

ABC of hypertension

Part IV Self-measurement of blood pressure

For more than 50 years, self-measured blood pressures in the home have been recognised to be lower than those recorded by a doctor. Self-measurement is popular with the public, as evidenced by the huge sales of devices for self-monitoring. Doctors have tended to be cautious in their use of the technique, but interest in self-measurement of blood pressure is reviving, although the fact that much research is needed is recognised.

General considerations

Devices and validation

Monitors for self-measurement of blood pressure include mercury column sphygmomanometers, aneroid manometers, and electronic semi-automatic or automatic devices. The sale of electronic devices designed for self-measurement of blood pressure is not necessarily subject to any medical influence. This freedom from medical control, coupled with a growing public desire to know more about health and illness, has resulted in the manufacture and marketing of a vast array of such devices, few of which have been evaluated according to the procedures considered necessary for equipment used to measure blood pressure in clinical practice.

Automated devices available for self-measurement all use the oscillometric technique. Three categories are available: devices that measure blood pressure in the upper arm, wrist, or finger.

Lack of popularity for self-measurement

- Patients need to be trained in the technique
- Technique subject to bias by patients (can be overcome with printouts from device)
- May cause anxiety to certain patients
- May make some patients obsessive about levels of blood pressure
- Devices largely have not been validated
- Most devices have been inaccurate (this is changing for the better)
- Lack of evidence to support use of the technique
- Not suitable for patients with certain disabilities



Selection of devices for self-measurement of blood pressure

Accuracy of wrist devices for self-measurement of blood pressure

Device	AAMI	BHS	ESH	Circumstance	Recommendation
Braun PrecisionSensor BP2000	Pass			At rest, manufacturer assistance	Questionable
Braun PrecisionSensor BP2550	Pass	B/B		Recruitment violation (AAMI)	Questionable
		B/B		Recruitment violation and analysis errors (BHS)	Questionable
				Abstract, results of systolic pressure unclear	Questionable
Braun PrecisionSensor BP2550(UG)			Pass/pass	At rest	Recommended
Braun VitalScan	Pass			Abstract; version not stated	Questionable
Braun VitalScan Plus 1650			Pass	Abstracts	Questionable
Omron 637IT	Pass	B/A	Fail/pass	Abstract; BHS 'pass' incorrectly reported	Questionable
				Ad hoc protocol, with or without position sensor, standard protocol projections inconclusive	Questionable

AAMI = American Association of Medical Instrumentation; BHS = British Hypertension Society; ESH = European Society for Hypertension.
Table adapted from dabl® Educational Trust.

User procedure

The same principles apply to self-measurement as apply to measurement in general. Some points, however, need emphasis.

Use in primary care

At present, self-measurement of blood pressure is performed mostly by patients on their own initiative, with devices bought on the free market without medical control. Primary care doctors should see self-measurement as a means of gaining further insight into control of blood pressure and the effects of management strategies in motivated and informed patients who remain under medical supervision.

The website [dableducational](http://dableducational.org) shows the latest selection of accurate devices for self-measurement. See example table—for full details go to www.dableducational.org

Advantages of current devices for self-measurement

- Inexpensive
- Remove observer bias
- Eliminate terminal digit preference
- Provide printouts of data or store data:
 - Levels of systolic and diastolic blood pressures
 - Mean blood pressure
 - Heart rate
 - Time and date of measurements
 - Trend plots
- Provide electronic storage and transmission of data

Measurement of blood pressure

Frequency and timing of self-measurement

The frequency of self-measurement may vary according to the indication and the information that is sought. Frequent measurement may be recommended for individual patients (such as those with poor compliance) or for participants in pharmacological studies.

Diagnostic thresholds

The threshold level of 135/85 mm Hg for self-measurement of blood pressure is the same as that for mean daytime ambulatory blood pressure.

Clinical indications

The clinical applications of self-measurement of blood pressure are beginning to become apparent only as the technique is used more widely and scientific data is gathered.

White coat hypertension

Self-measurement has been proposed as a useful alternative to measurement of ambulatory blood pressure to detect white coat hypertension. The finding of normal blood pressure on self-measurement, however, does not rule out the possibility that the blood pressure may be higher at other times of the day. Self-measurement, which is less costly and more convenient than measurement of ambulatory pressure, may be appropriate for long term follow up of patients with white coat hypertension.

Guiding antihypertensive treatment

Self-measurement may have a role in assessing the response to antihypertensive drug treatment outside the medical environment and over time. Measurement of blood pressure in the home environment under similar everyday conditions avoids the white coat effect and reduces variability. Self-measurement can improve the assessment of blood pressure control in the management of hypertension and clinical trials. Recent systematic reviews have shown that self monitoring improves blood pressure control. Whether or not this is though improved adherence to drug treatment, by improved tailoring of drug treatment or by other methods is not fully established.

Elderly patients

Feasibility of self-measurement in elderly patients may be influenced by physical and intellectual limitations and the complexity of the chosen device. Studies in elderly people have shown that automatic equipment is more precise and easier to use than semi-automatic equipment.

Pregnancy

As in the general population, blood pressures recorded by self-measurement are lower than conventional blood pressures. Self-measurement may be useful for the diagnosis of white coat responders and to monitor the effect of antihypertensive drugs. Data storage and electronic transmission of data may have a particular role for patients who live at distance from the maternity clinic. Very few data are available, however, on levels of normality for self-measured blood pressure in the different stages of pregnancy and the use of the technique in pregnancy.

User procedure for self-measurement

- Self-measurement should be performed after five minutes' rest
- Use devices that occlude brachial artery
- Wrist monitors unreliable but improving
- Finger monitors should performed not be used
- Device cuff must be at level of heart on arm with highest blood pressure
- Patient diaries may be unreliable
- Devices equipped with memory, with possibility of storing or transmitting data, preferred
- Readings from first day should be discarded
- Use all other data to calculate mean blood pressure
- In patients with arrhythmias, self-measurement may not be appropriate
- Self-measurement should be under medical supervision
- Patients should be trained in self-measurement and re-evaluated annually
- Self-measurement is suited to patients motivated towards the management of their own health

Scheme for self-measurement

Phase	Directions
Start	<ul style="list-style-type: none"> • Initial period of seven days • Two measurements between 0600 and 0900 • Two measurements between 1800 and 2100 • Discard readings from first day of measurement, which are unrepresentative because of anxiety and unfamiliarity • Use average measurements as reference for treatment and follow up
Treatment	<ul style="list-style-type: none"> • Repeat the above when the patient is on treatment • Morning measurements should be made before drugs are taken (trough levels of drug) • Average of two weeks on treatment should be compared with average of commencement phase to determine efficacy • Averages of two weeks on each treatment regimen should be compared to determine efficacy after a <u>change in treatment</u>
Follow-up	<ul style="list-style-type: none"> • Two measurements on one day a week in patients with good control of blood pressure • More frequent measurements in patients with poor control of blood pressure or compliance

Diagnostic thresholds for self-measurement

- Data from longitudinal studies limited
- Reference values derived principally from statistical evaluation of databases
- Suggested upper limit of normality 135/85 mm Hg (average of multiple readings taken on several days)
- Optimal 130/80 mm Hg (average of multiple readings taken on several days)

Factors that influence self-measurement

- Observer prejudice (can be overcome with printouts and devices equipped with memory)
- Training of patients by doctors or nurses
- Training should focus on:
 - Use of device
 - Correct procedure
 - Interpretation of results
 - Need for maintenance and calibration
 - Essentials of hypertension
 - Management and treatment
- Seasonal variation (blood pressure is higher in winter and lower in summer)

ABC of hypertension

Diabetes

Increasing evidence shows that stringent control of blood pressure reduces the cardiovascular and microvascular complications of diabetes. Self-measurement of blood pressure may be an additional means of ensuring that such control is achieved, although no data are available yet to guide the use of self-measurement in patients with diabetes.

Resistant hypertension

Patients with apparently uncontrolled blood pressure according to conventional monitoring may have adequate control at home. It may be possible to identify at least some of these patients by self-measurement, although ambulatory blood pressure is the preferred technique. In the evaluation of patients with resistant hypertension but no signs of target organ damage, the first step might be to use self-measurement; if the levels of blood pressure are low, measurement of ambulatory blood pressure may then be indicated to confirm the degree of control.

Predicting outcome

Self-measurement may offer some advantage over measurement of conventional blood pressure in predicting cardiovascular outcome in hypertension, but data are extremely limited and the results of ongoing trials are awaited. The results of cross sectional studies have shown that the degree of left ventricular hypertrophy determined by electrocardiography and echocardiography is correlated more strongly with self-measurement than conventional measurement.

Clinical indications for self-measurement

Accepted indications

- Screening for white coat hypertension
- Long term follow up
- Improving compliance to treatment
- Resistant hypertension

Potential indications

- Hypertension in pregnancy
 - Hypertension in patients with diabetes
 - Hypertension in elderly patients
-

Poor compliance with treatment

- One of the most important causes of refractory hypertension
 - Self-measurement may provide patients with an understanding of high blood pressure and its response to treatment, thus improving compliance with treatment
-