hypertension and the BP is below 170/90, THEN there should be evidence that 3 or more blood pressure measures of $\geq 140/90$ were obtained prior to the diagnosis.</p>
<p>Quality Indicator #2 IF a vulnerable elder is newly diagnosed with hypertension, THEN within 4 weeks of the diagnosis an electrocardiogram should be performed.</p>
<p>Quality Indicator #3 IF a vulnerable elder is newly diagnosed with hypertension, THEN there should be documentation regarding the presence or absence of other cardiovascular risk factors.</p>
<p>Quality Indicator #4 IF a vulnerable elder is diagnosed with hypertension, THEN nonpharmacologic therapy with lifestyle modification for treatment of hypertension should be recommended, including: dietary sodium restriction and weight loss if patient is > 10% over ideal body weight.</p>
<p>Quality Indicator #5 IF a vulnerable elder remains hypertensive after non non-pharmacologic intervention, THEN pharmacologic anti-hypertensive treatment should be initiated.</p>
<p>Quality Indicator #6 IF a vulnerable elder requires pharmacotherapy for treatment of hypertension in the outpatient setting, THEN a longer acting once daily or twice daily medication should be used unless there is documentation regarding the need for agents that require more frequent dosing.</p>
<p>Quality Indicator #7 IF a vulnerable elder has hypertension and has renal parenchymal disease with a serum creatinine >1.5 mg/dL or > 1 gram of protein/24 hours of collected urine, THEN therapy with an ACE inhibitor should be offered.</p>
<p>Quality Indicator #8 IF vulnerable elder has hypertension and asthma, THEN beta blocker therapy for hypertension should not be used.</p>

Related Quality Indicators for Hypertension

Check blood pressure at each outpatient visit for patients with diabetes (Diabetes #5)
Control blood pressure for patients with diabetes (Diabetes #7)
Basic fall evaluation including orthostatic blood pressure check (Falls #3)
Education for initiation of new medication (Medication #2)
Follow-up on therapeutic effect of new medication (Medication #4)
Annual electrolyte monitoring for diuretics (Medication #7)
Check potassium and creatinine after starting ACEI or diuretic (Medication #12)