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Comparison of Patients' Confidence in Office, Ambulatory and Home Blood Pressure Measurements as Methods of Assessing for Hypertension

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Abstract

Objective—Uncertainty exists when relying on office (clinic) blood pressure (BP) measurements to diagnose hypertension. Home BP monitoring and ambulatory BP monitoring (ABPM) provide measurements that are more strongly associated with cardiovascular disease. The degree to which patients exhibit uncertainty about office BP measurements is unknown, as is whether they would have less uncertainty about other BP measurement methods. We therefore assessed people's confidence in methods of BP measurement, comparing perceptions about office BP, home BP, and ABPM techniques.

Methods—We surveyed adults 30 years and older (n=193) who all had office BP measurements, two sessions of 24-hour ABPM, and two 5-day periods of home BP monitoring. Respondents were asked to indicate their level of confidence on a 1 to 9 scale that BP measurements represented their “usual” BP.

Results—Respondents had least confidence that assessments of BP made by office measurements (median 6) represented usual BP and greater confidence that assessments made by home BP (median 7, P<0.0001 vs office) and ABPM (median 8, P<0.0001 vs office) did so. Confidence levels did not vary significantly by BP levels, age, sex, race, or education level.

Conclusion—The finding that patients do not place a great deal of confidence in office BP measurements, but place a higher degree of confidence in home BP and ambulatory BP assessment methods, may be helpful in guiding strategies to diagnose hypertension and improve antihypertensive medication adherence.

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Keywords

hypertension; blood pressure measurement; ambulatory blood pressure monitoring; self blood pressure monitoring; home blood pressure monitoring

Introduction

Controlling hypertension is the single most effective clinical service for reducing overall mortality [1]. Unfortunately, only half of people with hypertension have their blood pressure (BP) controlled [2]. Among the modifiable factors known to be associated with poor BP control, suboptimal therapy plays a substantial role [3,4]. Suboptimal therapy is often due to clinical inertia—the failure of clinicians to initiate or intensify antihypertensive therapy despite elevated BP levels. One of the factors that plays a role in clinical inertia is clinical uncertainty [5]. Clinical uncertainty reflects in part that clinicians appreciate that a clinic (office) BP can be a poor gauge of a patient's true BP status, e.g., due to inherent variability or white-coat effect [6]. Indeed, ambulatory BP monitoring has demonstrated this to be the case [7-9].

It is likely that patients also have some uncertainty about clinic BP measurements. It is not uncommon for patients to use home BP monitors or monitors stationed in pharmacies to check their BP, and such measurements may vary markedly from clinic BP measurements [10-11]. Patients may also realize the hurried manner in which a clinic BP might be taken, or may have experienced the lower BP noted when it was repeated later in the same clinic visit. A patient's lack of confidence in the BP measurement upon which clinical decisions are made may translate into failure to believe that medications are needed, which in turn may lead to patients not initiating or persisting with medications.

To our knowledge, no prior research has sought to systematically examine the confidence people place in BP measurements or whether patients' confidence in measurements of their BP varies by method of assessment. We therefore developed an instrument that can be used to assess people's confidence in methods of BP measurement. Specifically, our goal was to be able to compare perceptions about office (clinic) BP, home BP, and ambulatory BP monitoring (ABPM) techniques.

Methods

Initial Questionnaire Development

We created a draft instrument based on a previously validated credibility and expectancy questionnaire [12]. We tailored the items for purposes of assessing respondents' beliefs about types of blood pressure measurements, creating versions that mirrored each other for office BP, home BP monitoring, and ambulatory BP monitoring.

Focus Group

After the initial instrument was created, we held a focus group with 8 people who had previously participated in a research study in which they had several office BP

measurements taken and wore a validated 24-hour ambulatory BP monitor on two occasions one week apart. They also performed home BP monitoring for 5 consecutive days per week over two weeks. Details of this BP measurement study have been published previously [13]. During the focus group, we asked participants to complete the questionnaires taking careful notes as they read and responded to the questions.

Refinement and Review by Experts

The revised instrument was then reviewed by experts in clinical hypertension, practicing clinicians, a biostatistician, and an expert in health communication at our quarterly Hypertension Research Program meeting. Based on feedback, we made further revisions to some of the items to create our final version (Appendix).

Survey Implementation

We mailed paper versions of the questionnaires consisting of the office BP and ambulatory BP monitoring items to 408 adults 30 years and older who previously participated in the BP measurement study described above. Approximately 3 months later, we mailed the same questionnaires in addition to the home BP monitoring questionnaire items to a random sample of 50 people who returned the first set of questionnaires, with a gift card for coffee included as a small incentive.

Variables

Our main outcomes of interest were self-reported confidence in methods of BP assessment on a scale from 1 (not at all confident) to 9 (very confident). We asked a similar item about confidence that the measurements are successful in determining a diagnosis (of hypertension), and confidence in need to take medications (or not) based on the measurements. We also asked about perceived accuracy comparing office to ambulatory BP and expected improvement in BP in response to treatment based on BP measurement method. To allow comparisons by patient characteristics, we also included demographic items, numeracy level using a previously validated scale [14], and office and ambulatory BP levels.

Analysis

We first examined missing item patterns. Next, we produced summary statistics for each item. For continuously measured response variables, we took note of minimum and maximum values, 25^{th} and 75^{th} percentiles, means, and medians. We examined test-retest reliability among a subsample using intraclass correlation coefficient. For categorical responses, we noted percent responding in each category.

Because reports of confidence on the 1 to 9 scale were skewed, we report medians for these variables and compared any noted differences between methods using Wilcoxon signed-rank and any differences across categorical variables using Kruskal-Wallis.

Results

Characteristics of Sample

A total of 193 people returned the initial questionnaire. A total of 43 (out of 50) returned the repeat questionnaire containing the HBPM items. The mean age of the 193 total respondents was 50 years; 43% were men, and 83% were white (Table 1). Approximately 28% had previously been noted to have office hypertension, and 77% had ambulatory hypertension. The non-respondents tended to be younger and have lower education and lower numeracy level. The characteristics of the subset of respondents who returned the repeat questionnaire containing the HBPM items are shown in Supplemental Table 1. The subset had a higher proportion of men, whites, and presence of office hypertension.

Missing Items, Response Distributions and Outliers

Most items had no missing responses. The ABPM items had from one to three missing items, with one respondent missing all of the items. That respondent did, however, complete the office BP items, which had no missing responses. As mentioned above, the responses for most items (Supplemental Table 2) were skewed. The interquartile ranges for office BP items were much wider than those for ABPM or home BP measurements. The medians and means for ABPM and home BP measurement items were higher than those for office BP measurement items.

Test-Retest Reliability

Among the subsample (N=43), the test-retest reliability of the office and ABPM sets of items was high as evidenced by their intraclass correlation coefficients ranging from 0.72 to 0.88 (Supplemental Table 3).

Confidence in Blood Pressure Assessment Methods

As shown in Figure 1, respondents had least confidence that assessments of BP made by office measurements represented usual BP and greatest confidence that assessments made by ABPM did so (median 8 vs 6; $P<0.0001$). A similar pattern was seen for confidence that measurements were successful in determining diagnosis. For both of those confidence assessments, home BP assessments received a greater vote of confidence than did office assessments (median 7 vs 6: $P<0.0001$), but did not fare as well as ABPM. For confidence in needing to take medicine based on measurements, home BP monitoring slightly edged out ABPM (median 8 vs 7), but the difference was not statistically significant ($P=0.43$).

Confidence levels did not vary significantly by age, sex, race, or education level (Table 2). Those with lower numeracy level were more likely to place higher confidence in office BP (median 7 vs 5; $P=0.0001$). Even when a discrepancy existed such that office BP was not elevated but ambulatory BP average was elevated (i.e. masked hypertension), confidence was not affected.

Overall perceptions of comparative accuracy between office and ambulatory BP are shown in Table 3. Most respondents (60%) believed ambulatory BP to be a lot more accurate than office BP. Approximately 8% indicated neither is accurate.

Likelihood of Taking Medication and Expected Improvement

Most respondents indicated that they would expect at least some improvement in their BP if they were to take medication based on any of the methods of measurement (Table 4). However, they indicated a greater expectancy of significant improvement and likelihood of actually taking medications in the case of elevated BP if assessed by home or ambulatory monitoring. On the scale from 1 to 9, the median reported likelihood was 6 for office BP vs 8 for both home and ambulatory BP (data not shown).

The majority of respondents (78%) indicated they would be more willing to take BP-lowering medication if high office BP was confirmed by ABPM (Table 5). Slightly more than half (52%) indicated definite willingness to take medication even if office BP was not elevated but ambulatory BP average was elevated

Discussion

We sought to compare patients' confidence in three main methods of BP assessment. Importantly, we found that patients place greater confidence in assessments of their BP status made by ambulatory and home BP monitoring as opposed to office BP measurements. This information is useful because home and ambulatory BP measurements have been shown to predict cardiovascular events better than office BP measurements [9]. Thus, patients seem to place greater confidence in methods that actually are more valid assessments of their BP in relation to prognosis.

Office BP measurements are fraught with potential error. Proper technique for measurement of BP is often not followed, or measurements are taken in a hurry in an effort to be efficient in busy clinical practices [15]. Ambulatory BP monitoring is now considered the reference standard for diagnosing hypertension [8,9]. Both the NICE guidelines (UK), and more recently the United States Preventive Services Task Force (USPSTF), recommend ABPM to confirm the diagnosis of hypertension, with substitution of home BP monitoring if ambulatory monitoring is not available [16,17]. Our findings suggest that a potential added benefit of this strategy will be that patients will be more confident of the diagnosis of hypertension.

In addition to being more confident in ambulatory BP and home BP assessments, respondents also indicated greater confidence in the need to take medication based on the measurements. This confidence may translate into better medication adherence. A small, but not insignificant, proportion of respondents appeared to lack confidence in both office and ambulatory BP measurements, and would not take medication regardless of how elevated BP was detected. This “no confidence” group did not differ from the remaining respondents by age, sex, race, office BP level or ambulatory BP level. They did have lower numeracy level, however (data not shown).

We also noted that overall, respondents with lower numeracy level were more likely to place higher confidence in office BP. This finding suggests that the value of multiple measurements (as obtained with ambulatory or home BP monitoring) and their use in providing a BP average may need to be more greatly emphasized to some patients. Future

research could also compare the effectiveness of various methods of depicting ambulatory and home BP results, e.g., in tabular versus graphical form.

One other learning point that is important not to overlook is that respondents indicated greater confidence in ambulatory BP even when office BP was not elevated. More than half indicated willingness to take BP medications if ambulatory BP was elevated even if office BP was not elevated. Such “masked hypertension” is associated with target organ damage and cardiovascular events [18]. While it is not yet known whether treatment of masked hypertension improves cardiovascular outcomes, our finding that patients would be willing to consider medications based solely on ABPM is a valuable one.

Limitations

This study is the first we know of that examines people's confidence in BP assessment methods. However, we acknowledge several limitations. First, our sample was not necessarily representative of a general population of clinic patients. Our respondents were basing their experience with ABPM on a research protocol, which may be different than an actual clinical experience. Importantly, though, the processes were all standardized such that approaches to BP monitoring were the same for all respondents. The study participants also had a high prevalence of ambulatory hypertension, as described previously [13]. However, we would have expected this finding to bias responses less in favor of ABPM. Thus, in a more representative sample (e.g., with a higher prevalence of white-coat hypertension), ratings may actually be more strongly in favor of ABPM. Another limitation is that we only collected data on home BP comparisons from a subsample of the respondents. Finally, we did not examine actual medication initiation or adherence.

Conclusion

Both clinician and patient must believe that whatever measurements they are relying on to manage BP are an accurate reflection of the patient's usual BP. We found that patients do not place a great deal of confidence in office BP measurements, but place a much higher degree of confidence in home BP and ambulatory BP assessment methods. Future research in more generally representative samples should be conducted and should examine whether this greater confidence is associated with better medication adherence.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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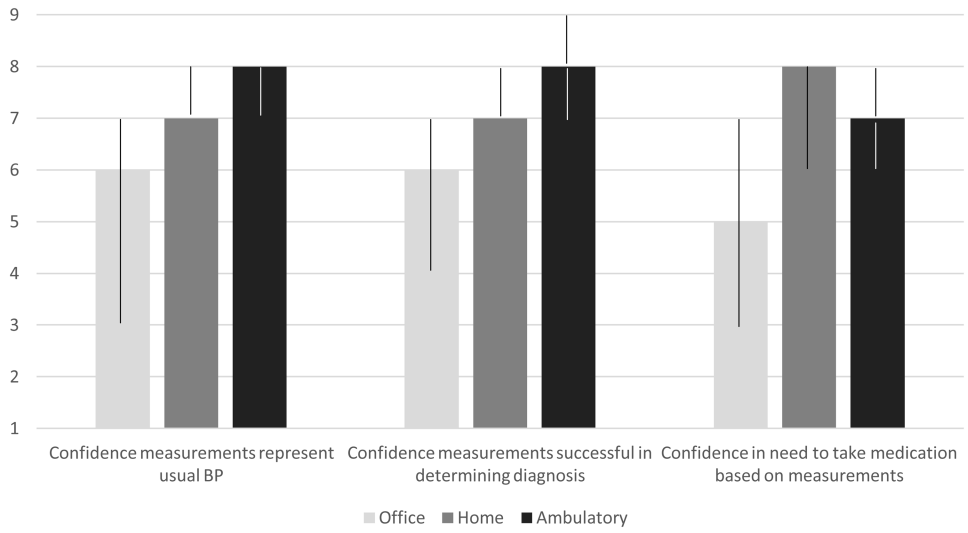

Figure 1. Confidence in Blood Pressure Measurement Methods

P<0.0001 for all comparisons of office vs home and office vs ambulatory. Difference between home and ambulatory were not significant. Bars show interquartile range. For example, the median value for confidence that measurements represent usual BP by office measurements was 6, with the 25th percentile at 3 and the 75th percentile at 7.

Table 1
Characteristics of Total Sample Comparing Respondents to Nonrespondents

	Respondents (N=193)	Nonrespondents (N=215)	P-value
Age, mean (SD)	50 (12)	46 (11)	0.0002
Age group (%)			0.002
30-44 years	37.4	51.7	
45-64 years	46.8	42.0	
65 years and older	15.8	6.3	
Male sex (%)	42.5	46.0	0.54
Race (%)			0.004
White	82.9	67.4	
Black	14.5	27.4	
Other	2.6	5.1	
Education level (%)			0.003
College graduate	81.9	66.0	
Some college	14.0	24.2	
< High school	4.1	9.8	
Numeracy level (%)			0.001
Low/marginal	22.3	38.1	
Adequate	77.7	61.9	
Study visit office BP average, mm Hg (SD)	130/80 (12/9)	130/82 (12/8)	0.34
24-hour ambulatory BP average, mm Hg (SD)	137/81 (13/9)	138/82 (12/8)	0.83
Office hypertension (%)	28.4	26.6	0.70
Ambulatory hypertension (%)	76.8	77.6	0.85
Masked hypertension (%)	48.5	53.3	0.33

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Table 2

Confidence (Median Values) that Blood Pressure Measurements of Various Methods Represent Usual BP, by Participant Characteristics

	Office (N=193)	P-value	Home (N=43)	P-value	Ambulatory (N=193)	P-value
Age group		0.35				
30-44 years	6		7		8	
45-64 years	6		7		8	
65 years +	5		7		8	
Sex						
Male	6	0.03	7		8	
Female	5		7		8	
Race		0.11				0.17
White	6		7		8	
Black	7		7		7	
Education level		0.03				
College graduate	6		7		8	
Some college	7		7		8	
< High school	7		7		8	
Numeracy level		0.0001				
Low/marginal	7		7		8	
Adequate	5		7		8	
Office hypertension		0.31				
Yes	5		7		8	
No	6		7		8	
Ambulatory hypertension		0.13				
Yes	5		7		8	
No	6		7		8	
Masked hypertension				0.92		
Yes	6		8		8	
No	6		7		8	

P-value calculated by Kruskal-Wallis test, shown only for categories for which there was a difference in the median value. For example, since there was no difference in the median value in office BP confidence between those with vs without masked hypertension, the P-value of 1 is not shown.

Table 3

Perception of Comparative Accuracy between Office BP and Ambulatory BP Monitoring

	Percent (N=193)
ABPM a lot more accurate	60%
ABPM a little more accurate	27%
Office a little more accurate	2%
Office a lot more accurate	3%
Neither is accurate	8%

Table 4

Reported Expectancy of Blood Pressure to Respond to Treatment Based on Measurement Method

	None or very little improvement (%)	Some improvement (%)	Significant improvement (%)
Office	14*	43*	43*
Home	5	26†	70‡
ABPM	4	31‡	65

Percents may not add to 100 because of rounding

*P<0.002 compared to ABPM

†P<0.05 compared to office

‡P<0.005 compared to office

Table 5
Willingness to Take Blood Pressure-Lowering Medication (%)

Willingness based on office BP in relation to ABPM	
More willing if high BP confirmed by ABPM	78.2
Not more willing even if high BP confirmed by ABPM	15.0
Would not take medication either way	6.7
Willingness to take BP-lowering medication if hypertension detected *only* by ABPM	
Would definitely take medication	51.6
Would be more likely if office BP was also elevated	37.4
Would not take medication either way	11.0

ABPM, ambulatory blood pressure monitoring