Recommendations for Blood Pressure Measurement in Humans: An AHA Scientific Statement from the Council on High Blood Pressure Research Professional and Public Education Subcommittee

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Ten years have passed since the last version of the American Heart Association (AHA) blood pressure (BP) measurement recommendations,[1] during which time there have been major changes in the ways in which BP is measured in clinical practice and research; hence this document represents a major revision of previous versions.[2] BP determination continues to be one of the most important measurements in clinical medicine, and still one of the most inaccurately performed. The gold standard for clinical BP measurement has always been readings taken by a trained health care provider using a mercury sphygmomanometer and the Korotkoff sound technique. There is increasing evidence, however, that this procedure may lead to the misclassification of large numbers of individuals as hypertensive, and fail to diagnose other individuals whose BP may be normal in the clinic setting but elevated at other times. There are three reasons for this: 1) inaccuracies in the methods, some of which are avoidable; 2) the inherent variability of BP; and 3) the tendency for BP to increase in the presence of a physician (the so-called "white coat effect").

Numerous surveys have shown that physicians and other health care providers rarely follow established guidelines for BP measurement, but when they do, the readings they get correlate more closely with more objective measures of BP than the usual clinic readings. It is generally agreed that conventional clinic readings, when made correctly, are a surrogate marker for a patient's true BP, which is conceived as the average level over prolonged periods of time, and which is thought to be the most important component of BP in determining its adverse effects. Usual clinic readings give a poor estimate of this, not only because of poor technique, but also because they typically consist only of one or two individual measurements, and the beat-to-beat BP variability is such that a small number of readings may only give a crude estimate of the average level.

The recognition of these limitations of traditional clinic readings has led to two parallel developments: first, increasing use of measurements out of the clinic,

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which avoids the unrepresentative nature of the clinic setting and also allows for an increased number of readings; and second, the increased use of automated devices, which are being used both in and out of the office setting. This decreased reliance on traditional readings has been accelerated by the fact that mercury is being banned in many countries, although there is still uncertainty as to what will replace it.

Several dimensions of BP are associated with an increased risk of vascular disease. Clinic-based measurements that predict vascular disease include systolic and diastolic BP as well as mean arterial pressure and pulse pressure. Several studies have attempted to tease apart the relative importance of these measurements.[3,4] Despite evolving interest in pulse pressure, the best available evidence still supports the use of systolic and diastolic BPs to classify individuals.

CLASSIFICATION/SUBTYPES OF HYPERTENSION

Isolated Systolic Hypertension (ISH)

As adults age, systolic BP tends to rise and diastolic BP tends to fall. When the average systolic BP is ≥140 and diastolic BP is <90 the patient is classified as having ISH. The increased pulse pressure (systolic – diastolic) and systolic pressure predict risk and determine treatment.[5]

ISH of the Young

In older children and young adults, more often males, the combination of rapid growth in height and very elastic arteries accentuates the normal amplification of the pressure wave between the aorta and brachial artery, resulting in a high systolic pressure in the brachial artery, but normal diastolic and mean pressures. The aortic systolic pressure is normal, however. This can be suspected from pulse wave analysis.[6]

Isolated Diastolic Hypertension (IDH)

More commonly in some younger adults, IDH is defined as systolic BP <140 and diastolic BP ≥90. Although diastolic pressure is generally believed to be the best predictor of risk in patients under the age of 50, some prospective studies of isolated diastolic hypertension have indicated that the prognosis may be benign.[7] This topic remains controversial.

White Coat Hypertension (WCH) or Isolated Office Hypertension

WCH is commonly defined as a persistently elevated average office BP of >140/90 and an average awake ambulatory reading of <135/85 mm Hg, and occurs in about 15%–20% of people with stage 1 hypertension.[8] Patients with WCH may progress to sustained hypertension and need to be followed carefully with office and out-of-office measurements of BP. Treatment with antihypertensive drugs may lower the office BP but does not change the ambulatory measurements.[9]

Masked Hypertension or Isolated Ambulatory Hypertension

Somewhat less frequent than WCH, but more problematic to detect, is the converse condition—normal BP in the office and elevated BPs elsewhere, e.g., at work or at home. There is some evidence that such patients have more target organ damage and are at higher risk than subjects who are normotensive all the time.[10]

Pseudohypertension

In a small number of elderly patients, the peripheral muscular arteries become very rigid, such that the cuff has to be at a higher pressure to compress them. The brachial or radial artery may be palpated distal to the fully inflated cuff in these instances (positive Osler's sign). When suspected, an intra-arterial radial artery BP can be obtained for verification. Osler's maneuver is not a reliable screen for pseudohypertension.

Orthostatic or Postural Hypotension

Orthostatic hypotension is defined as a reduction of systolic BP of at least 20 mm Hg or 10 mm Hg in diastolic BP within 3 minutes of quiet standing.[11] If chronic, the decrease in BP may be part of pure autonomic failure, multiple system atrophy, and other dysautonomias. These patients may not only have profound hypotension on standing, but also severe hypertension when supine during the night.

BP MEASUREMENT METHODS

The auscultatory method has been the mainstay of clinical BP measurement for as long as BP has been measured; this is gradually being supplanted by other techniques that are more suited to automated measurement.

The Auscultatory Method

It is surprising that nearly 100 years after it was first discovered, and the subsequent recognition of its limited accuracy, the Korotkoff technique for measuring BP has continued to be used without any substantial improvement. The brachial artery is occluded by a cuff placed around the upper arm and inflated to above systolic pressure. As it is gradually deflated pulsatile blood flow is reestablished and accompanied by sounds that can be detected by a stethoscope held over the brachial artery just below the cuff. The onset

of phase I of the Korotkoff sounds (tapping sounds corresponding to the appearance of a palpable pulse) corresponds to systolic pressure, but tends to underestimate the systolic pressure recorded by direct intra-arterial measurement.[12] The disappearance of sounds (phase V) corresponds to diastolic pressure, but tends to occur before diastolic pressure determined by direct intraarterial measurement.[12] The fifth phase should be used, except in situations in which the disappearance of sounds cannot reliably be determined because sounds are audible even after complete deflation of the cuff, for example, in pregnant women, in which case the fourth phase (muffling) may be used.[13]

In older patients with a wide pulse pressure, the Korotkoff sounds may become inaudible between systolic and diastolic pressure and reappear as cuff deflation is continued. This phenomenon is known as the auscultatory gap. In some cases this may occur because of fluctuations of intraarterial pressure, and is most likely to occur in subjects with target organ damage.[14]

Mercury Sphygmomanometers. The design of mercury sphygmomanometers has changed little over the past 50 years, except that modern versions are less likely to spill mercury if dropped. There is less to go wrong with mercury sphygmomanometers than with other devices, and there is negligible difference in the accuracy of different brands. However, many devices in everyday use are defective. The random zero sphygmomanometer was designed to eliminate observer bias, but is no longer available.

Aneroid Sphygmomanometers. In these devices, the pressure is registered by a mechanical system of metal bellows that expands as the cuff pressure increases and a series of levers that register the pressure on a circular scale. This type of system may not maintain its stability over time. They therefore require calibrating at regular intervals. Recent developments in the design of aneroid devices may make them less susceptible to damage when dropped.

Hybrid Sphygmomanometers. Devices have been developed which combine features of both electronic and auscultatory devices, and are referred to as "hybrid" sphygmomanometers. The mercury column is replaced by an electronic pressure gauge, such as are used in oscillometric devices, and BP is taken using the auscultatory technique.[15] The hybrid sphygmomanometer has the potential to become a replacement for mercury.

The Oscillometric Technique

When the oscillations of pressure in a sphygmomanometer cuff are recorded during gradual deflation, the point of maximal oscillation corresponds to the mean intra-arterial pressure. The oscillations begin above systolic BP and continue below diastolic BP, so that systolic and diastolic BPs can only be estimated indirectly according to some empirically derived algorithm. One advantage of the method is that no transducer needs to be placed over the brachial artery, so placement of the cuff is not critical. However, in older people with wide pulse pressures, the mean arterial pressure may be significantly underestimated.[16] The oscillometric technique has been used successfully in ambulatory BP monitors and home monitors.

Location of Measurement—Arm, Wrist, Finger

The standard location for BP measurement is the upper arm, but wrist monitors may be useful in very obese patients if the monitor is held at heart level. Finger monitors are not recommended.

Validation of Monitors

It is recommended that only those devices that have passed standardized validation tests should be used in practice, and oscillometric monitors should be validated on each patient before the readings are accepted.[17] With non-automatic devices, such as mercury and aneroid monitors, it is recommended that the accuracy of the pressure registration mechanism be checked.

BP MEASUREMENT IN THE CLINIC OR OFFICE

Accurate auscultatory office BP measurement is the bedrock of the diagnosis and treatment of hypertension; however, it is becoming increasingly clear that, as it is used in everyday practice, there are major shortcomings.

Subject Preparation

A number of factors related to the subject can cause significant deviations in measured BP. These include room temperature, exercise, alcohol or nicotine consumption, positioning of the arm, muscle tension, bladder distension, talking, and background noise. The patient should be asked to remove all clothing that covers the location of cuff placement. The individual should be comfortably seated, with the legs uncrossed, and the back and arm supported, such that the middle of the cuff on the upper arm is at the level of the right atrium (the midpoint of the sternum). At the initial visit, BP should be measured in both arms. The patient should be instructed to relax as much as possible, and not to talk during the measurement procedure; ideally 5 minutes should elapse before the first reading is taken.

Choice of BP Measurement Devices

It is recommended that, if available, a properly maintained mercury sphygmomanometer be used for routine office measurements. There is a role for other types of devices, both as a substitute for the traditional mercury readings (e.g., aneroid and hybrid sphygmomanometers), and as supplements to them (e.g., oscillometric automatic devices). Mercury sphygmomanometers are necessary for evaluating the accuracy of any type of non-mercury device.

Cuff Size

A common source of error is "miscuffing," where the use of a cuff that inadequately encircles the arm gives a falsely high reading. The "ideal" cuff should have a bladder length that is 80%, and a width that is at least 40% of arm circumference (a length-to-width ratio of 2:1). The recommended cuff sizes are:

- For arm circumference of 22–26 cm, the cuff should be "small adult" size—12 × 22 cm.
- For arm circumference of 27–34 cm, the cuff should be "adult" size—16 × 30 cm.
- For arm circumference of 35–44 cm, the cuff should be "large adult" size—16 × 36 cm.
- For arm circumference of 45–52 cm, the cuff should be "adult thigh" size—16 × 42 cm.

Effects of Body Position

BP measurement is most commonly made in either the sitting or supine position, but the two positions give different measurements. When measurements are taken in the supine position the arm should be supported with a pillow. Diastolic pressure measured while sitting is higher than when measured supine (by about 5 mm Hg). When the arm position is meticulously adjusted so that the cuff is at the level of the right atrium in both positions, the systolic pressure is about 8 mm Hg higher in the supine than the upright position.[18] If the back is not supported (as when the patient is seated on an examination table rather than a chair) the diastolic pressure may be 6 mm Hg higher. Crossing the legs may raise systolic pressure by 2–8 mm Hg.[19] The position of the arm is also important when seated measurements are taken: if the upper arm is below the level of the right atrium (when the arm is hanging down while in the sitting position) the readings will be too high. Similarly, if the arm is above the heart level, the readings will be too low. These differences can be attributed to the effects of hydrostatic pressure and may be 2 mm Hg for every inch above or below the heart level.[20]

Differences Between the Two Arms

BP should be checked in both arms at the first examination. This may be helpful in detecting coarctation of the aorta and upper extremity arterial obstruction. When there is a consistent inter-arm difference, the arm with the higher pressure should be used for follow-up.

Cuff Placement and Stethoscope

Cuff placement must be preceded by selection of the appropriate cuff size for the subject's arm circumference. The observer must first palpate the brachial artery in the antecubital fossa and place the midline of the bladder of the cuff so that it is over the arterial pulsation over the patient's bare upper arm. The sleeve should not be rolled up such that it has a tourniquet effect above the cuff, and the lower end of the cuff should be 2–3 cm above the antecubital fossa. Neither the observer nor the patient should talk during the measurement. The Korotkoff sounds are best heard using the bell of the stethoscope over in the antecubital fossa. The cuff should initially be inflated to at least 30 mm Hg above the point at which the radial pulse disappears, and deflated at a rate of 2–3 mm Hg per second (or per pulse when the heart rate is very slow).[21]

IMPORTANT POINTS FOR CLINICAL BP MEASUREMENT

- The patient should be seated comfortably with the back supported and the upper arm bared without constrictive clothing. The legs should not be crossed.
- The arm should be supported at heart level, and the bladder of the cuff should encircle at least 80% of the arm circumference.
- The mercury column should be deflated at 2–3 mm/sec, and the first and last audible sounds taken as systolic and diastolic pressure. The column should be read to the nearest 2 mm Hg.
- Neither the patient nor the observer should talk during the measurement.

Observers and Training

The observer is the most critical component of accurate BP measurement, and must:

- Be properly trained in the techniques of BP measurement.
- Use an accurate and properly maintained device.
- Recognize subject factors, such as anxiety and recent nicotine use, that would adversely affect BP measurements.
- Position the subject appropriately.
- Select the correct cuff and position it correctly.
- Perform the measurement using the auscultatory or automated oscillometric method and accurately record the values obtained.

Observer error is a major limitation of the auscultatory method. Terminal digit preference is perhaps the most common manifestation of suboptimal BP determination. It is recommended that the observer should read the BP to the nearest 2 mm Hg.

Before training begins, potential observers should be assessed for physical and cognitive competencies required to carry out the procedure, including adequate vision, hearing, and manual dexterity. Standardized programs with audio-visual tapes that test and retest accuracy in measurement are effective in training and retraining. The evaluation of observers should include an assessment of their knowledge of the different types of observer bias, general technique. Retraining of all health care professionals is strongly recommended.

Number of Measurements

The predictive power of multiple BP determinations is much greater than a single office reading. One advantage of supplementing auscultatory readings with readings taken by an automated device is the ability to obtain a larger number of readings. When a series of readings is taken, the first is typically the highest; a minimum of two readings should be taken at intervals of at least 1 minute, and the average used to represent the patient's BP. If there is more than a 5 mm Hg difference between the first and second readings, additional (one or two) readings should be obtained and then the average of these multiple readings is used.

Automated Methods

Automated oscillometric BP devices are increasingly used in office BP measurement, as well as for home and ambulatory monitoring. When they are used in the office, the readings are typically lower than readings taken by a physician or nurse. The potential advantages of automated measurement in the office are the elimination of observer error, minimizing the white coat effect, and increasing the number of readings. The main disadvantages are the error inherent in the oscillometric method, and the fact that epidemiologic data are mostly based upon auscultated BP measures.

Automated devices may also offer the opportunity to avoid expensive and repetitive training of health care professionals in auscultation which is necessary to reduce observer errors. Their use still requires careful patient evaluation for caffeine or nicotine use, selection of the correct cuff size, and proper patient positioning if accurate BPs are to be obtained. Devices are now available that can take a series of sequential readings and automatically average them.

The "White Coat Effect"

In hypertensive patients (but not necessarily in normotensives) the BP recorded by a physician or nurse is typically higher than the average daytime level, and this difference is commonly referred to as the "white coat effect." Physicians also typically record higher pressures than nurses,[22] and it is recommended that physician BPs should not be used exclusively in the routine management of the hypertensive subject.

SELF-MEASUREMENT

The standard monitor for home use is now an oscillometric device that records pressure from the brachial artery. An up-to-date list of validated monitors is available.[23] Home or self-monitoring has numerous advantages over ambulatory monitoring, principal among which are that it is inexpensive and provides a convenient way for monitoring BP over long periods of time (Table I). There is some evidence that it improves both therapeutic compliance and BP control.[24–26] Unfortunately, accurate readings do not guarantee accurate reporting to the physician. Devices that have memory or print-outs of the readings are therefore recommended.

When readings are taken, the patient should not have recently indulged in any activity such as exercise or eating that is likely to affect the BP, and should be resting quietly in a comfortable chair for 3–5 minutes with the upper arm at heart level. Three readings should be taken in succession, separated by at least one minute. It is helpful to get readings both in the early morning and the evening.

What Is Normal Home BP?

Home BPs are consistently lower than clinic pressures in most hypertensive patients. The recommended upper limit of normal for home and ambulatory BP is 135/85 mm Hg, which is roughly equivalent to a clinic pressure of 140/90 mm Hg.[27] As with office BP, a lower home BP goal is advisable for certain patients, including diabetics, pregnant women, and patients with renal failure.

Prognostic Significance

One factor that has held back the wider use of self-monitoring in clinical practice has been the lack of prognostic data. Two prospective studies have found that home BP predicts morbid events better than conventional clinic measurements.[10,28]

Telemonitoring

Devices are now available that have the capacity to store readings in their memory, and then transmit them via

Table I. Features of Different Methods of Blood Pressure Measurement

	Clinic	Home	Ambulatory
Predicts outcome	Yes	Yes	Yes
Initial diagnosis	Yes	Yes	Yes
Upper limit of normal	140/90 mm Hg	135/85 mm Hg	135/85 mm Hg (day)
Evaluation of treatment	Yes	No	Yes
Assess diurnal rhythm	No	No	Yes
Cost	Inexpensive	Inexpensive	Moderate

the telephone to a central server computer and thence to the health care provider. They have the potential to improve patient compliance and hence BP control.[29]

AMBULATORY BP (ABP) MEASUREMENT

ABP monitoring is a noninvasive, fully automated technique in which BP is recorded over an extended period of time, typically 24 hours. It has recently been approved by Medicare for reimbursement in patients with suspected white coat hypertension. The standard equipment includes a cuff, a small monitor attached to a belt, and a tube connecting the monitor to the cuff. Most ABP devices use an oscillometric technique. An up-to-date list of validated monitors is available.[23]

During a typical ABP monitoring session, BP is measured every 15–30 minutes over a 24-hour period including both awake and asleep hours, preferably on a workday. The total number of readings usually varies between 50 and 100. BP data are stored in the monitor and then downloaded into device-specific computer software. The raw data can then be synthesized into a report that provides mean values by hour and period: daytime (awake), nighttime (asleep), and 24-hour BP, both for systolic and diastolic BP. The most common outputs used in decision making are absolute levels of BP, that is, mean daytime, nighttime, and 24-hour values.

The monitors are attached by a trained technician, who should be skilled in BP measurement techniques. The cuff is attached to the nondominant upper arm, and a series of calibration readings taken with a mercury sphygmomanometer to ensure that the device is giving accurate readings (within 5 mm Hg of the mercury readings). It is important to instruct the patient to hold the arm still by their side while the device is taking a reading. It may be helpful to ask the patient to keep a diary of activities, particularly when he/she goes to bed and gets up in the morning.

Clinical Applications

The most common application of ABPM is to ascertain an individual's usual level of BP outside the clinic setting, and thereby identify individuals with WCH. Other potential applications of ABP include the identification of individuals with a "non-dipping" pattern (e.g., in diabetes), patients with apparently refractory hypertension but relatively little target organ damage, suspected autonomic neuropathy, and patients in whom there is a large discrepancy between clinic and home measurements.

What Is Normal ABP?

Prognostic Significance. The suggested normal values for daytime, nighttime, and 24-hour average levels are shown in Table II. Several prospective studies have documented that the average level of ABP predicts risk of morbid events better than clinic BP.[30–36] In addition to mean absolute levels of ABP, certain ABP patterns may predict BP-related complications. The patterns of greatest interest are WCH and "non-dipping" BP. WCH is a pattern in which clinic BP is in the hypertensive range but ABP is normal or low. Individuals with WCH are at lower risk for BP related complications in comparison to individuals with sustained hypertension. Using both daytime and nocturnal ABP, one can identify individuals, termed "non-dippers", who do not experience the normal nocturnal decline in BP. Usually, nighttime (asleep) BP drops by 10% or more from daytime (awake) BP. Individuals with a "non-dipping" pattern (<10% BP reduction from night to day) appear to be at increased risk of BP-related complications compared with those with a normal dipping pattern.[37] Other evidence suggests that the nighttime BP may be the best predictor of risk.[38]

BP RECORDING IN SPECIAL SITUATIONS

Elderly Patients

Elderly patients are more likely to have white-coat hypertension, isolated systolic hypertension, and pseudohypertension. BP should be measured while seated, two or more times at each visit, and the readings averaged. BP should also be routinely taken in the standing position as the elderly may have postural hypotension. Self-measurements can be quite helpful when considering changes in dosage of antihypertensive medications. Ambulatory

BP monitoring, sometime coupled with Holter recordings of electrocardiogram, can help elucidate some complaints such as episodic faintness, and nocturnal dyspnea.

Obese Patients

A longer and wider cuff is needed for adequate compression of the brachial artery in the obese patient with a very large upper arm. The error of overestimating the pressure when measuring with a cuff that is too small for an obese arm can be considerable and can lead to misclassification of an individual as hypertensive and to unnecessary concern and therapy.

Children

BP is most conveniently measured in children by auscultation with a standard mercury sphygmomanometer. The selected cuff should have a bladder width that is at least 40% of the upper arm circumference, and cover 80%–100% of the circumference of the arm. For newborn-premature infants a cuff size of 4 × 8 cm is recommended; for infants, 6 × 12 cm; and for older children, 9 × 18 cm. A standard adult cuff, a large adult cuff, and a thigh cuff for leg BP measurement and for use in children or adolescents with very large arms should also be available. The techniques for BP measurement are the same as in adults.

Elevated BP measurements in a child or adolescent must be confirmed on repeated visits before characterizing a child as having hypertension. Within individual children, BP at high levels tends to decrease on subsequent measurement. Therefore, a more precise characterization of an individual's BP level is an average of multiple BP measurements taken for weeks or months. An exception to this general guideline for asymptomatic generally well children would be situations in which the child is symptomatic or has profoundly elevated BP. Children who show elevated BP on repeated measurement should also have the BP measured in the leg as a screen for coarctation of the aorta. To measure the BP in the leg, a thigh cuff or an oversized cuff should be placed on the thigh and the BP measured by auscultation over the popliteal fossa. If the systolic BP measured in the thigh is more than 10 mm Hg lower than the systolic BP measured in the arm and peripheral pulses are decreased, additional studies for coarctation should be performed.

There continues to be an increase in the use of automated devices to measure BP in children. These devices are easier to use, and are becoming alternative instruments for BP measurement when mercury sphygmomanometers are not available. The interpretation of the BP measurement in children requires consideration of the child's age, sex, and height. Hypertension in children and adolescents is defined as systolic and/or diastolic BP that is consistently equal to or greater than the 95th percentile of the BP distribution. Tables are available that provide the systolic and diastolic BP level at the 95th percentile according to age, sex, and height.[39] These tables should be consulted to determine if the BP measurements are normal or elevated. Children also demonstrate white coat effects, but the role of ambulatory BP monitoring is less clear in children.

Table II. Suggested Values for the Upper Limit of Normal Ambulatory Pressure

	Optimal (mm Hg)	Normal (mm Hg)	Abnormal (mm Hg)
Daytime	<130/80	<135/85	>140/90
Nighttime	<115/65	<120/70	>125/75
24 Hour	<125/75	<130/80	>135/85

Pregnant Women

The detection of elevated BP during pregnancy is one of the major aspects of optimal antenatal care, and thus accurate measurement of BP is essential.[40] Mercury sphygmomanometry continues to be the recommended method for BP measurement during pregnancy. BP should be obtained in the seated position, but the left lateral recumbency position is a reasonable alternative, particularly during labor. The 5th Korotkoff sound should be used for diastolic pressure, but when sounds are audible with the cuff deflated Korotkoff 4 should be used.

It is recognized that alternatives to mercury devices may be necessary in the future, and a small number of automated BP recorders have been validated for use in pregnancy.[41] Self-monitoring may be useful in evaluating BP changes during pregnancy.

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Commentary

Treatment of Diabetic Hypertensive Patients: Results of a National Survey

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Elsewhere in this issue of *The Journal of Clinical Hypertension* results are reported from a survey of practice results and adherence levels for the treatment of hypertensive and diabetic patients.[1] We have recently completed a national survey involving 22,165 patients (mean age 64 years) with hypertension and type 2 diabetes treated by 2247 physicians in the United States in an effort to determine the level of adherence to the American Diabetes Association (ADA) Treatment Guidelines for this population.[2] A majority of the patients were obese (average body mass index 33 kg/m^2), 43% had evidence of coronary heart disease, and 88% had hyperlipidemia. All patients had been screened for proteinuria, via different methods, in accordance with ADA guidelines. The majority of patients were treated for diabetes with dietary advice (87%), oral agents (79%), and exercise (74%); a smaller percentage was receiving insulin (22%). Thirty-seven percent of treated patients had achieved a blood pressure (BP) goal of <130/80 mm Hg, consistent with the ADA and other guidelines,[2,3] but 45% had BP levels >140/90 mm Hg. The ADA and many investigators have recommended that diabetic hypertensive patients receive a medication that blocks the activity of the renin-angiotensin-aldosterone system. These medications have been shown to reduce cardiovascular disease events in patients with diabetes.[2,4] They include: angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers and β blockers, most often in combination with a diuretic. Despite this recommendation, angiotensin-converting enzyme inhibitors were prescribed alone or in combination with other drugs in only 35% of patients surveyed. Angiotensin II receptor blockers were used alone or combined with other medications in only 19%. The average number of medications used was 1.9; thus, drugs that block the renin-angiotensin-aldosterone system were not always incorporated into the regimen to control BP.

Although there are numerous limitations of a survey that depends on physician responses, our results are consistent with other data in the literature and indicate that more aggressive therapy is necessary in this high-risk group of patients, where the benefit of lowering BP and blocking the renin-angiotensin-aldosterone system has been demonstrated. BP control may be more significant in determining outcome than lowering blood glucose levels.[5] Wider dissemination of the ADA recommendations is indicated.

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