



## HOME BLOOD PRESSURE MONITORING

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### Introduction

Home blood pressure (BP) monitoring has been recommended as a supplement to measurements in the clinic in the 2003 European Society of Hypertension-European Society of Cardiology (ESH-ESC) hypertension guidelines (1). Detailed recommendations for home BP monitoring have previously been published in the first international guidelines for home BP monitoring (2) and in the 2003 ESH recommendations for BP measurement (3). The method has several advantages in comparison to BP measurement in the clinic (Table 1) which contribute to its usefulness in the management of hypertension (1-4).

Characteristic	Clinic	Home
Number of measurements	Few	Many
Observer bias	Yes/No*	Yes/No*
White Coat Effect	Yes	No
Reflection of target organ damage	Moderate	Good
Prediction of prognosis	Moderate	Good
Improvement of compliance	?	Possible
Placebo effect	Yes	Limited

\*Automated measurement

Table 1. Advantages of home blood pressure monitoring. Adapted from references 2 and 4.

Measurement Method	Systolic Blood Pressure	Diastolic Blood Pressure
Office or clinic	140	90
24-hour ambulatory	125	80
Home (self)	135	85

Table 2. Blood pressure thresholds (mm Hg) for definition of hypertension with different types of measurement. Adapted from reference 1.

### Characteristics of home blood pressure monitoring

The mean home BP in studies is generally lower than clinic BP, and similar to the average daytime ambulatory BP (5,6). However, timing of measurements, definitions of clinic and home BP, and differences between study populations may partly explain why this clinic-home difference is small or absent in some studies (7-9).

Home BP seems to accurately reflect the patient's mean daytime ambulatory BP, whether measured manually (10) or automatically (11). When assessed with simultaneous intra-arterial BP, home BP is as accurate as clinic BP (12). Home BP is more reproducible than clinic BP (13,14), partly due to an increased number of measurements (11). However, inaccurate reporting of BP values to the physician may be a problem (7,15).

Home BP monitoring may increase the patients' compliance with anti-hypertensive drug therapy (16). BP control was shown to improve in patients instructed to monitor their BP at home and to adjust antihypertensive drug therapy themselves, compared to patients receiving usual office-based care (17). In a recent study (18), adjustment of anti-hypertensive treatment based on home BP instead of office BP led to less intensive drug treatment and marginally lower costs but also to less BP control.

### Prognostic significance and reference values

Cross-sectional studies have shown that home BP is indicative of hypertensive target organ damage (2,4). The reduction in home BP during treatment also predicts regression of left ventricular hypertrophy (19). In the Tecumseh study, home BP was more predictive than clinic BP of hypertension and normotension after three years in untreated borderline hypertensives (13). In the Ohasama study, home BP had a stronger predictive power than clinic BP for cardiovascular and overall mortality in the general population (20,21), and predicted first-time stroke better than clinic BP (22). In a recent study (23), home BP predicted cardiovascular events in elderly, treated hypertensive patients, whereas office BP did not. However, specific studies are needed to compare the prognostic values of clinic, home, and ambulatory BP measurements.

Two meta-analyses of the home BP distribution in normotensives have resulted in proposals for diagnostic thresholds of 135/85 mm Hg (24) and 137/85 mm Hg (25), respectively. The first report to propose reference values based on prognostic criteria (26) suggested a hypertensive threshold of 137/84 mm Hg, based on overall 5-year mortality in the general population. The ESH-ESC guidelines for management of hypertension (1) and the international guidelines for home BP monitoring (2) have recommended values of 135/85 mm Hg or higher to be considered hypertensive (Table 2), but the prognostic value of these thresholds remains to be evaluated by prospective studies. Likewise, longitudinal studies are needed to determine the antihypertensive treatment target for home BP.

### Usefulness of home blood pressure monitoring

In the diagnosis of hypertension, home BP monitoring is a useful supplement, but home BP values should not override clinic BP values. Home BP monitoring should be encouraged in order to provide more information for the doctor's decision and improve patient's adherence to treatment regimens, but should be discouraged whenever it causes patients anxiety or induces self-modification of the treatment regimen (1). Poor standardisation of measurement and wrong technique may be common if patients are not given specific instructions (27). However, even manual home BP measurement can be learned by patients from different age groups and across a wide range of backgrounds (7,28). Valid measurements can be obtained in elderly subjects (29). Home BP monitoring may be used as a screening test for white coat hypertension, followed by ambulatory BP monitoring if home values are low. It may also be appropriate for the follow-up of white coat hypertensives, and in refractory hypertension, which is

often caused by poor compliance (2). Patients may also be found to have high home BP values despite normal office BP ("masked hypertension") (23), which is accompanied by a greater prevalence of left ventricular hypertrophy (30).

Home BP monitoring may be useful in clinical trials as well (2,4). In a group of patients, home BP and ambulatory intra-arterial BP measurements show similar reductions in BP during treatment. When comparing active treatment with placebo, home BP measurements improve the statistical power, and minimize or eliminate the placebo effect. Home BP monitoring may also improve the sensitivity of a trial to detect a difference in BP between two drugs. Further, morning and evening values may be used for assessment of the duration of drug action and the effects of different dosing patterns.

### Practical issues

Fully automated devices for measurement at the upper arm are recommended, whereas devices designed for measurement at the wrist or in the finger have so far not been considered sufficiently accurate (1-3,31). Patients with irregular cardiac rhythm should use a manual auscultatory device. Printer- or memory-equipped devices may be used for reduction of observer bias (2). Many automated devices suitable for home BP monitoring are available. ESH has previously recommended devices, based on published evidence of independent validation for accuracy (31), but such surveys need continuous updating as more devices become validated. Up-to-date lists of validated devices are available on websites (32,33) recommended by the ESH (34). Devices which have passed validation according to the British Hypertension Society protocol or International protocol are listed in Table 3.

Table 3. Automatic blood pressure monitors suitable for home/self assessment listed by the British Hypertension Society (33).

A&D UA-767
A&D UA-779
A&D UA-787
Omron MIT
Omron M5-I
Omron 705IT
Omron 705 CPII
Microlife 3BT0-A
Microlife 3AG1

Home BP monitoring should be used under medical supervision. BP measurements should be performed in the seated position, after five minutes of rest. The cuff should be kept at heart level, and the arm with the highest BP level should be used (2,3). The number of measurements that maximises the prognostic value of home BP is not known. It is currently recommended that during diagnosis and initiation of treatment, duplicate BP measurements should be made in the morning and evening for 1 week. For long-term observation, this should be repeated for 1 week every 3 months. For each measurement period, all recorded data except those from the first day should be used to calculate the mean home BP. However, the frequency may vary according to the severity of hypertension and the need for adjustments of pharmacological treatment (2,3). In patients with a low (<20%) 10 year cardiovascular risk, and until further prognostic data become available, the recommended home BP threshold of 135/85 mm Hg (1-3) may be used for the confirmation of hypertension, while ambulatory BP monitoring should be used to exclude white coat hypertension if the mean home BP is <135/85 mm Hg. A tentative treatment target of <130-135/85 mm Hg has been suggested (2). Studies are needed to evaluate different measurement protocols and frequency of measurements.

Patient education should include information about hypertension and cardiovascular risk, in addition to training in BP measurement, and information about measurement protocol and interpretation of BP readings, and advice on equipment. This requires special training of doctors and nurses, preferably done by completion of a specific training course (2).

### Conclusions

Home BP monitoring offers advantages over clinic BP measurements, and may improve the overall management of hypertension. The use of the method is limited by the lack of definite diagnostic thresholds and treatment target values, and further longitudinal studies are needed to define its precise role in clinical practice. Until such prospective data become available, management of hypertension exclusively based on home BP is not recommended.

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