

Research article

Open Access

Favorable patient acceptance of ambulatory blood pressure monitoring in a primary care setting in the United States: a cross-sectional survey

Michael E Ernst*¹ and George R Bergus²

Address: ¹Division of Clinical and Administrative Pharmacy, College of Pharmacy; and, Department of Family Medicine, Roy J. and Lucille A. Carver College of Medicine. The University of Iowa, Iowa City, Iowa, USA and ²Department of Family Medicine, Roy J. and Lucille A. Carver College of Medicine. The University of Iowa, Iowa City, Iowa, USA

Email: Michael E Ernst* - michael-ernst@uiowa.edu; George R Bergus - george-bergus@uiowa.edu

* Corresponding author

Published: 08 October 2003

Received: 04 August 2003

BMC Family Practice 2003, 4:15

Accepted: 08 October 2003

This article is available from: <http://www.biomedcentral.com/1471-2296/4/15>

© 2003 Ernst and Bergus; licensee BioMed Central Ltd. This is an Open Access article: verbatim copying and redistribution of this article are permitted in all media for any purpose, provided this notice is preserved along with the article's original URL.

Abstract

Background: The use of ambulatory blood pressure monitoring (ABPM) in the diagnosis and management of hypertension in primary care settings in the United States is increasing. Insufficient information is available describing patients' experiences and acceptance of this technology in the United States, where medical insurance coverage of the procedure is often limited. The objective of this study was to describe patient satisfaction with ABPM performed in a primary care office in the United States, using modern ABPM technology.

Methods: Cross-sectional survey performed on consecutive patients referred to the ABPM service of the Family Care Center, University of Iowa Hospitals and Clinics, Iowa City, Iowa from January 2001 to July 2003. Measures of patient satisfaction and acceptance with the device, comfort, and overall session were assessed via a 9-question, Likert-scale response survey.

Results: Since its inception two and a half years ago, 245 total ABPM sessions have been conducted in 235 unique patients. Of the 235 eligible respondents, 177 returned completed surveys, yielding a 75% response rate. Three-fourths (75%) of patients believed that undergoing the test was worthwhile considering the time and monetary cost involved, while most (90%) reported they thought the information provided by the test would be helpful to their physician in making treatment decisions. Patients reporting that their physician had clearly explained the benefit of undergoing the testing were more likely to report that they thought the results of the test would be more helpful in making treatment decisions. Few patients (20%) found that wearing the monitor was uncomfortable.

Conclusions: When clinically indicated, clinicians should not hesitate to order ABPM testing for fear of subjecting patients to an uncomfortable test, or an uncovered insurance benefit. When ordering ABPM, they should be sure to educate the patient about the potential benefits of undergoing the testing. Most patients believe the test will provide useful information in making treatment decisions, despite probable lack of insurance coverage, and appear willing to experience some discomfort for the overall gain of the results obtained from undergoing the session.

Background

Non-invasive, 24-hour ambulatory blood pressure monitoring (ABPM) has emerged as an important instrument assisting clinicians in the diagnosis and management of hypertension. Although several studies have validated the prognostic significance of data acquired from ABPM; historically, access to the technology in the United States is generally limited to specialty referral clinics such as cardiology or nephrology, found in larger teaching institutions [1-4]. The limited access in primary care offices is probably due, in part, to the lack of reimbursement by most medical insurance companies for the procedure. Thus, the routine use of the technology in primary-care offices is somewhat of a novelty.

However, the landscape of ABPM in the United States is currently shifting. Recent prospective outcome studies have fueled the argument that ABPM should play a more prominent role in the diagnosis and management of the hypertensive patient [5]. The Joint National Committee of the National High Blood Pressure Education Program and the British Hypertension Society recommend its use in a number of clinical scenarios, while other organizations have cautiously endorsed its use [6-11]. Although some experts question the cost-effectiveness of routine use of ABPM in hypertensive patients [12], others have proclaimed that judicious ABPM use can actually decrease cost of care [13,14]. When available, ABPM appears to be well-accepted by physicians [15].

With recent accumulating evidence supporting the role of ABPM in clinical practice, the United States Centers for Medicare and Medicaid Services (CMS) now reimburses for the testing in patients with suspected white-coat hypertension [16]. Because a significant number of patients with hypertension are insured by Medicare, it is likely that the demand for ABPM services will increase, and this shift will occur in primary care clinics [17]. Several prior studies have examined utilization of ABPM in clinical practice; that is, reasons why physicians order the test and how the results of the test influence decision-making [18-20]. While these studies have documented the physician use and acceptance of ABPM technology, none of the studies examined patient satisfaction associated with use of ABPM in this setting. Furthermore, improved microelectronic and battery technology have allowed the equipment to become more compact and lightweight in the last 10 years, increasing portability and perhaps comfort.

Patients undergoing ABPM testing are required to wear the device for 24-hours, during which time the monitor records blood pressure at regularly programmed intervals [17]. Since patients are asked to go about their normal daily activities while wearing the monitor, it is probable they will experience some discomfort during the session

and anticipation of this discomfort may negatively influence their acceptance of undergoing the testing, and possibly their acceptance of any pharmacologic interventions which might result from the testing. Because limited information exists in the medical literature on this topic, and particularly lacking in the primary care setting, the purpose of this report is to describe our primary care clinic's experience with patient acceptance of ABPM.

Methods

Description of the ABPM Service

The ABPM service is located within the University of Iowa Family Care Center. The Family Care Center serves nearly 60,000 patient visits yearly between its Family Medicine and Internal Medicine outpatient clinics. The ABPM service is co-directed by a board-certified family physician (GB) and a clinical pharmacist who is a board-certified pharmacotherapy specialist (ME).

Primary care physicians who, in the course of a routine office visit determine that ABPM is clinically indicated in the management of their patient, refer the patient to the service. The patient returns to the clinic on a different day to have the monitor fitted by the clinical pharmacist, and returns the monitor the next day after completing the 24-hour testing period. The data from the monitor is then downloaded into a software program for data analysis. The report is initially reviewed by the clinical pharmacist, with particular reference to the effects of any medications, then the results are forwarded to the ordering physician for final review and action.

SpaceLabs Medical, Inc. (Redmond, WA) 90207 Ultralite ABP monitors are used by the service. The computer software program used is the ABP Report Management System, version 1.03.11 from SpaceLabs Medical, Inc., which provides a printout of all blood pressures, including summary statistics for mean blood pressures and blood pressure load for daytime, nighttime and overall 24 hours. The service began in January 2001 and follow-up for this study represents data accrued through July 31, 2003. The study was approved by the University of Iowa institutional review board.

Patient Satisfaction Survey

Consecutive patients referred for ABPM testing by their primary care provider were asked to complete a 9-item questionnaire regarding their experience with ABPM, upon completion of the 24-hour ABPM session (see Additional File 1). The questionnaire was anonymous and if patients did not return the survey, they were not contacted with a follow-up reminder. Patients who were referred for a follow-up ABPM session were only surveyed once.

The questionnaire asked for responses to the following questions regarding the ABPM session, using a five point Likert scale ranging from "strongly agree" to "strongly disagree": "My doctor clearly explained the benefit of undergoing this testing;" "Wearing the monitor for 24 hours was not uncomfortable;" "Considering the monetary and time cost to me, I think undergoing ambulatory blood pressure monitoring was worthwhile;" "I think information provided by the test will be helpful in making decisions about how to treat my blood pressure;" and, "Overall, I am very satisfied with my experience." The other four questions on the survey asked specifically about the physical resources of the ABPM service, such as location and staff involved, and were included for quality assurance purposes. Thus, their responses are not relevant to this analysis. Finally, space was given on the survey for any additional comments patients wished to include. These comments were aggregated into major themes.

The data obtained from the survey were entered into a spreadsheet and frequency distributions and descriptive statistics were used to summarize the data. For analysis purposes, responses of "neutral" were considered to be a negative response and grouped with the "disagree" and "strongly disagree" responses as a more conservative method of assessing satisfaction, while "strongly agree" and "agree" responses were combined. Comparisons between the groupings were assessed via chi-square analysis.

Results

Two hundred forty-five ABPM sessions were performed between January 1, 2001 and July 31, 2003. Ten patients had two or more ABPM sessions during this period, reducing the number of eligible participants surveyed to 235. Of these, 177 returned patient satisfaction surveys yielding a final response rate of 75%.

Because the survey was anonymous, the demographic data represent the demographics of the 245 patients who completed at least one ABPM session, not just the responders to the survey. The mean age of the ABPM participants was 52.6 years (range 17–86; std. dev 16.3), and just over half (51%) of the patients were male (Table 1). While Family Medicine physicians ordered more of the ABPM sessions ($n = 137/245$; 56%) than Internal Medicine physicians, the indications for ordering the test were not different between the two groups (chi-square, $p = 0.13$).

The most frequent indication ($n = 71$; 29% of patients) for undergoing ABPM testing was to evaluate blood pressure control on current antihypertensive therapy, followed by evaluation of borderline office hypertension ($n = 62$; 25% of patients), and suspected white-coat hypertension in an

untreated patient ($n = 60$; 24% of patients). The most common management outcome resulting from the data obtained from the ABPM test was the initiation of an antihypertensive agent ($n = 51$; 21% of patients). White-coat hypertension was diagnosed in 20% of the patients. Overall, the ABPM sessions were well-tolerated, with only 3 patients failing to wear the device for the entire testing period. Complications, such as petichiae at the cuff site, or arm thrombosis, were not reported by any of the patients.

Patient satisfaction was generally high with ABPM in this setting. Of the 177 surveys returned, 75% ($n = 132/177$) of patients reported that the twenty-four hour ABPM test was worthwhile when considering the time and monetary cost of the session. Most patients ($n = 132/177$; 90%) thought the test results would provide information that would help their physician make treatment decisions. Overall, most patients ($n = 157/177$; 89%) reported being satisfied with their ABPM experience.

Despite the overall positive patient perceptions of ABPM, some patients voiced dissatisfaction with the comfort of ABPM. Twenty percent ($n = 36/177$) of patients reported that the ABPM session was uncomfortable, while another 28% ($n = 50/177$) responded neutrally to the statement. However, when asked about whether the test results would provide useful information in helping make treatment decisions, the 86 patients who rated ABPM as uncomfortable or neutral were just as likely to report that they believed the test would provide useful information to help make treatment decisions, as the 89 patients who reported no discomfort from the test (chi-square; $p = 0.07$).

A second area of dissatisfaction reported by patients was related to whether their physician clearly explained the benefit of undergoing the testing. Seventeen (7%) patients did not feel that their physician had clearly explained the benefit of undergoing the testing. Additionally, 30% of these patients reported they did not think the results of the ABPM testing would be helpful in making treatment decisions. In contrast, of the 159 (90%) patients who reported that their physician had clearly explained the benefit of undergoing the testing, only 6% reported they did not think the results of the test would be helpful (chi-square; $p < 0.01$). Further analysis of the patients who reported that their physician did not clearly explain the benefit of the testing found a trend for reporting greater discomfort with the test (chi-square; $p = 0.11$) compared to patients who reported they were satisfied with their physicians' explanations of the benefit of undergoing the testing.

Finally, in the open ended general comment section, 43 patients provided content which were organized into 4

Table 1: Demographics of the population undergoing ABPM testing one or more times during the analysis period (n = 245).

Age (in years)	
Mean ± SD	52.6 ± 16.3
(Range)	(17–86)
Gender	
Female	119 (49%)
Male	126 (51%)
Indication for ABPM ^a	
Evaluation of blood pressure control	71 (29%)
Borderline hypertension ^b	62 (25%)
Suspected white-coat hypertension	60 (24%)
Treatment resistance	19 (8%)
Other	33 (13%)
Outcome Resulting from ABPM ^a	
Medication initiated	51 (21%)
Diagnosed white-coat hypertension	49 (20%)
No change in therapy (blood pressure controlled)	37 (15%)
Medication changed	31 (13%)
Dose/regimen adjusted	21 (9%)
Recommend lifestyle modifications	14 (6%)
Other/unknown	42 (18%)

^a categories are mutually exclusive ^b defined as those patients with office blood pressures that are elevated into the Stage I range at some visits, but also in the pre-hypertension range (per JNC-VII classification – ref. [10]) at other visits. These patients are untreated and have not been officially diagnosed with hypertension.

general themes: (1) problems with the ABPM session (e.g., physical discomfort; difficulty performing normal daily activities; difficulty sleeping); (2) perceived benefit of undergoing the testing (e.g. unsure what useful information would be obtained) (3) ease of testing (e.g. surprised at how easy the test was); and, (4) miscellaneous (e.g. scheduling, fitting of monitor, etc.). The most common written comment, mentioned by 24 patients, pertained to the ABPM device and problems encountered while performing activities of daily living and sleep. However, 9 patients noted the test was easier than expected and that the information should be helpful in making treatment decisions.

Discussion

Over a two-and-a-half-year period, patients undergoing ABPM in a primary care office setting in the United States reported that this method of testing was well-accepted and tolerated. The most common complaint was about discomfort while undergoing the testing but only 20% of patients reported this trouble. Additionally, even those patients who offered this complaint generally felt the test was worthwhile.

Although ABPM recordings are considered more reliable than office or home blood pressure measurements, there is a trade-off between patient comfort and accuracy with ABPM. Our data indicate that patients generally believe the results will be helpful in making treatment decisions and are willing to be inconvenienced by an ABPM session.

We also found that the physician's effectiveness in explaining the need for ABPM testing to a patient is linked to the patients' perception of the study. Thus, physicians should clearly explain the benefit of undergoing ABPM testing to their patients when it is ordered.

Our findings about patient satisfaction with ABPM are the first reported in a population from the United States, a country where ABPM is generally not reimbursed, and routine use of ABPM in clinical practice is the exception and not the norm. Our results are consistent with those described in a recent qualitative study of ABPM in Great Britain [21]. In this study, patient preferences for different methods of measuring blood pressure (home, ambulatory, nurse, doctor) in the primary care setting were compared, and it was concluded that respondents felt all methods were worth the trouble to get accurate measurements [21]. However, home blood pressure monitoring has limitations which include lack of recording during sleep hours, an important time period for obtaining data which may have value for prognosis, as well as questionable accuracy as patients may not record their blood pressures faithfully [22,23]. Although ambulatory measurements were noted in the study findings to have higher likelihood of discomfort and disturbance of life and sleep compared to the other methods of measurement, it was otherwise well-accepted by patients. Our findings are fairly similar; this similar level of acceptance is notable given the differences in use of ABPM and how

medical care is financed in Great Britain compared to the United States.

Aside from the study by Little et al. [21], there is a modest amount of other information about patient satisfaction with ABPM. Acceptability and tolerance of ABPM was evaluated in a study by Mallion et al. based on a case series of 672 patients [24]. Problems that patients encountered while undergoing ABPM included those related to the cuff pressure (32%), awkwardness of the machine (14%) and noise of the monitor (6%). Sleep disturbances were reported by 55% of patients, although only 14% of patients reported more than 3 awakenings. However, this study differed from ours and could be subject to bias since the physician ordering the test actually filled out the survey after asking the patient a series of questions upon completing the ABPM session. Furthermore, the study was performed in French cardiologist offices using older ABPM equipment. Thus, it is unlikely that these findings apply to a primary care population in the United States undergoing ABPM using current technology.

Our study must be interpreted within the context of several important limitations. The demographics reported represent the entire population completing ABPM, not just the survey responders; thus, no information is known about survey non-responders and how their experience with ABPM compared. However, our response rate was very high, which increases the generalizability of our data and suggests we have accurately assessed the perceptions of patients undergoing ABPM within our setting. Secondly, our study was conducted at one site, so geographical differences in practice styles might be a consideration. However, our site is a typical primary care setting in the United States, and to our knowledge the study is the first to examine patient satisfaction with ABPM in this setting. This is important since ABPM is likely to transition from being used almost exclusively in specialty referral clinics to more widespread use in primary care settings. Lastly, it is known that physician approach can often influence patient behavior. We did not provide suggested language to physicians for how to explain to the patient the rationale and need for ordering the test. It is possible that confusion on the part of the uninformed patient might then have influenced survey responses, although our study reflects how the test would likely be ordered in usual practice.

In spite of these limitations, our survey provides useful information regarding patient acceptance of modern ABPM testing in a primary care setting in the United States. Because of its proven utility in the clinical setting, and recent CMS approval for coverage in patients with suspected white coat hypertension, demand for the ABPM

testing in the future is likely to shift predominantly from specialty referral centers to primary care offices.

Conclusions

When clinically appropriate, clinicians should not hesitate to order ABPM for fear of subjecting their patient to potential discomfort, and they should be sure to educate the patient about the potential benefits of undergoing the testing. Despite in many cases being an uncovered insurance benefit, patients generally believe the test will provide useful information in making treatment decisions, and appear willing to experience some discomfort in the process.

List of Abbreviations Used

ABPM = ambulatory blood pressure monitoring

Competing Interests

None declared

Authors' Contributions

ME and GB conceived the study and developed the survey instrument. ME administered the survey questionnaires, performed the data analysis, and drafted the manuscript. GB participated in the design and coordination of the study, and provided statistical analysis consultation. All authors read and approved the final manuscript.

Additional material

Additional File 1

Ambulatory Blood Pressure Monitoring Survey

Click here for file

[<http://www.biomedcentral.com/content/supplementary/1471-2296-4-15-S1.doc>]

References

1. Staessen JA, Byttebier G, Buntinx F and et al: **Antihypertensive treatment based on conventional or ambulatory blood pressure measurement.** *JAMA* 1997, **278**:1065-1072.
2. Ohkubo T, Imai Y, Tsuji I and et al: **Prediction of mortality by ambulatory blood pressure monitoring versus screening blood pressure measurements: a pilot study in Ohasama.** *J Hypertens* 1997, **15**:357-364.
3. Staessen JA, Thijs L, Fagard R and et al: **Predicting cardiovascular risk using conventional vs ambulatory blood pressure in older patients with systolic hypertension.** *JAMA* 1999, **282**:539-546.
4. Perloff D, Sokolow M and Cowan R: **The prognostic value of ambulatory blood pressures.** *JAMA* 1983, **249**:2792-2798.
5. Clement DL, De Buyzere ML, De Bacquer DA, de Leeuw PW, Duprez DA, Fagard RH, Gheeraert PJ, Missault LH, Braun JJ, Six RO, Van Der Niepen P and E O'Brien: **Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension.** *N Engl J Med* 2003, **348**:2407-2415.
6. Pickering T: **Recommendations for the use of home (self) and ambulatory blood pressure monitoring.** *Am J Hypertens* 1996, **9**:1-11.

7. Sheps SG: **Ambulatory blood pressure monitoring. Hypertensive Diseases Committee, American College of Cardiology.** *J Am Coll Cardiol* 1994, **23**:1511-1513.
8. Staessen JA, Beilin L, Parati G and et al: **Task Force VI: Clinical use of ambulatory blood pressure monitoring.** *Blood Press Monit* 1999, **4**:319-331.
9. O'Brien E: **Use and interpretation of ambulatory blood pressure monitoring: recommendations of the British hypertension society.** *BMJ* 2000, **320**:1128-1134.
10. Chobanian AV, Bakris GL, Black HR and WC Cushman: **The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure.** *JAMA* 2003, **289**:2560-2572.
11. O'Brien E, Asmar R, Beilin L, Imai Y, Mallion J-M, Mancia G, Mengden T, Myers M, Padfield P, Palatini P, Parati G, Pickering T, Redon J, Staessen J, Stergiou G and P Verdecchia: **European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement.** *Journal of Hypertension* 2003, **21**:821-848.
12. Moser M: **Hypertension can be treated effectively without increasing the cost of care.** *J Hum Hypertens* 1996, **10**(suppl 2):S33-8.
13. Krakoff LR: **Ambulatory blood pressure monitoring can improve cost-effective management of hypertension.** *Am J Hypertens* 1993, **6**:221S-4.
14. Pierdomenico SD, Mezzetti A, Lapenna D and et al: **'White-coat' hypertension in patients with newly diagnosed hypertension: evaluation of prevalence by ambulatory monitoring and impact on cost of health care.** *Eur Heart J* 1995, **16**:692-697.
15. Grin JM, McCabe EJ and WB White: **Management of hypertension after ambulatory blood pressure monitoring.** *Annals of Internal Medicine* 1993, **118**:833-837.
16. Servives. CMS. Centers for Medicare and Medicaid: **Medicare Coverage Policy Decisions. Ambulatory Blood Pressure monitoring.** 2001 [<http://www.cms.hhs.gov/ncdr/memo.asp?id=5>].
17. Ernst ME and Bergus GB: **Non-invasive 24-hour ambulatory blood pressure monitoring: overview of technology and clinical applications.** *Pharmacotherapy* 2002, **22**:597-612.
18. Gardner SF and Schneider EF: **24-hour ambulatory blood pressure monitoring in primary care.** *J Am Board Fam Pract* 2001, **14**:166-171.
19. Kelley KW, King DS, Wofford MR and et al: **The use of ambulatory blood pressure monitoring to influence drug regimens in a hypertension specialty clinic (abstract).** *Pharmacotherapy* 2001, **21**:1261-1262.
20. Dart RA and Berg RL: **The clinical utility of ambulatory blood pressure monitoring in a multispecialty clinic setting.** *Blood Press Monit* 1996, **1**:475-480.
21. Little P, Barnett J, Barnsley, Marjoram J, Fitzgerald-Barron A and Mant D: **Comparison of acceptability of and preferences for different methods of measuring blood pressure in primary care.** *BMJ* 2002, **325**:258-259.
22. Verdecchia P: **Ambulatory blood pressure. An independent predictor of prognosis in essential hypertension. [see comments.] [erratum appears in Hypertension 1995 Mar;25(3):462.]** *Hypertension* 1994, **24**:793-801.
23. T Mengden, RM Hernandez Medina, B Beltran, E Alvarez, K Kraft and H Vetter: **Reliability of reporting self-measured blood pressure values by hypertensive patients.** *American Journal of Hypertension* 1998, **11**:1413-1417.
24. Mallion J-M, de Gaudemaris R, Baguet J-P, Azzouzi L, Quesada J-L, Sauzeau C, Siche J-P, Tremel F and Boutelant S: **Acceptability and tolerance of ambulatory blood pressure measurement in the hypertensive patient.** *Blood Press Monit* 1996, **1**:197-203.

Pre-publication history

The pre-publication history for this paper can be accessed here:

<http://www.biomedcentral.com/1471-2296/4/15/prepub>

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

