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Measuring Adherence to Practice Guidelines for the Management of Hypertension:

An Evaluation of the Literature

Jessica L. Milchak

From the Division of Clinical and Administrative Pharmacy, College of Pharmacy, University of Iowa, Iowa City

Barry L. Carter and Gail Ardery

From the Division of Clinical and Administrative Pharmacy, College of Pharmacy and Department of Family Medicine, Roy J. and Lucille A. Carver College of Medicine, University of Iowa, Iowa City

Paul A. James

Department of Family Medicine, Roy J. and Lucille A. Carver College of Medicine, University of Iowa, Iowa City.

Abstract

Adherence to practice guidelines is frequently used as a measure of quality of care. Numerous studies have evaluated physician adherence to hypertension guidelines by prescription data, physician survey data, or medical record review. However, most have methodological limitations that might underestimate physician adherence. Accurate and meaningful characterization of adherence rests on evaluation of varied components of hypertension care, use of explicit validated performance measures, incorporation of implicit and explicit review, and linkage of process measures to blood pressure outcomes.

Keywords

hypertension, detection and control; population; lifestyle; epidemiology

Practice guidelines serve as useful tools for clinical decision making. Guidelines are used to reduce practice variation, guide appropriateness, and measure quality of care.^{1,2} Ultimately, the goal of a guideline is to improve patient outcomes through a change to evidence-based physician practices. Unfortunately, substantial gaps have been documented between the development and dissemination of consensus statements and their implementation in practice. In short, clinical practice guidelines do not consistently change physician behavior.³⁻⁷

Although the National Heart, Lung, and Blood Institute (NHLBI) has published 7 guidelines for the treatment of hypertension,⁸⁻¹⁴ control of high blood pressure remains suboptimal. An estimated 40% of the 50 million persons in the United States with hypertension remain untreated, and 66% of hypertensive patients have blood pressure values that are not controlled to the recommended levels.^{14,15} Many studies have concluded that physician adherence to hypertension guidelines has been low.¹⁶⁻²² It is tempting, therefore, to connect poor blood pressure control to poor adherence to hypertension guidelines.

Correspondence to Barry L. Carter, PharmD, Professor and Head, Division of Clinical and Administrative Pharmacy, College of Pharmacy, Department of Family Medicine, Roy J. and Lucille A. Carver College of Medicine, University of Iowa, Iowa City, IA 52242. E-mail barry-carter@uiowa.edu.

However, valid and meaningful conclusions regarding physician adherence and its link to blood pressure control rest on the completion of 2 tasks. First, physician adherence to hypertension guidelines must be assessed accurately. Second, the relation between physician adherence and blood pressure control must be empirically demonstrated.

This article reviews pertinent literature regarding physician adherence to hypertension guidelines and the relation of adherence to blood pressure outcomes. The review focuses on methods that limit evaluation of adherence and concludes with recommendations for strengthening future adherence research.

Literature Search

A literature search using MEDLINE from 1966 to 2004 was conducted by combining the terms “guideline adherence” and “hypertension.” English articles were screened for inclusion by review of the title and abstract. A copy of all studies that compared prescribing trends or physician practice to guideline recommendations was obtained. Bibliographies of chosen references were reviewed for additional citations. Articles that compared physician practice to recommendations of the Joint National Committee (JNC) on the Detection, Evaluation, and Treatment of High Blood Pressure and included commentary regarding physician adherence to those recommendations were selected for inclusion in this review. Additionally, studies that examined adherence to other hypertension guidelines and that used a unique aspect to their methodology, such as the use of explicit criteria, were included.

Measuring Adherence to Clinical Practice Guidelines for Hypertension

Quality of care frequently is measured in terms of how care provided to patients compares with care recommended in practice guidelines.²³⁻²⁶ Guideline adherence constitutes desirable behavior to the degree that adherence is correlated with positive patient outcomes. Several studies have examined the degree to which care delivered to patients with hypertension parallels practices recommended in JNC guidelines.^{16-22,27-35} Most of the studies that we evaluated analyzed prescription data, physician survey data, and/or medical record review data and described trends in physician prescriptive practice over time. Few studies examined the relation between hypertension care and blood pressure control.

Studies That Used Prescription Data to Evaluate Guideline Adherence

Several studies have used either prescription data or drug-dispensing data to evaluate guideline adherence (Table 1). The prescription data evaluated in studies by Nelson and Knapp³⁶ and Monane et al¹⁶ revealed 2 major trends during the period 1980 to 1995: decreased use of diuretics and increased use of calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitors (ACEIs), and angiotensin II receptor blockers (ARBs). Drug-dispensing studies by Siegel and Lopez¹⁷ and Siegel et al³⁴ that reflect practice patterns between 1996 and 1999 have also shown decreased use of diuretics and increased use of CCBs and ACEIs, as well as decreased use of β -blockers. A Canadian study by Campbell and colleagues³⁷ that compared prescriptions written from 1996 to 1998 to those written from 1999 to 2001 found significant increases in overall prescription rates for diuretics, β -blockers, ACEIs, and CCBs and a decrease in ARB prescriptions.

The authors of these prescription and dispensing studies have drawn differing conclusions regarding guideline adherence. Monane et al¹⁶ Siegel and Lopez,¹⁷ and Siegel et al³⁴ concluded that physicians were not adherent to guideline recommendations. Nelson and Knapp,³⁶ focusing on the most frequently prescribed antihypertensive drug classes, concluded that prescribing patterns were generally consistent with guideline recommendations. However, the trends that they described can be interpreted as not being consistent with guideline

recommendations.³⁸ Campbell et al³⁷ concluded that their reported trends reflected adherence to the Canadian Hypertension Society (CHS) guidelines and attributed the improvement in practice to an extensive educational intervention aimed at improving hypertension management. Study conclusions become unclear and perhaps inconsistent when studies do not explicitly define what constitutes adherence. Prescription studies, therefore, point out the need to explicitly define criteria against which guideline adherence can be measured.

Another weakness of these prescription and dispensing studies is their failure to describe the effect of comorbid conditions on prescriptive practice. None of these studies was able to evaluate the number of prescriptions written or dispensed for subpopulations of patients with specific comorbidities. Siegel et al³⁴ speculated that analysis of subpopulations would be unlikely to affect overall results, but they did not present any data to substantiate their position. Siegel and Lopez¹⁷ commented that ACEIs were prescribed at a greater rate than would be warranted for the subpopulation of patients with congestive heart failure (CHF) and that the infrequent and decreasing use of β -blockers did not parallel the widespread presence of coronary artery disease (CAD). Campbell and colleagues³⁷ noted that the observed increases in ACEI and β -blocker prescriptions were more substantial than the changes in nitrate and digoxin prescriptions (used as markers of CAD and CHF), suggesting that these comorbid conditions alone were not the primary reason for the increased prescribing rates.

However, some degree of evidence suggests that the degree of physician adherence might vary, depending on the presence of a comorbid condition. Carter et al,²⁸ for example, found that although CCB use increased from 1996 to 1998 ($P < 0.02$), patients with diabetes or heart failure were more likely to be taking the recommended ACEIs or diuretics, whereas patients with CAD were most often treated with the recommended ACEIs, CCBs, diuretics, or β -blockers. Adherence to recommended therapies, therefore, appeared to be improved for patient subpopulations with diabetes, heart failure, or CAD. Weiss et al²⁹ found varying adherence to recommended treatments for patients with comorbid conditions. The majority of patients with diabetes were prescribed recommended ACEIs as initial monotherapy between 1997 and 2000, and as recommended, no patients with CHF or diabetes were treated with CCBs. However, a smaller percentage of patients with CHF were treated initially with ACEIs or β -blockers. Finally, Clause and Hamilton¹⁸ found that only 40% of patients prescribed a CCB or an ACEI during 1994, 1997, and 1999 had a compelling indication for 1 of these agents as recognized by JNC V or VI, indicating that prescriptive trends cannot be explained solely by parallel trends in the presence of comorbid conditions. These conflicting findings, at a minimum, underscore the importance of evaluating prescriptive practices for subpopulations with specific comorbidities. Because physicians frequently prescribe antihypertensives on the basis of patient age, race, and coexisting disease,³⁰ consideration of comorbidities is critical to an accurate evaluation of adherence.

Several additional weaknesses plague prescription and dispensing studies. First, they assume that prescribing trends and pharmacy databases are good surrogate markers of adherence to guidelines. However, this has never been shown. Second, they fail to describe other important aspects of hypertension care, including diagnosis, evaluation, and follow-up, thereby limiting conclusions regarding adherence. Finally, JNC pharmacological recommendations have changed over time, from stepped care to the use of a range of agents based on individualized indications to the more recent focus on use of diuretics. These changing recommendations complicate and potentially confound studies of adherence that are based on pharmacological trends.

Studies That Used Survey Data to Evaluate Guideline Adherence

Studies that used survey data to evaluate adherence have drawn varied conclusions. Surveys by Cloher and Whelton³¹ and Manolio et al³³ concluded that physician-reported practices were largely adherent to specific JNC guidelines. McAlister et al³⁹ concluded that reported treatment choices, threshold for initiation of treatment, and goal blood pressures for patients with isolated systolic hypertension were consistent with JNC V and CHS guidelines.

However, other survey studies have concluded that practice was less adherent. Hyman and Pavlik³⁵ found that 52% percent of physicians would not start treatment for middle-aged adults with a systolic blood pressure between 140 and 160 mm Hg, only 24% would start treatment for elderly patients with a systolic pressure of <160 mm Hg, and physicians most frequently chose ACEIs for monotherapy. The physicians surveyed by Mehta et al¹⁹ reported several areas of practice that were not consistent with JNC V, including the initiation of appropriate antihypertensive treatment for patients with comorbidities, patients >75 years of age, blacks, or those with mild renal failure. Overall adherence to the British Hypertension Society guidelines was found to be low when Dickerson et al²⁰ examined blood pressure measurement, nonpharmacological treatment, threshold for intervention, treatment of the elderly, isolated systolic hypertension, treatment goals, drug use and dosage, laboratory monitoring, and follow-up.

Patient survey data have paralleled physician survey data. A study by Xu et al⁴⁰ that assessed adherence to JNC V guidelines found that diuretics and β -blockers were used in 36.72% of patients, whereas CCBs and ACEIs were used in 67.49%. The authors concluded that compliance to JNC guidelines was low and that increasing compliance might reduce the costs of prescriptions and other medical services. Henderson et al³² concluded that overall treatment of black and Latino respondents did not correspond closely to JNC VI, based on the high rates of ACEI and CCB use and low β -blocker use.

It is critical to note that physician and patient surveys provide a qualified view of adherence because they rely on self-reported data. Disparities can exist between actual performance and reports of performance.^{41,42} Consequently, survey data, taken alone, might not lead to valid conclusions regarding adherence.

Studies That Used Medical Record Data as a Measure of Hypertension Care

Several studies that examined medical record data have found varying adherence to several published guidelines. Naiman and Barker's²⁷ review of 200 medical records included consideration of both comorbidities, indicating specific treatment, and acceptable rationales for nonadherence (adverse reactions, contraindications, and financial limitations). The overall percentage of patients with selected compelling indications who were treated with guideline-recommended therapy was relatively high at 72%. This percentage increased to 80% when adjusted for documentation of acceptable reasons for nonadherence. Blood pressure control was described as "similar" for patients who were prescribed recommended therapy (43%) and for those who were not (33%). However, the absence of statistical findings comparing groups who did and did not receive recommended treatments makes it difficult to link variation in adherence to patient outcomes.

In contrast, Cuspidi et al,²² using 12 explicit criteria to evaluate physician adherence to the 1999 World Health Organization/International Society of Hypertension Guidelines, found poor adherence to the minimum recommended clinical and laboratory evaluation work-up, high use of ACEIs (65.6%), lower use of diuretics (49.1%), and poor patient outcomes, with only 18.7% of patients having a controlled blood pressure. The retrospective chart review by McAlister et al⁴³ of 969 patients similarly found several areas of practice that were not adherent to the CHS

guidelines: high use of ACEIs and CCBs, lower use of diuretics and β -blockers, low recommendations for lifestyle modifications, and wide variation in the performance of laboratory tests.

Asch et al²¹ used 13 explicit criteria supported by JNC guidelines or randomized controlled trials to measure adherence to hypertension quality indicators in 234 female patients. Medical records were abstracted for blood pressure measurement, medications, and visit frequency. Subjects were evaluated for physician adherence to only those criteria for which they were eligible (mean=3). Adherence to individual criteria ranged from 0% to 100%. Total adherence rates were suboptimal, with the average woman receiving 64% of the recommended care for which she was eligible. When adherence rates were ranked, none of the women whose blood pressure was controlled ($\leq 140/90$ mm Hg) received care ranked in the lowest tertile, suggesting that better care was positively associated with blood pressure control. Several aspects of the Asch study are notable: quality indicators were based on either guideline recommendations or clinical trials, the indicators spanned various aspects of hypertension management, and the study related guideline adherence to blood pressure outcomes. However, the only comorbidity addressed was diabetes. Furthermore, the study did not evaluate the degree to which instances of nonadherence might have been justified, possibly resulting in a more negative conclusion than might have been warranted.

Berlowitz and colleagues⁴⁴ reviewed medical records of 800 hypertensive men at Veterans Administration hospitals, assessed predictors of physician decisions to change antihypertensive medication, and evaluated the association between intensity of treatment and blood pressure control. Physicians frequently failed to increase or change medications when blood pressures were elevated, doing so for only 25.6% of cases where there were elevations in both systolic (≥ 155 mm Hg) and diastolic (≥ 90 mm Hg) pressures and for only 21.6% of cases where only systolic pressure was elevated (≥ 165 mm Hg). The investigators did find a significant association between more intensive therapy and improved blood pressure control, even after adjustment for baseline characteristics ($P < 0.01$). Furthermore, a high percentage of patients (59.6%) whose blood pressure was $\geq 160/90$ mm Hg at the outcome visit had antihypertensive regimens that were ranked in the lowest quintile of intensity. Unfortunately, this study does not address questions related to physician adherence to hypertension guidelines. However, the study's examination of the relation between treatment intensity and blood pressure control makes an important contribution to the literature by commenting on physicians' lack of aggressiveness in achieving systolic blood pressure targets.

Adherence studies that use medical record data critically assume that documentation in medical records accurately reflects practice. Although this assumption is reasonable, the adequacy of physician documentation could vary across physicians and across studies. Indeed, the differing conclusions in these studies might reflect variation in the adequacy of physician documentation as well as actual variation in adherence. Because none of the studies that were reviewed demonstrated a close relation between documentation and practice, their conclusions regarding adherence remain tentative.

Conclusions

Various measures of physician practice have been examined to evaluate the degree of physician adherence to hypertension guidelines. Regardless of the methods used, the bulk of the literature has focused on the use of pharmacological therapy to make inferences regarding adherence. Methodological weaknesses, including failures to evaluate multiple aspects of care, describe comorbidities, and use explicit criteria to measure adherence, have often compromised any conclusions regarding guideline adherence (Table 2). The study by Asch et al²¹ stands out for its strengths, including the use of explicit criteria to examine a range of care and relating

physician practice to blood pressure outcomes. However, this study failed to consider patient comorbidities and factors that might have explained instances of nonadherence. In view of the paucity of adherence studies with methodological strength, conclusions regarding the degree of physician adherence to hypertension guidelines are premature.

Investigators who are evaluating physician adherence to hypertension guidelines can use several strategies to strengthen future research. First, the limits imposed by the type of data used to measure adherence must be considered and when possible, minimized. Survey self-report data should not be used as a sole measure of adherence, because its validity is difficult to determine. Prescription data should not be used as a sole measure of adherence, because it cannot capture the wide range of physician practices that comprise hypertension care. Ideally, several physician practices should be examined, including assessment, treatment, achievement of blood pressure goals, follow-up, and monitoring. Second, researchers will need to define and validate explicit criteria for measuring adherence, thus enabling researchers to compare adherence across studies and provide clinicians with a taxonomy for describing areas where practice is weak. Use of measurable criteria that reflect the spectrum of care delivery provides the foundation for a comprehensive measure of guideline adherence.^{24,45,46} Third, incorporating an implicit review, as well as an explicit review, permits researchers to consider factors that reflect justifiable nonadherence to a guideline. Implicit review recognizes physicians' needs to consider unique patient characteristics and situations. Finally, linking process measures to blood pressure outcomes makes studies of adherence clinically meaningful.

Perspectives

This evaluation of the literature reveals many limitations in our ability to make inferences about adherence to hypertension guidelines. An ongoing study is testing a comprehensive set of explicit criteria for measuring adherence to hypertension guidelines and combining this explicit measurement with an implicit review process.⁴⁷ Agreed-on methods and criteria for evaluating adherence could serve as an evidence-based algorithm against which clinicians could evaluate their practice. Researchers, in turn, could use these methods to test strategies for improving adherence when it is found to be weak. Developing a consensus on appropriate methods for evaluating adherence, therefore, will constitute a critical step in advancing improvements in the quality of hypertension care.

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TABLE 1

Trends in Drug Use

Study	Guideline	Antihypertensive Use				
		Diuretics	β-Blockers	ACEIs/ARBs	CCBs	
Nelson and Knapp ^{*†}	JNC I–V	1980: 37.9% [‡]	1980: 6.3% [‡]	1985: 6.4% [§]	1985: 1.9% [§]	
		35.2% [§]				
		1985: 27.4% ^{‡//}	1985: 14.8% [‡]	1990: 12.9% [‡]	1990: 14.9% [‡]	
		51.4% [§]	1990: 11.1% [‡]			
		1990: 16.4% ^{‡//}	1995: 8.0% [‡]	1995: 18.2% [‡]	1995: 21.3% [‡]	
23.6% [§]						
1995: 11.6% ^{‡//}						
19% [§]		37.0% ^{§//}	39.8% ^{§//}			
Monane et al ^{//}	JNC II–IV	1982: 59%	1982: unavailable	1982: 0.3%	1982: 7%	
Siegel and Lopez ^{//}	JNC V	1988: 33%	1988: unavailable	1988: 16%	1988: 28%	
		1992: 16%	1992: 18%	1992: 25%	1992: 33%	
Siegel et al ^{//}	JNC V–VI	1995: 8%	1995: 11%	1995: 33%	1995: 38%	
		1997: 11.5%	1997: 19.1%	1997: 36.4%	1997: 33%	
Carter et al ^{*//}	JNC V	1998: 11.9%	1998: 19.9%	1998: 37%	1998: 31.2%	
		1999: 12.8% [#]	1999: 21.1%	1999: 36.8%	1999: 29.3%	
Clause and Hamilton ^{*//}	JNC V–VI	Uncomplicated				
		Period 1:	30.3%	14.3%	25.4%	31.6%
		Period 2:	43.9% [#]	19.7%	35.2% [#]	43.4% [#]
		Period 3:	41.4% [#]	22.1% [#]	33.6% [#]	44.7% [#]
		Diabetes				
		Period 1:	34.0%	21.4%	45.8%	36.6%
		Period 2:	47.1% [#]	29.0%	63.4% [#]	45.8% [#]
		Period 3:	52.1% [#]	32.4% [#]	62.2% [#]	42.9%
		CHF				
		Period 1:	50.0%	18.8%	46.9%	31.3%
		Period 2:	79.7% [#]	20.3%	78.1% [#]	42.2%
		Period 3:	70.3% [#]	32.8%	68.8% [#]	32.8%
		CAD				
		Period 1:	30.0%	29.4%	31.8%	36.9%
		Period 2:	43.5% [#]	40.2% [#]	50.8% [#]	48.0% [#]
Period 3:	44.4% [#]	43.2% [#]	48.0% [#]	41.4%		
Compelling indication						
1994: 11.0%	9.9% [#]	25.4% [#]	43.8% [#]			
1997: 9.6%	14.2% [#]	30.5% [#]	40.0% [#]			
1999: 9.9%	12.9% [#]	29.5% [#]	35.9% [#]			
Weiss et al ^{*†//}	JNC V–VI	Compelling indication				
		1997: 23.9%	22.6%	22.9%	18.3%	
		1998: 26.1%	24.3%	25.2%	13.2%	
		1999: 23.5%	25%	26.9%	12.6%	
		2000: 25%	27.2%	26.5%	10.9%	
		CHF				
		1997: 7.8%	24.7%	30.1%	24.1%	
		2000: 56.6%	16.2%	21.5%	0%	
		Diabetes				
		1997: 32.1%	10.0%	51.2%	4.0%	
2000: 14.9%	13.9%	66.1%	0.0%			

Abbreviations are as defined in text.

* Patients were diagnosed with hypertension.

[†] Percentage of antihypertensive mentions.

[‡] Monotherapy.

[§] Monotherapy or in combination.

// Reported as statistically significant.

^{//} Percentage of antihypertensive prescriptions.

[#] $P < 0.05$.

TABLE 2

Evaluation of Study Methodology

Study	Data Source	Methodological Characteristics					Author Conclusions Regarding Adherence
		Evaluated Multiple Aspects of Care	Evaluated Subpopulations With Comorbidities	Used Explicit Criteria to Measure Adherence	Evaluated Justifiable Nonadherence	Related Adherence to Blood Pressure (BP) Outcomes	
Cloher and Whelton	Survey	Yes	No	Yes	No	Not measured	High percentage of measures were concordant with guideline recommendations Prescribing trends are expensive and unproven Practice was consistent with JNC V
Manolio et al	Published drug use information	No	No	No	No	Not measured	BP thresholds for diagnosis and treatment exceed JNC recommendations Physicians were not compliant; care improved for patients with CHF, DM, and MI
McAlister et al	Survey	Yes	No	Yes	No	Not measured	There was a broad spectrum of extent of conformity to guidelines
Hyman and Pavlik	Survey	Yes	No	No	No	Not measured	Compliance with JNC guidelines was low and costly
Mehta et al	Survey	No	Yes	No	No	Not measured	Antihypertensive medications did not closely correspond to guidelines
Dickerson et al	Survey	Yes	No	Yes	No	Not measured	Overall adherence is reasonably good; best in patients with comorbidities
Xu et al	Survey	No	No	No	No	Not measured	BP control higher with prescribed guideline medications (43% vs 33%)
Henderson et al	Survey	No	No	No	No	Not measured	Not measured
Nairman and Barker	Medical records	No	Yes: DM, CHF, and CAD	Yes	Yes	Not measured	Diagnostic work-up is largely different from guideline recommendations Marked variation existed in the investigation and treatment of hypertension
Cuspidi et al	Patient survey and medical records	Yes	No	Yes	No	Not measured	
McAlister et al	Medical records	Yes	No	Yes	No	Not measured	

Study	Methodological Characteristics						Author Conclusions Regarding Adherence
	Data Source	Evaluated Multiple Aspects of Care	Evaluated Subpopulations With Comorbidities	Used Explicit Criteria to Measure Adherence	Evaluated Justifiable Nonadherence	Related Adherence to Blood Pressure (BP) Outcomes	
Asch et al	Medical records	Yes	Diabetes	Yes	No	Adherence lower for patients with uncontrolled BP (54% vs 73%)	Average patient received 64% of recommended care
Berlowitz et al	Medical records	Yes	Yes	Not applicable	No	Not measured, but more intense treatment was favorably related to BP outcomes	No conclusions regarding adherence

DM indicates diabetes mellitus; MI, myocardial infarction. All other abbreviations are as defined in text.