Does Clinical Inertia Vary According to Provider Type?

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Despite the well established risks of persistently elevated blood pressure, as well as the benefits of controlling such elevations, hypertension remains underdiagnosed and undertreated. These VA researchers compared the rates of antihypertensive medication intensification between resident physicians, midlevel practitioners, and attending physicians.

Hypertension currently affects 50 million people in the United States,[1] and by 2020, this figure is projected to increase to 70 million.[2] For years now, the contribution of hypertension to such outcomes as coronary artery disease, stroke, renal failure, and death has been clear,[1] and the ability of adequate hypertension control to delay or prevent many of these complications has been demonstrated.[3–6] Despite these well established facts, only 69% of individuals with hypertension are diagnosed with the condition, and only 24% of diagnosed individuals achieve a blood pressure (BP) of less than 140/90 mm Hg.[7] Clearly, there is room for improvement in the identification and management of hypertension in the United States.

Prior studies addressing these issues have focused on patients' access to health care, patient adherence, and how physicians treat hypertension and other cardiovascular risk factors.[8,9] Berlowitz and colleagues found that, at five VA sites in New England over the course of two years, providers intensified medical therapy at only 26% of outpatient visits in which hypertensive patients had a diastolic BP (DPB) measurement of 90 mm Hg or greater and a systolic BP (SBP) measurement of 155 mm Hg or greater.[8] More recently, Rodondi and colleagues determined that medical therapy modifications were made within three months for only 54% of patients with poorly controlled SBP and 63% of patients with poorly controlled DBP in a large, managed care population.[9]

At academic medical centers, primary care is rendered by a variety of providers, including attending physicians, residents in training, nurse practitioners, and physician assistants. Our research group recently found that, within primary care practices at the VA Connecticut Healthcare System (VACHS), patients of residents were less likely to reach their goal BP values than the patients of either attending physicians or midlevel practitioners (nurse practitioners and physician assistants).[10] In the present study, described here, we explored the question of whether this observation could be explained by differences in the likelihood of intensifying antihypertensive medication therapy between these three provider types.

METHODS

Practice setting

The VACHS is comprised of two major academic health care centers—the West Haven VA Medical Center (VAMC) in West Haven, CT and the Newington VAMC in Newington, CT—and six community-based outpatient clinics. Together, these facilities provide health care to over 44,600 veteran patients. Upon enrollment with the VACHS, each patient is assigned to a primary care provider based on the next available appointment. Pri-

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mary care providers include attending physicians, midlevel practitioners, and internal medicine residents.

A total of 56 internal medicine residents—40 of whom are affiliated with Yale University School of Medicine, New Haven, CT and 16 of whom are affiliated with the University of Connecticut School of Medicine, Farmington—fulfill their longitudinal general medicine clinic requirements at the VACHS, either at the West Haven campus (Yale residents) or Newington campus (University of Connecticut residents). These residents provide care for 8.4% of the VACHS's primary care patients, and each one is supervised by an attending physician who is a general internal medicine faculty member from the resident's respective academic institution. Residents are expected to present each patient to the attending physician; during this meeting, the resident and attending physician discuss the patient's problems and conjointly develop a plan for care. Attending physicians also cosign all resident notes. When a resident completes his or her residency training, his or her panel of patients is transferred to that of another incoming resident.

A total of 18 midlevel practitioners—13 nurse practitioners and five physician assistants—practice primary care at the VACHS. While these providers practice independently, they are assigned to designated attending physicians for consultation purposes in the event that clinical questions arise.

A total of 39 attending physicians are engaged in the practice of primary care at the VACHS. Although all attending physicians assigned to residents or midlevel practitioners have their own panel of primary care patients, they do not see their own patients during hours designated for resident supervision. Attending physicians supervising residents are responsible for two to three residents at any one time.

Data collection

At each VACHS primary care visit, the provider assigns the patient *International Classification of Disease, Clinical Modification, 9th Edition* (ICD-9) codes that correspond to the diagnoses for which the patient was treated. BP values are obtained at all primary care visits and are entered into the patient's electronic medical record, along with the ICD-9 codes and other information pertaining to the visit.

Using the VA's electronic medical record system, we identified patients who had primary care visits at the VACHS between October 1, 2004 and March 31, 2005, during which their providers assigned ICD-9 codes for hypertension (401.xx), with or without a concurrent diagnosis code for diabetes mellitus (250.xx), and documented an elevated BP measurement. Both primary and secondary diagnoses of hypertension and diabetes were included. For nondiabetic patients, we defined an elevated BP measurement at an index primary care clinic visit as one in which the SBP was 140 mm Hg or greater or the DBP was 90 mm Hg or greater. For patients with diabetes, we used lower threshold values of 130 mm Hg for SBP and 80 mm Hg for DBP, based on recent guidelines for managing BP in these patients.[11] When a given patient had more than one qualifying visit during the study period, we used the first of these visits as the index visit for the analysis.

We also collected information on patients' demographic characteristics, psychiatric comorbidities, medications, and provider types from the electronic records. The psychiatric diagnoses of alcohol disorder, drug disorder, and severe mental illness (bipolar disorder, major depressive disorder, and schizophrenia) were identified using the following ICD-9 codes: 291.xx, 292.xx, 295.xx, 296.xx, 303.xx, 304.xx, 305.00, 305.01, 305.02, 305.03, 305.2x, and 305.99.

We used the VA's electronic pharmacy database to identify intensification of antihypertensive medical therapy, which we defined as receipt of a prescription for an increased dosage of an existing antihypertensive medication or the addition of an antihypertensive medication from another class within 14 days of the index visit wherein an elevated BP measurement was recorded.

Patients with a coded diagnosis of hypertension without BP measurements and those without an identified provider documented in the electronic record were excluded from the analysis. The study protocol was approved by the Institutional Review Board of the VACHS.

Statistical analysis

To determine the statistical significance of differences in patient characteristics by provider type, we used analyses of variance (ANOVA) for means and Kruskal-Wallis for medians of continuous variables and χ^2 tests for categorical variables. Logistic regression was used to assess the association of provider type with intensification of therapy.

Because patients treated by the same provider may have correlated responses, which could potentially lead to erroneous statistical inference, we accounted for the clustering of patients within provider using generalized estimating equations (GEE).[12] We used GEE logistic regression for binary responses with logit link and an exchangeable correlation structure (PROC GENMOD, SAS v. 9.13, SAS Institute, Cary, NC) to determine which factors were associated inde-

Table 1. Patient characteristics, site of care, and BP[a] values, by provider type

Variables	Attending (n = 3,713)	Midlevel (n = 1,497)	Resident (n = 575)	*P* value[b]
Patient age in years				
Mean (SD)	71 (10)	71 (11)	70 (11)	.063
Median (range)	73 (30–95)	73 (27–93)	72 (26–90)	.169
Male gender, no (%)	3,658 (99)	1,487 (99)	556 (97)	< .001[c]
Race, no. (%)				.650
Black	209 (13)	72 (13)	32 (12)	
White	1,372 (84)	493 (86)	220 (85)	
Hispanic/other	44 (3)	9 (2)	6 (2)	
Unknown	2,088 (56)	923 (62)	317 (55)	.001[c]
Site of care, no. (%)				< .001[c]
Medical center A	1,482 (40)	383 (26)	243 (42)	
Medical center B	1,305 (35)	753 (50)	332 (58)	
CBOC[d]	926 (25)	361 (24)	0 (0)	
Diabetes, no. (%)	1,507 (41)	616 (41)	212 (37)	.185
Psychiatric disorder, no. (%)	282 (8)	96 (6)	58 (10)	.017[c]
SBP[e] in mm Hg				
Mean (SD)	148 (13)	147 (13)	148 (12)	.128
Median (range)	146 (110–243)	145 (94–210)	147 (118–193)	.035[c]
SBP elevation[f]				.920
Mild, no. (%)	2,889 (78)	1,158 (77)	449 (78)	
High, no. (%)	824 (22)	339 (23)	126 (22)	
DBP[g] in mm Hg				
Mean (SD)	79 (11)	80 (11)	80 (11)	.036[c]
Median (range)	80 (24–120)	80 (48–134)	80 (44–114)	.095
DBP elevation[h]				.980
Mild, no. (%)	3,494 (94)	1,407 (94)	540 (94)	
High, no. (%)	219 (6)	90 (6)	35 (6)	

[a]BP = blood pressure. [b]*P* values are for comparisons between all three provider types. [c]Statistically significant. [d]CBOC = community-based outpatient clinic. [e]SBP = systolic BP. [f]Mild SBP elevation was defined as an SBP measurement of 140 to 159 mm Hg for nondiabetic patients and 130 to 149 mm Hg for diabetic patients. High SBP elevation was defined as an SBP measurement higher than these levels. [g]DBP = diastolic BP. [h]Mild DBP elevation was defined as a DBP measurement of 90 to 99 mm Hg for nondiabetic patients and 80 to 89 mm Hg for diabetic patients. High DBP elevation was defined as a DBP measurement greater than these levels.

pendently with intensification of therapy. In adjusted models, we controlled for patients' age, race, diabetes status, presence of psychiatric diagnoses, and site of care. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using the coefficients and robust standard errors from the GEE models. Statistical significance was defined as a two-tailed *P* value less than .05.

RESULTS

A total of 5,785 unique patients with a diagnostic code for hypertension and a BP measurement above the treatment goal were identified. Of these, attending physicians treated 3,713 (64%), midlevel practitioners treated 1,497 (26%), and internal medicine residents treated 575 (10%) (Table 1). Patients' mean age; the proportion of patients with diabetes; and the proportions that identified their race as white, black, or Hispanic/other did not differ between provider types. Patients with missing race data, however, were more likely

Table 2. Antihypertensive medication intensification rates, by provider type and patients' diabetes status

Provider type	Total patients, no.		Medication intensification, no. (%)		*P* value
	Diabetic	Nondiabetic	Diabetic	Nondiabetic	
Attending	1,507	2,206	1,010 (67%)	1,632 (74%)	< .001
Midlevel	616	881	394 (64%)	617 (70%)	.010
Resident	212	363	155 (73%)	280 (77%)	.230

Table 3. Generalized estimating equation logistic regression results of medication intensification by provider type

	Unadjusted model		Adjusted model[a]	
	OR[b] (95% CI[c])	*P* value	OR (95% CI)	*P* value
Resident vs. attending	1.23 (1.03–1.47)	.022	1.22 (1.04–1.44)	.016
Resident vs. midlevel	1.44 (1.13–1.83)	.003	1.54 (1.25–1.91)	< .001
Attending vs. midlevel	1.17 (0.98–1.41)	.090	1.26 (1.06–1.50)	.010

[a]Adjusted for age, race, diabetes status, presence of a psychiatric diagnosis, and site of care. [b]OR = odds ratio. [c]CI = confidence interval.

to be treated by midlevel practitioners (P = .001), and residents had a significantly higher proportion of female veterans (P < .001) and patients with psychiatric comorbidities (P = .017).

There were significant differences in patients' DBP and SBP by provider type. The proportion of patients with mild and high elevations in SBP and DBP, however, did not differ by provider type (P = .92 for SBP and P = .98 for DBP).

Overall, of these 5,785 patients, 4,088 (71%) had at least one medication intensification within two weeks of the index visit. Intensification rates by provider type were: 71% for attending physicians, 68% for midlevel practitioners, and 75% for residents (P = .002). Attending physicians and midlevel practitioners were less likely to intensify therapy in diabetic patients above goal compared with nondiabetic patients above goal (67% versus 74%, P < .001 and 64% versus 70%, P = .01, respectively), while residents did not differ in the proportion of patients with intensification by diabetes status (73% versus 77%, P = .23) (Table 2).

In an unadjusted GEE logistic regression analysis, residents were significantly more likely to intensify therapy compared to both attending physicians (OR, 1.23; CI, 1.03–1.47) and midlevel practitioners (OR, 1.44; CI, 1.13–1.83) (Table 3). Similarly, in the adjusted analysis, residents were more likely to intensify therapy than attending physicians (OR, 1.22; CI 1.04–1.44) and midlevel practitioners (OR, 1.54; CI 1.25–1.91). The analyses also showed that attending physicians were more likely to intensify therapy than midlevel practitioners (adjusted OR, 1.26; CI 1.06–1.51).

When the SBP was mildly elevated (140 to 159 mm Hg for nondiabetic patients and 130 to 149 mm Hg for diabetic patients), providers overall were less likely to intensify medication therapy than when the SBP elevation was higher (69% versus 75%, P < .001) (Table 4). Residents were significantly more likely than attending physicians to intensify therapy when the SBP elevation was in the high range (84% versus 75%, P = .023) and more likely than midlevel practitioners to intensify therapy in both the mild range (73% versus 67%, P = .016) and the higher range (84% versus 72%, P = .006).

When the DBP was mildly elevated (90 to 99 mm Hg for nondiabetic patients and 80 to 89 mm Hg for diabetic patients), intensification rates overall were similar to when the DBP elevation was higher (70% versus 74%, P = .148). Residents were more likely to intensify therapy than attending physicians when the DBP elevation was in the mild range (75% versus 71%, P = .049) and more likely than midlevel practitioners to intensify therapy in both the mild range (75% versus 68%, P = .005) and the high range (86% versus 63%, P = .015).

DISCUSSION

Less clinical inertia among residents?

While there is ample evidence that pharmacologic treatment of hyper-

Table 4. Percentage of patients receiving medication intensification, by degree of SBP[a] or DBP[b] elevation and provider type

Provider type	SBP elevation[c]		DBP elevation[d]	
	Mild	High	Mild	High
All providers				
Total patients, no.	4,496	1,289	5,441	344
Intensification, %	69	75	70	74
P value[e]	< .001[f]		.148	
Attending				
Total patients, no.	2,889	824	3,494	219
Intensification, %	70	75	71	77
Midlevel				
Total patients, no.	1,158	339	1,407	90
Intensification, %	67	72	68	63
Residents				
Total patients, no.	449	126	540	35
Intensification, %	73	84	75	86
P value				
Attending vs. resident	.181	.023[f]	.049[f]	.233
Midlevel vs. resident	.016[f]	.006[f]	.005[f]	.015[f]

[a]SBP = systolic blood pressure. [b]DBP = diastolic blood pressure. [c]Mild SBP elevation was defined as an SBP measurement of 140 to 159 mm Hg for nondiabetic patients and 130 to 149 mm Hg for diabetic patients. High SBP elevation was defined as an SBP measurement higher than these levels. [d]Mild DBP elevation was defined as a DBP measurement of 90 to 99 mm Hg for nondiabetic patients and 80 to 89 mm Hg for diabetic patients. High DBP elevation was defined as a DBP measurement greater than these levels. [e]For intensification rates among patients with mild vs. high elevations. [f]Statistically significant.

tension and other cardiovascular risk factors can prevent or delay cardiovascular events,[13–17] BP and other risk factor control remains suboptimal.[18–21] Heretofore, much of the research into possible explanations have focused on patients' lack of access to care and nonadherence.[22] More recently, however, the actions of health care providers have been examined.

The tendency of health care providers not to initiate or intensify therapy after a problem is recognized has been termed "clinical inertia."[22] Speculation as to the causes of clinical inertia have focused on the fact that, historically, medicine has centered on the treatment of patients' symptoms. Since risk factors for cardiovascular disease are largely asymptomatic, providers may be less inclined to intervene to modify these risk factors.[22]

Our findings from the present study suggest that residents were less likely to succumb to clinical inertia and more likely than attending physicians or midlevel practitioners to intensify medical therapy for patients with hypertension whose BP measurements were above the goal values. This is an important finding, since resident physicians have less clinical experience than attending physicians and also may be more likely to have competing responsibilities (such as inpatient care) that detract from their outpatient care performance.

Notably, we have found previously that hypertensive patients treated by residents were less likely to achieve goal BP levels than patients of either attending physicians or midlevel practitioners.[10] It is possible that, although residents might be more likely to intensify medical therapy than either attending physicians or midlevel practitioners, their patients might be less adherent to their pharmacologic interventions or their efforts at implementation of nonpharmacologic treatments may be less successful. Additionally, residents may be less likely to involve patients in self-management, which has been shown recently to improve BP control.[23] Our study was not designed to assess any of these possibilities.

Not surprisingly, we found that health care providers, overall, were more likely to intensify therapy for patients whose SBP elevations were higher than for those with milder elevations. While guidelines support treating BP to a goal of less than 140/90 mm Hg for patients without diabetes and less than 130/80 mm Hg for

those with diabetes, there is a dearth of evidence supporting the treatment of mild, isolated systolic hypertension.[24]

Study limitations and strengths

Our study has several limitations. Since all resident progress notes are cosigned by a supervising attending physician, it is possible that the higher rate of intensification might be due, in part, to input from attending physicians. While we cannot conclude that the higher rates of intensification were driven solely by increased aggressiveness by the resident provider, we can conclude that patients assigned to residents were more likely to have pharmacotherapeutic intensification than those assigned to the other provider types.

Additionally, since patients were selected by ICD-9 codes, we do not know if providers or specific provider subtypes are more likely to code a visit for hypertension if they make a therapeutic intervention. Coding disparities between groups could be a potential confounder.

Furthermore, our study population was drawn from a cohort of predominantly older, male veterans residing in the state of Connecticut. We do not know whether a study population comprised mainly of younger patients, containing a larger percentage of women, or situated in another geographic region would result in similar findings.

Lastly, our methodology allowed for data collection only from within the VA health care system. If patients received medications from outside the VA, we were not able to record this. Patients often seek care at the VA for the pharmacy benefit, however, and a lack of capture of medication intensification occurring outside the VA system would bias the results toward the null hypothesis.

The major strengths of our study are that we were able to include a large cohort of patients with retrievable BP and pharmacy data and that our provider pool included multiple residents, midlevel practitioners, and attending physicians from more than one major university. In addition, this study demonstrates the utility of an electronic medical record system for examining provider behavior in the management of a chronic disease. Future research on the implementation of treatment guidelines will be more feasible as additional health care systems implement electronic medical records.

Resident physicians in training appear to be less likely to succumb to clinical inertia than either attending physicians or midlevel practitioners when encountering a patient whose BP is above the target level.

CONCLUSION

We found that rates of intensification of antihypertensive medication therapy for hypertensive patients with elevated BP values were fairly high, although opportunities for improvement seem to exist. Resident physicians in training appear to be less likely to succumb to clinical inertia than either attending physicians or midlevel practitioners when encountering a patient whose BP is above the target level. Thus, differences in rates of medication intensification do not appear to explain the less effective BP control previously reported for residents compared with attending physicians. ●

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