Are Home Blood Pressure Telemonitoring Management Interventions Effective for Hypertension Control?

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Study Overview

Objective. To determine which of 3 novel telephone interventions (nurse-administered behavioral management, nurse-administered and physician-directed medication management, or both) vs. usual care is most effective at long- and short-term blood pressure (BP) control.

Design. 4-arm randomized controlled trial.

Setting and participants. Veteran patients seen in primary care clinics at the Durham, NC, Veterans Affairs Medical Center (VAMC) from May 2006 to July 2009. Inclusion criteria were having a primary diagnosis of hypertension, currently using a BP-lowering medication, and having a mean annual BP (of the 12 months prior to recruitment) > 140/90 mm Hg. Exclusion criteria were current history of hemodialysis, serum creatinine > 2.5 or no documentation of renal function, organ transplant, hospitalization 3 months prior for stroke, myocardial infarction or coronary artery revascularization, metastatic cancer or dementia, residing in a nursing home or receiving home health care, having severe hearing or speech impairment, and not having a home telephone. Eligible patients were recruited with mailed letters, telephone calls, and in-person meetings at the next available primary care provider visit for informed consent and a baseline interview.

Interventions. Subjects in the 3 intervention arms all received wireless home BP monitors, a telemedicine device that transmitted via a telephone line BP measures to a secure server, and were advised to measure their BP every other day. Randomized telephoned interventions were triggered if 2-week average home BP measures exceeded 135/80 mm Hg. The nurse-administered behavioral management intervention consisted of 11 health behavioral models focused on improving BP self-management with predetermined scripts and patient-specific tailored algorithms. Each encounter involved 3 to 4 modules with the telephone intervention lasting 12 to 14 minutes. The medication management intervention was guided with a decision support software algorithm that recommended BP medication changes. A study physician reviewed the triggering BP, BP medications, and patient's adherence history and advised BP medication changes based on the algorithm. The nurse relayed changes to the patient and the physician electronically prescribed the medication. The combined intervention received the full dose of each of the above interventions.

The usual care arm received no contact with the intervention nurses or home telemonitoring equipment.

Main outcome measures. The primary outcome was a comparison of the difference in slopes (treatment by time interaction in a logistic mixed-effect regression model) of BP control at baseline and 6, 12, and 18 months. Secondary analyses examined the intervention group effect on mean systolic and diastolic BP over time. Additionally, a post-hoc analysis to evaluate the intervention group effect on BPs was done comparing patients who had BP in control at the baseline timepoint versus those whose BPs were out of control. Finally, differences in median medical resource use and costs at 18 months were compared between the 4 groups.

Main results. 591 subjects were randomized to the 4 arms; 503 (85%) completed 18 months of follow-up. Compared with usual care, there were statistically significant BP control improvements in the behavior and the medication management intervention arms at 12 months, but these were not sustained at 18 months. The largest sustained improvement of systolic BP was in the combination intervention group. At 12 months, when compared with usual care systolic BPs, the mean systolic BP was lower by 2.1 mm Hg for the behavioral arm, 2.4 mm Hg for the medication arm, and 4.3 mm Hg for the combination arm. There were no statistically significant differences in diastolic BP. Post-hoc subgroup analyses found those with poor baseline BP control had significant decreases in systolic BP (14.8 mm Hg lower at 12 months and 8.0 mm Hg lower at 18 months) in the combined intervention arm when compared with usual care. The costs of the intervention arm implementation ranged from $947 to $1275 (compared with the usual care arm [$0]) with no significant difference in median 18-month total VA medical costs across groups.

Conclusion. Use of a home BP telemonitoring system and telephone interventions to improve management of hypertension are novel methods to improve primary care delivery. The cost and effectiveness of these methods to improve BP control, however, remain equivocal.

Commentary

Uncontrolled and untreated hypertension continues to be associated with increased cardiovascular mortality in the world and in the US, with a direct association between mortality risk and systolic BP [1]. Improving blood pressure control beyond current models of care in the ambulatory care setting may require novel modalities. Use of home BP monitoring is recommended by the American Heart Association for long-term management of hypertension [2], enhances patient participation in hypertension care with improved compliance [3], and is becoming more common in ambulatory clinical practice [4]. General guidelines in the measurement of BP recommend both ambulatory monitoring and self-measurement. More recently, McManus et al found self-management of hypertension in combination with home telemonitoring of BP measurements an effective tool to reduce systolic blood pressure [5]. A secondary analysis of the current study by Powers et al published in the 21 June 2011 *Annals of Internal Medicine* was reviewed in JCOM's August 2011 issue. It found a single BP reading was inadequate for clinical decision making in hypertension, thus confirming the utility of multiple BP measures in different settings (ambulatory and home).

This study by Bosworth et al adds to the medical literature potential tools in the management of uncontrolled hypertension. This was a randomized clinical trial of the impact of telephone behavioral management modules versus clinician medication titration and management versus a combination of these for patients provided BP telemonitoring devices versus usual care. The study found BP telemonitoring combined with nurse-administered interventions effective in improving systolic BP control at 12 months, but these effects were not sustained at 18 months. Primary implications of the study include the feasibility of conducting home BP telemonitoring, the effectiveness of a BP control program to improve hypertension over a 12-month period, and consideration in the costs and benefits of proceeding with a relatively expensive BP care management program. Similar to the 2010 McManus study, this study also incorporated BP telemonitoring, plus the addition of remote nurse management of hypertension via telephone behavioral or medication management of a US population. This confirms previous findings of the feasibility and utility of BP telemonitoring while expands the generalizability of the interventions by evaluating a population of US male veterans that is more diverse in

socioeconomic levels, race/ethnicities, literacy and education levels. Unfortunately, the effects of all intervention arms were less effective in maintaining BP control improvements at 18 months. Additionally, relative to usual care, these interventions were resource-intensive and required additional implementation costs of up to $1274 over 18 months while showing no significant savings in 18-month total VA median cost. Clinicians should weigh the costs and benefits of implementing a BP telemonitoring program with remote clinician management versus that of routine care for individuals with uncontrolled hypertension. It may be more cost-effective to simply encourage home BP monitoring by the patient to improve patient interaction, compliance, and time management for poor BP control.

As noted, there are several strengths of the study, including diverse patient population, the ability to study comprehensive total costs of health care in a veteran population, and the long-term evaluation of intervention effects at 18 months. No prior studies have evaluated BP control interventions beyond 12 months. Ideally, future BP intervention studies are needed even longer-term (beyond 18 months) to evaluate the effect of good BP control against health outcomes and total health care costs. If such BP interventions are effective in not only controlling BP, but reduce total health care costs, the earlier upfront costs of these resource intense interventions may lead to cost savings downstream. Study limitations include the predominantly male study population. While diverse in race/ethnicity and socioeconomic levels, a US veteran population is still primarily male. Interpretation of subcohort post-hoc analyses should also be cautioned as stratification of these subjects (by baseline BP levels; of which 59% had adequate control at the start of the study) were not planned for a priori.

Applications for Clinical Practice

The results of this study present a potential method to improve blood pressure control through a primary care delivery model. As medical telemonitoring expands in ambulatory care setting, there will be greater opportunities for patient interactive self-care and clinician-guided medical management interventions. Albeit costly, implementation of a home BP telemonitoring system with remote clinician management may be considered as a possible alternative for hypertension control in patients who historically have been shown to have inadequate BP control.

—Review by Ula Hwang, MD, MPH

References

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