



Finding the right role for home blood pressures

It has been 60 years since Brown¹ reported self-measurement of blood pressure outside of a medical environment and 50 years since Ayman and Goldshine² documented that clinic blood pressures were generally higher than those measured by the patient at home. With the advent of effective antihypertensive therapy, physicians came to value self-measured blood pressures in the establishment of effective therapeutic regimens, often basing clinical decisions on the integration of the patient's observations with office measurements.

■ See Vidt and associates, (pp 28–32).

Gould and colleagues³ documented the correlation between simultaneous readings by patients and physicians. Engel and associates⁴ demonstrated the feasibility of daily self-monitoring. Self-measurement devices permit recording several awake blood pressure measurements daily, in different positions and in various environments.^{4,7} Home blood pressures are valuable for testing antihypertensive drug efficacy⁸ and they correlate better with target organ damage (such as electrocardiographic evidence of left ventricular hypertrophy) than office blood pressures do.⁹

Mejia and co-workers¹⁰ used self-determination of blood pressure in a community-wide survey lasting longer than 1 year; they concluded that in Tecumseh, Mich., the upper limit of normal for home blood pressures (two standard deviations above the mean) was 142/92 mmHg for men and 131/85 mmHg for women.

SOME LIMITATIONS

Some problems are associated with home blood pressure determinations. A variety of mercury, manual,

aneroid, and electronic blood pressure devices are available for self-monitoring, but the development of a consistently accurate instrument has been a challenge. Frequent re-evaluation (at least annually) of equipment is necessary in a continuing care program that uses home blood pressure determinations.^{11–15}

The act of inflating the blood pressure cuff has some potential for artifacts. Veerman and associates¹⁶ and Mejia and co-workers¹⁷ (but not Parati and associates¹⁸) demonstrated an instantaneous, significant rise in systolic pressure in some hypertensive and normotensive subjects during cuff inflation. Systolic pressures increased by as much as 20 mmHg and diastolic pressures by 15 mmHg, as determined by simultaneous intra-arterial pressures. The return to baseline may take up to 21 seconds after stopping cuff inflation. This phenomenon also has been documented during passive cuff inflation. The frequency of the cuff inflation artifact needs to be further investigated.

The potential for subjective bias remains a problem when the measurement is fully automated but the values are recorded by the observer.¹⁹

SEMI-AUTOMATED MONITORING

In this issue of the *Cleveland Clinic Journal of Medicine*, Vidt and colleagues present their evaluation of a new semi-automated auscultatory device, Telelab, that corrects many of the difficulties of other home blood pressure devices. On average the Telelab records a diastolic pressure 3.5 mmHg lower than that obtained simultaneously by trained observers, but systolic pressures are identical. This accuracy is maintained after prolonged home use.

The device is easy to use. After the patient initiates the recording, the remainder of the measurement is automatic and the result can be blinded to the ob-

server. The data are stored and transmitted by telephone at a convenient time. The device is lightweight and can be taken to work and other locations outside the home.

James and associates²⁰ analyzed the same equipment and concluded that the device, while accurate, became less so as the blood pressure increased. Even with this limitation, the accuracy is superior to most other home blood pressure monitors.

A recent consensus document²¹ lists clinical problems in which 24-hour noninvasive ambulatory blood pressure may be useful. Accurate self-monitoring over a more prolonged period may also be helpful in the management of some of these problems, including borderline hypertension with target organ damage, evaluation of drug resistance, episodic hypertension, hypotensive symptoms related to antihypertensive medications, and office or "white coat" hypertension. Abrupt changes in blood pressure (either hypertension or hypotension), evaluation of blood pressure changes during sleep, autonomic dysfunction, carotid sinus syncope, and pacemaker syndromes cannot be addressed satisfactorily by self-measurement of blood pressure.

THE DEBATE OVER OFFICE V HOME MEASURES

Debate continues over the significance of the difference between standardized office or clinic blood pressures and those obtained in other environments. Two elements of that debate deserve mention.

Pickering and co-workers²² reported that from 12% to 21% of adults with mild hypertension in the office may be normotensive under all other circumstances (as shown by 24-hour ambulatory blood pressure monitor-

ing). A much smaller percentage of subjects have higher blood pressure when outside of a medical environment. Office or white coat hypertension may persist for months or years despite the individual's growing familiarity with office procedures and personnel. On the other hand, Siegel and associates²³ could not distinguish patients considered to have white coat hypertension from those with more sustained elevations in blood pressure, despite the use of a battery of clinical, demographic, emotional, and reactivity measures.

Although standardized office blood pressure has been the measure used to guide trials of antihypertensive therapy, there is some concern at present that too marked a reduction in office blood pressure by drug therapy may be associated with an increase in mortality.²⁴⁻²⁶ It is unknown whether patients who have high blood pressure only in the office are particularly at risk of overtreatment.

The Telelab device is a distinct improvement over previous devices for self-measurement of blood pressure. Future research may demonstrate whether self-measurement of blood pressure and ambulatory monitoring yield better information regarding morbidity, mortality, and the selection of patients for therapeutic intervention. Interpretation of these measurements for the diagnosis and control of hypertension at present is based on enlightened empiricism.

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REFERENCES

1. Brown GE. Daily and monthly rhythm in the blood pressure of a man with hypertension. *Ann Intern Med* 1930; 3:1177-1189.
2. Ayman D, Goldshine AD. Blood pressure determinations by patients with essential hypertension. *Amer J Med Sci* 1940; 200:465-494.
3. Gould BA, Kieso HA, Hornung R, Altman DG, Cashman PM, Raftery EB. Assessment of the accuracy and role of self-recorded blood pressures in the management of hypertension. *Br Med J* 1982; 285:1691-1694.
4. Engel BT, Gaardner LR, Glasgow MS. Behavioral treatment of high blood pressure: 1. Analysis of intra- and interdaily variations during a 1-month, baseline period. *Psychosom Med* 1981; 43:255-270.
5. Zachariah PK, Sheps SG, Smith RL. Clinical use of home and ambulatory blood pressure monitoring. *Mayo Clin Proc* 1989; 64:1436-1446.
6. Mengden T, Böttig B, Vetter W. Self-monitoring of blood pressure. *J Hum Hypertens* 1990; 4(suppl 1):47-50.
7. Llabre MM, Ironson GH, Spitzer SB, Gellman MD, Weidler DJ, Schneiderman N. How many blood pressure measurements are enough? An application of generalizability theory to the study of blood pressure reliability. *Psychophysiology* 1988; 25:97-106.
8. Menard J, Serrurier D, Bautier P, Plouin P-F, Corvol P. Crossover design to test antihypertensive drugs with self-recorded blood pressure. *Hypertension* 1988; 11:153-159.
9. Ibrahim MM, Tarazi RC, Dustan HP, Gifford RW. Electrocardiogram in evaluation of resistance to antihypertensive therapy. *Arch Intern Med* 1977; 137:125-129.
10. Mejia AD, Julius S, Jones KA, Schork NJ, Kneisley J. The Tecumseh blood pressure study: normative data on blood pressure self-determination. *Arch Intern Med* 1990; 150:1209-1213.
11. Blood pressure monitors. *Consumer Reports* 1987; 52:314-319.
12. Hunt JC, Frohlich ED, Moser M, Roccella EJ, Keighley EA. Devices used for self-measurement of blood pressure. *Arch Intern Med* 1985; 145:2231-2234.
13. Conway J. Home blood pressure recording. *Clin Exp Hypertens [A]* 1986; 8:1247-1294.
14. O'Brien E, Mee F, Atkins N, O'Malley K. Inaccuracy of seven popular sphygmomanometers for home measurement of blood pressure. *J Hypertens* 1990; 8:621-634.

15. Evans CE, Hanes RB, Goldsmith CH, Heuson SA. Home blood pressure measuring devices: a comparative study of accuracy. *J Hypertens* 1989; **7**:133-142.
16. Veerman DP, van Montfrans GA, Wieling W. Effects of cuff inflation on self-recorded blood pressure. *Lancet* 1990; **335**:451-453.
17. Mejia AD, Egan BM, Schork NJ, Zweifler AJ. Artifacts in measurement of blood pressure and lack of target organ involvement in the assessment of patients with treatment-resistant hypertension. *Ann Intern Med* 1990; **112**:270-277.
18. Parati G, Pomidossi G, Casadei R, Mancia G. Lack of alerting reactions to intermittent cuff inflations during noninvasive blood pressure monitoring. *Hypertension* 1985; **7**:597-601.
19. Bruce NG, Shaper AG, Walker M, Wannamethee G. Observer bias in blood pressure studies. *J Hypertens* 1988; **6**:375-380.
20. James GD, Yee LS, Cates EM, Schluskel YR, Pecker MS, Pickering TG. A validation study of the Instrumedix Baro-Graf QD home blood pressure monitor. *Am J Hypertens* 1990; **3**:717-720.
21. National High Blood Pressure Education Program Working Group report on ambulatory blood pressure monitoring. *Arch Intern Med* (in press).
22. Pickering TG, James GD, Boddie C, Harshfield GA, Blank S, Laragh, JH. How common is white-coat hypertension? *JAMA* 1988; **259**:225-228.
23. Siegel WC, Blumenthal JA, Divine GW. Physiological, psychological, and behavioral factors and white-coat hypertension. *Hypertension* 1990; **16**:140-146.
24. Samuelsson OG, Wilhelmsen LW, Pennert KM, Wedel H, Berglund GL. The J-shaped relationship between coronary heart disease and achieved blood pressure level in treated hypertension: further analyses of 12 years of follow-up of treated hypertensives in the Primary Prevention Trial in Gothenburg, Sweden. *J Hypertens* 1990; **8**:547-555.
25. Hansson L. How far should blood pressure be lowered? What is the role of the J-curve? *Am J Hypertens* 1990; **3**:726-729.
26. Alderman MH. Commentary on Hansson L. How far should blood pressure be lowered? What is the role of the J-curve? *Am J Hypertens* 1990; **3**:730-732.

