

Explicit and Implicit Evaluation of Physician Adherence to Hypertension Guidelines

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This study evaluated physician adherence to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) hypertension guidelines in 6 community-based clinics. Explicit review of retrospective medical record data for patients with uncontrolled hypertension measured guideline adherence using 22 criteria. Mean overall guideline adherence was 53.5% and did not improve significantly over time. Random-effects models demonstrated significant associations between guideline adherence and various demographic and medical predictors, including age, minority status, comorbid conditions, and number of medications. A subsequent implicit review evaluated the degree to which nonadherence was justifiable and identified factors that might have affected adherence. Nonadherence was rated as justifiable for only 6.6% of the failed explicit criteria. In general, adherence to the JNC 7 guidelines was modest even when barriers that might have affected adherence were taken into consideration. (J Clin Hypertens. 2007;9:113–119) ©2007 Le Jacq

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An estimated 59 million persons in the United States have hypertension.¹ Despite the publication by the National Heart, Lung, and Blood Institute of 7 sets of guidelines for the management of hypertension, blood pressure (BP) is controlled to recommended levels for only about 34% of persons with hypertension.² One possible explanation for low control rates is poor physician adherence to guidelines. Several studies have examined physician adherence and arrived at differing conclusions.^{3–16} These studies, however, failed to evaluate multiple aspects of care, describe adherence of patients with specific comorbid conditions, use both explicit and implicit reviews, or consider factors that might explain instances of nonadherence.¹⁷

The goals of this study were to: (1) describe physician adherence to the guidelines of the Seventh Report of the Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)² for patients with uncontrolled hypertension using a set of explicit criteria; (2) evaluate adherence in subpopulations with specific comorbid conditions; (3) detect any trend in adherence following release of the guidelines; (4) evaluate the degree to which nonadherence is justified; and (5) identify barriers that might contribute to poor adherence. Unique features of this evaluation include a comprehensive review of medical records and the inclusion of community-based primary care practices.

MATERIALS AND METHODS

The study was conducted at 6 family medicine community-based residency training offices in Iowa and approved by each site's institutional review board and by the University of Iowa institutional review board. All subjects gave informed consent,



Table I. Eligibility Criteria

Inclusion
Age at least 21 years
Average blood pressure 135–179 mm Hg systolic or 85–109 mm Hg diastolic for patients with diabetes, otherwise 145–179 mm Hg systolic or 95–109 mm Hg diastolic
Taking 0–3 antihypertensive medications
No change in medication regimen in the past 4 weeks
Exclusion
Clinic blood pressure \geq 180 mm Hg systolic or \geq 110 mm Hg diastolic
Evidence of hypertensive emergency
Myocardial infarction in the past 6 months
New York Heart Association class III or IV heart failure
Unstable angina
Serious renal or hepatic disease
Pregnancy
Life expectancy shorter than 3 years
Dementia or other cognitive impairment

and all procedures were followed in accordance with institutional guidelines.

No formalized, structured training was provided on the management of hypertension or the JNC 7 report before this investigation, but all 6 sites had clinical pharmacists who were members of the training faculty and who had frequent contact with the physicians about specific patients. All physicians also received educational updates on hypertension from the clinical pharmacy faculty members before this study.

Medical Record Abstraction. Six clinic study coordinators, each a nursing staff member, enrolled patients and abstracted medical record data. Participants were identified through prescriptions for antihypertensive medications, diagnostic coding for hypertension, and physician referral. Patient eligibility criteria appear in Table I. Enrollment took place from February 2004 to October 2004.

Study coordinators were trained in medical record abstraction during six 90-minute joint meetings over the Iowa communications network and given comprehensive written instructions. An index visit was identified for each patient, and a standardized form was used to abstract the following data elements for the 18-month period before and including the index visit: demographics, medical and family history, comorbid conditions, clinic visit dates, BPs, weights, medications, lifestyle recommendations, laboratory values, and consultations. Because the study was retrospective, there were no controls on measuring

clinic BPs. Study coordinators photocopied patient summary sheets, medication sheets, physician notes that mentioned hypertension, reports of electrocardiograms (ECGs), hospital admission and discharge information, and referral and consultation reports. All patient, physician, hospital, worksite, and geographic identifiers were redacted, yielding blinded abstracts.

An investigator (GA) audited the first 33 abstracts for accuracy and found an error rate of 1.1% for 5027 unique data elements. Each error was corrected, and study coordinators were instructed on how to avoid future errors. The investigator subsequently compared every submitted abstract form with the photocopied records to verify accuracy and make corrections when needed. Data were double-entered into a computer database.

Evaluation of Physician Adherence. Physician adherence was evaluated using both explicit and implicit methods. The explicit review used 22 criteria created by 3 hypertension experts to measure guideline adherence; its reliability has been described previously.¹⁸ A computerized algorithm assigned a score for each of the explicit criteria. Due to the extensive time required to review each case using implicit methods, a random sample of 73 cases (21.2%) stratified by site were evaluated by implicit review. Two blinded investigators (BLC, GRB) independently conducted the implicit review, reading every progress note, laboratory report, and discharge summary that addressed hypertension. Investigators identified patient, physician, and system factors that might have influenced adherence in each case and rated physician failure to adhere to each explicit criterion as justifiable or not justifiable. Nonadherence was judged justifiable when a patient, health system, or other factor beyond physician control was identified that might have influenced adherence to a criterion. Investigators also rated the overall quality of care using a 7-point Likert-type scale (1=very poor, 7=excellent).

Data Analyses. Physician adherence scores were calculated for each patient during the 6-month period before and including the index visit. A mean overall adherence score described the percent of physician adherence to all applicable criteria. Since the study design involved potential hierarchical effects of physician and clinic, random-effects models were used to adjust for these effects, as necessary, when testing for significant predictors of the adherence scores. Predictors of interest primarily consisted of demographic and medical factors. We also compared adherence scores for patients

CRITERIA EVALUATED ONCE DURING THE ENTIRE AUDIT PERIOD	PATIENTS, % (No.)*
All major cardiovascular risk factors are documented	62.2 (199/320)
A recommended goal blood pressure (BP) is documented	4.4 (15/345)
Patient provided with goal BP	62.5 (5/8)
Patient treated with a thiazide or a loop diuretic when appropriate	69.9 (241/345)
Appropriate pharmacologic treatment for patients with:	
Heart failure	93.3 (14/15)
History of myocardial infarction	95.0 (19/20)
Coronary artery disease	100 (40/40)
Diabetes	100 (149/149)
History of stroke or transient ischemic attack	94.4 (17/18)
Chronic kidney disease	77.8 (49/63)
Fasting lipid profile measured within the past 12 months	51.9 (179/345)
Patients with diabetes or chronic kidney disease screened for urine albumin	29.1 (52/179)
Serum creatinine measured within the past 12 months	79.7 (275/345)
Blood glucose measured within the past 12 months	58.3 (201/345)
Hematocrit measured within the past 12 months	31.9 (110/345)
Potassium level measured within the past 12 months	78.8 (272/345)
Calcium level measured within the past 12 months	62.6 (216/345)
An electrocardiogram has ever been performed	41.5 (143/345)
CRITERIA EVALUATED DURING MULTIPLE VISITS	VISITS, % (No.†)
When BP is not controlled, a return visit occurs within 1 month (35 days)	39.8 (270/678)
Absence of BP control referenced in progress note	62.2 (483/776)
Medication increased or changed when BP uncontrolled	55.9 (434/776)
Discussion of lifestyle recommendations documented	21.5 (183/853)

*Number of patients for whom criterion was met divided by number of patients for whom criterion applied. †Number of visits at which criterion was met divided by number of visits at which criterion applied.

enrolled during 3 distinct 3-month time periods between February 2004 and October 2004 to assess whether adherence improved following the release of the guidelines in 2003. Each risk factor was considered by itself in univariate analyses, after which a manual stepwise procedure was implemented to find a multivariate regression model.

Analyses of implicit review included: (1) mean number of extenuating factors identified per case; (2) mean percent of failed criteria that were judged to be justifiable; and (3) mean score for overall quality of care. A Spearman correlation coefficient test evaluated the inter-rater reliability of the 2 reviewers' ratings for overall quality of care.

RESULTS

Subjects. The study included 345 patients who were mostly white (71.4%) women (61.3%), with a mean age of 60.0±14.7 years (range, 22–99 years). The most frequent payment sources were Medicare (38.2%) and private insurance (37.3%); 27.4% had documented prescription coverage. Chronic comorbid conditions included dyslipidemia (63.2%), diabetes (40.9%), chronic kidney

disease (18.3%), and coronary artery disease (CAD) (13.9%).

Explicit Adherence Scores. Table II reports scores for the 22 individual explicit criteria. Documentation of all cardiovascular risk factors occurred for 62.2% of patients, but only 4.4% had a goal BP documented. Most (69.9%) were treated with a thiazide diuretic or a loop diuretic when appropriate. Most patients with specific comorbid conditions received at least 1 appropriate drug therapy recommended by JNC 7. Adherence to specific laboratory monitoring criteria varied widely (range, 29.1%–79.7%). ECG documentation existed for 41.5% of patients.

Physicians provided moderately intensive care when BP was elevated, mentioning lack of BP control at 62.2% of these visits, adjusting medications at 55.9% of such visits, and seeing patients within 1 month (35 days) following only 39.8% of such visits. Physicians documented discussion of lifestyle modifications at 21.5% of all visits.

Mean overall physician adherence to guidelines across all cases was 53.5%±16.2% (range, 0.0%–88.2%). Based on an analysis of random-effects

Table III. Univariate and Multivariate Regression Estimates

PREDICTOR	UNIVARIATE	MULTIVARIATE
Age (per 10-year increase)	-1.1*	-1.7‡
Age >65 years	-3.1*	–
Sex (female vs male)	0.22	–
Minority	6.4†	5.6†
Number of comorbidities	2.6‡	1.9†
>2 comorbidities	8.4§	–
Ever smoked	2.9*	–
Current smoker	2.0	–
Coronary artery disease	10.5§	7.6‡
History of myocardial infarction	8.9†	–
Stroke/transient ischemic attack	7.8†	–
Diabetes	3.5†	–
Chronic kidney disease	2.9	–
Number of medications	3.5§	3.1‡
Private insurance	.96	–
Insurance covered	1.2	–
Quarterly comparison		
2 vs 1	1.6	–
3 vs 1	3.3	–

* $P<.100$. † $P<.050$. ‡ $P<.010$. § $P<.001$. ||Comparing adherence over three 3-month quarters in 2004 to evaluate effect of time following publication of guidelines in 2003.

models, the within-physician correlation was estimated to be small (7.2%), while the within-clinic correlation was even smaller (2.4%). These findings suggest little variance among physicians and clinics. We found several factors to be significantly associated with adherence scores (Table III). The estimates that are shown represent the amount of change in the adherence scores that were observed. For example, the mean score for minority (non-white) patients was 59.4%, while the mean score for white patients was 52.7% (ie, a difference of 6.4%–6.7% was found between adherence for different races).

In addition to a difference due to minority status, we also found significant univariate associations with total comorbidities, CAD, history of myocardial infarction, history of stroke or transient ischemic attack, diabetes, and the number of medications. We found a slight negative association with increasing patient age. The older the patient, the less physician adherence to guidelines we found.

Scores were higher, but not significantly so, for patients who had ever smoked ($P=.0999$). Adherence showed a nonsignificant improvement over the 3 successive enrollment quarters ($P=.31$). With the multivariate model, we found simultaneous associations for age, minority status, comorbidities, CAD, and number of medications; a white

75-year-old with no comorbidities and no medications would receive care consistent with a mean adherence score of 40%, while a minority 55-year-old with CAD, 4 comorbidities, and 4 medications would receive care consistent with a mean adherence score of 77%.

Implicit Review. Two investigators reviewed a random sample of 73 cases (21.2%), identifying extenuating factors that might have influenced physician adherence. The most frequently identified factors were the presence of comorbidities and patient noncompliance (Table IV). The mean number of possible influencing factors identified was 0.9 ± 0.9 per patient. For 14 cases (19.2%), neither reviewer identified any extenuating factor that might have explained adherence failures.

A mean of 15.3 ± 1.5 criteria applied in the 73 cases. The mean failure rate for applicable criteria was 7.8 ± 2.7 per case. The 2 reviewers agreed for 503 out of 561 criterion failures (89.7%), with both rating 493 failures (87.9%) as not justifiable and 10 (1.8%) as justifiable. Reviewers rated a mean of $6.6\pm 12.8\%$ failed criteria per patient as justifiable (range, 0%–100%).

The mean rating for overall quality of care was 3.5 ± 1.6 (1=very poor, 7=excellent). The 2 reviewer ratings were identical for 14 cases (19.2%), differed by 1 point for 34 cases (46.6%), and differed

EXTENUATING FACTOR	NO. OF TIMES IDENTIFIED*
Complex comorbidities requiring ongoing attention	51
Patient noncompliance	31
Intolerance to the recommended regimen	18
Infrequent clinic visits	13
Limited resources	9
Pain or trauma	6
Patient declines recommended regimen	5
Blood pressures better controlled outside of the clinic	4
Focus on lifestyle changes to control blood pressure	1
Alternate blood pressure goal	1
Patient seen by multiple physicians	1
Language barrier	1
Patient sensory deficits	1
Patient contraindication to the recommended regimen	1
Substance abuse	1

*Out of 146 possible.

by an average of 1.4 ± 1.1 points per case. The Spearman correlation coefficient comparing the 2 reviewers' scores was 0.45732, indicating modest agreement for overall quality-of-care ratings.

DISCUSSION

We found modest physician adherence to JNC 7 guidelines. The comparison of scores for patients enrolled in successive calendar quarters demonstrated only a nonsignificant increase in adherence following release of the new guidelines. Most patients, however, received appropriate diuretic therapy; this suggested increased prescriptions for diuretics since publication of previous evaluations.^{3,5,12,14} In addition, physicians generally adhered to the pharmacologic recommendations for patients with specific comorbid conditions. Adherence was low, however, for criteria that reflect intensity of care. Some delays in follow-up might have resulted from patient noncompliance with the recommended return schedule, but this was not likely a consistent cause, because the implicit reviewers identified only 13 instances (of 146 possible) where infrequent patient visits might have affected adherence. Failure to adjust medication at 44% of visits where BP was uncontrolled suggests that BP control was not pursued aggressively. The study results suggest continued clinical inertia, that is, the failure to promptly initiate/adjust therapy and follow-up with patients who had abnormal clinical BPs. Clinical inertia has been described by other researchers¹⁹ and is the major reason BP remains poorly controlled.^{19–22}

Physicians infrequently documented discussion of lifestyle recommendations, even though weight loss,

sodium restriction, and increased activity are known to lower BP.^{23–25} This finding might reflect poor documentation. Alternatively, physicians might not prioritize this aspect of care, believing that many patients will be unresponsive to lifestyle recommendations. Infrequent documentation of lifestyle recommendations could, however, reflect another type of clinical inertia—namely, missed opportunities to promote patient self-management.

Many of the laboratory criteria indicated poor adherence, which might reflect cost-saving efforts. Annual monitoring of glucose and lipids, however, does not constitute extravagant care, and at least 1 ECG is warranted and recommended for all persons with hypertension.² ECGs performed in a different setting might inadvertently be missing, but missing data nevertheless result in absence of information pertinent to care.

Infrequent documentation of goal BP might reflect documentation omission rather than true error in practice. Nevertheless, setting a clear goal and treating to goal is a critical component of care. Physicians tended to communicate goal BPs that were documented to patients. Specifying a goal BP might help physicians focus care on goal attainment.

The presence of comorbidities and patient non-compliance were identified most frequently as extenuating factors that might have led to poor adherence to guidelines. Nonadherence, however, cannot be attributed primarily to these factors, since only 6.6% of criterion failures were judged to be justifiable. In addition, the overall quality of care, rated as 3.5 on a 1-to-7 scale, indicates care that was less than acceptable for many cases. The implicit review, therefore, gives added support

to the finding that overall physician adherence to hypertension guidelines was modest.

The higher scores noted for nonwhites might indicate more aggressive care for high-risk African Americans, and higher scores for patients with increased medication use or more comorbid conditions suggest an increased focus on hypertension when patients have complex medical conditions.

Possible Limitations of the Study. Reliance on medical records as the primary data source is a study limitation. The potential for incompleteness and inaccuracy has been well described^{26–28} and can make it difficult to differentiate true deficiencies in performance from poor record-keeping. Nonetheless, since good documentation has been related to better quality of care,^{29,30} medical records may serve as a reasonable data source when investigating quality of adherence.

High adherence by physicians to pharmacologic recommendations for patients with specific comorbid conditions might, in part, result from the guideline's inclusion of multiple recommended drug classes for a given comorbid condition. JNC 7 does not specify drugs of choice or suggest combinations for comorbid conditions. Guideline recommendations for diabetics, for example, include any diuretic, angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, β -blocker, or calcium channel blocker. Recommendations for other comorbid conditions are equally liberal, and recommended classes of agents are not ranked, precluding discrimination among classes. These liberal inclusion requirements made the likelihood of meeting these criteria inherently high. Nonetheless, these criteria and the elements required to implement them accurately reflect guideline recommendations.¹⁸

This study measured guideline adherence only for patients with uncontrolled BPs. This might have led to a selection bias that included cases more likely to have lower adherence scores. The study provided evidence, however, that most of these cases should have received more intensive care. Consequently, it remains reasonable to conclude that physician adherence to BP guidelines is modest at best.

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