Randomised controlled trial

Averaging clinic and home measures associated with reductions in within-patient variability and may give a better indication of blood pressure control

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Commentary on: Powers BJ, Olsen MK, Smith VA, *et al.* Measuring blood pressure for decision making and quality reporting: where and how many measures? *Ann Intern Med* 2011;**154**:781–8, W–289–90.

Context

In 2003,¹ European guidelines addressed the variability in blood pressure (BP) measurements. They proposed that two or more readings at 1-min intervals be taken at each visit,¹ with further readings in case of uncertainty. They also stated that the alarm reaction to BP measurement may persist after several visits, so for patients with sustained elevation of BP, more measurements should be obtained on different occasions over a number of weeks or months before diagnostic or management decisions are made. Alternatively, ambulatory BP measurement or self-measurement of BP away from the medical environment should be performed.¹ In a secondary analysis of the Hypertension Intervention Nurse Telemedicine Study (HINTS),² Powers *et al* attempted to determine the optimal setting and number of BP measurements that should be used for clinical decision making.

Methods

The HINTS² was a randomised trial that enrolled patients with poor BP control. Patients were randomised to four arms: (1) a control group receiving usual care; (2) nurse-administered tailored behavioural intervention; (3) nurse-administered medication management; and (4) the combination of the interventions. The major achievement of HINTS was to prove the feasibility of BP telemonitoring in patients with uncontrolled hypertension and low average educational attainment.^{3,4} In this secondary analysis, patients assigned to the three intervention arms who electronically transmitted home BP readings were eligible. They measured BP repeatedly over 18 months by using three methods: research BPs were measured at the clinic at 6-month intervals, using a 'BpTRU' device; clinic BPs were obtained during outpatient visits, using Alaris

4200s and 4410s/4415s automated devices; and home BPs were obtained using an 'A&D UA767PC' monitor interfaced with a (Carematix) telemonitoring platform. Using complex mathematical modelling, Powers *et al* calculated the probability that a patient's true systolic BP was in the hypertensive range given the observed mean systolic BP and using the recommended systolic BP treatment thresholds of 140 mm Hg for clinic BP and 135 mm Hg for home BP.

Findings

Powers *et al* showed that the effects of within-subject variability could be greatly reduced by averaging several measurements. For clinic systolic BPs between 136 and 144 mm Hg, at least 10 measurements had to be averaged to correctly classify a patient as normotensive or hypertensive with 80% probability. By contrast, for home BP only five measurements were needed to correctly classify subjects with the same probability. The authors conclude that physicians who want to have 80% or more certainty that they correctly classify patients' BP should use the average of several measurements.

Commentary

Recommendations by expert panels^{5,6} published since 2003 have reinforced similar standards for the frequency and conditions of BP measurement. This secondary analysis of HINTS supports the recommendation that treatment decisions should be based on the average of several measurements, perhaps fewer when they are done at home.

However, we should not overlook the limitations of the present study. First, because in the intervention

groups, all treatment decisions were based on the self-measured BP at home;⁴ the HINTS investigators cannot really determine the optimal setting for BP measurement. Second, the authors dichotomised systolic BP into normotensive and hypertensive values, disregarding that BP is continuously distributed and the potential contribution of diastolic hypertension. Third, the analyses involving 18-month data might not be applicable to clinical practice, because in most patients a shorter time period is required to confirm the diagnosis of hypertension and institute treatment. Fourth, the analyses rely on the discrepancy between the mean of several observed BPs and the true BP. However, the true BP used in analyses was not measured but estimated from the mean, variance and covariance of the observed BP distribution. This method might introduce bias. Fifth, patients randomised to intervention were asked to provide at least three BP measurements per week. The timing of these measurements was not standardised and therefore, a potential source of bias. Patients anxious about their well-being might have measured their BP more frequently, and non-adherent patients were contacted by the care providers.⁷ Sixth, to our knowledge, the Alaris devices used for the BP measurements at the outpatient clinics have not been validated and may be unsuitable for use in clinical research or patient management. Finally, the study population (92% men, 48% African-Americans, 40% participants with low-literacy level, and 41% patients with uncontrolled hypertension) may not yield broadly generalisable findings.

In conclusion, the secondary analysis of HINTS by Powers *et al* is consistent with earlier evidence, and suggests that repeated and home BP measurements improve

reliability, leading to a more accurate diagnosis and management of hypertension.

Competing interests None.

References

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