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Research Article

Cost estimation of hypertension management based on home blood pressure monitoring alone or combined office and ambulatory blood pressure measurements

Nadia Boubouchairopoulou, MSc[a], Nikos Karpettas, MD[b], Kostas Athanasakis, PhD[a], Anastasios Kollias, MD[b], Athanase D. Protogerou, MD[c], Apostolos Achimastos, MD[b], and George S. Stergiou, MD, FRCP[b,*]

[a]*Department of Health Economics, National School of Public Health, Athens, Greece;*
[b]*Hypertension Center, STRIDE Hellas-7, Third University Department of Medicine, Sotiria Hospital, Athens, Greece; and*
[c]*Hypertension Unit and Cardiovascular Research Lab, First Department of Internal and Propaedeutic Medicine, Laiko Hospital, Athens, Greece*

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Abstract

This study aims at estimating the resources consumed and subsequent costs for hypertension management, using home blood pressure (BP) monitoring (HBPM) alone versus combined clinic measurements and ambulatory blood pressure monitoring (C/ABPM). One hundred sixteen untreated hypertensive subjects were randomized to use HBPM or C/ABPM for antihypertensive treatment initiation and titration. Health resources utilized within 12-months follow-up, their respective costs, and hypertension control were assessed. The total cost of the first year of hypertension management was lower in HBPM than C/ABPM arm (€1336.0 vs. €1473.5 per subject, respectively; $P < .001$). Laboratory tests' cost was identical in both arms. There was no difference in achieved BP control and drug expenditure (HBPM: €233.1 per subject; C/ABPM: €247.6 per subject; $P =$ not significant), whereas the cost of BP measurements and/or visits was higher in C/ABPM arm (€393.9 vs. €516.9, per patient, respectively $P < .001$). The cost for subsequent years (>1) was €348.9 and €440.2 per subject, respectively for HBPM and C/ABPM arm and €2731.4 versus €3234.3 per subject, respectively ($P < .001$) for a 5-year projection. HBPM used alone for the first year of hypertension management presents lower cost than C/ABPM, and the same trend is observed in 5-year projection. The results on the resources consumption can be used to make cost estimates for other health-care systems.

Keywords: Blood pressure measurement methods; cost effectiveness; economic analysis; hypertension treatment.

Introduction

The diagnosis of hypertension and the evaluation of treatment-induced effects on blood pressure (BP) and target-organ damage have been based for decades on conventional office BP measurement. It is now, however, recognized that these measurements are often misleading due to the white-coat and masked hypertension phenomena, the poor reproducibility of office measurements and observer issues such as prejudice and bias.[1] Studies have shown that out-of-office measurements, using 24-hour ambulatory BP (ABP) monitoring (ABPM) or self-monitoring by patients at home, are more reliable than office measurements, have higher reproducibility, and higher diagnostic value, and therefore reflect more accurately preclinical target-organ damage[2] and the risk of cardiovascular events.[3–6]

Both home blood pressure (HBP) monitoring (HBPM) and ABPM record BP in multiple occasions and in the usual environment of each subject, away from the office environment.[1,5,6] However, ABP records BP data only for 24 hours but during all the individual's kinds of activities including sleep, whereas HBP provides readings for several days,

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*Corresponding author: George S. Stergiou, MD, FRCP, Hypertension Center, STRIDE Hellas-7, Third University Department of Medicine, Sotiria Hospital, 152 Mesogion Avenue, Athens 11527, Greece. Tel: +302107763117; fax: +302107719981.
E-mail: gstergi@med.uoa.gr

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weeks, or months, but only in the sitting posture and at home.[1,5,6] Although both ABPM and HBPM are endorsed by current European,[1,5–7] UK (National Institute for Clinical Excellence),[8] United Sates,[9] and Japanese[10] guidelines, there is still no agreement on how these methods should be used in clinical practice. Guidelines in Europe, the United States, and Japan recommend that HBPM should be offered to all patients with elevated BP, whereas ABPM should be restricted in selected cases.[1,5,9,10] In contrary, the UK National Institute for Clinical Excellence organization recommends ABPM to be offered to all subjects with suspected hypertension, whereas HBP should was left as a ''suitable alternative'' for subjects ''unable to tolerate ABP monitoring''.[8]

Recently, a randomized study that compared the use of office BP measurements combined with ABPM (as confirmatory method) against HBPM alone in terms of hypertension diagnosis, treatment initiation, and titration, demonstrated that, after an average of 13.4 months follow-up, the two strategies did not differ in terms of BP decline, hypertension control, and target-organ damage regression.[11] Given the major importance of cost-effectiveness analysis of all medical interventions applied in routine clinical practice, the comparison of different BP measurement methods in terms of their requirements for health-care system resources and subsequent costs is essential. Moreover, due to the high prevalence of hypertension in the population, even small differences in the cost of applying different strategies is expected to have large impact on the health-care service costs. This article presents a comparative cost analysis of the two BP monitoring strategies considering the data collected in the above mentioned prospective study.[11]

Methods

Overview

This analysis is an estimate of the expenditures attributed to the health resources utilized for hypertension management by patients using HBPM alone versus patients using office BP measurement and occasionally ABPM as confirmatory test. These data were derived from a published prospective randomized study.[11] This study compared the BP reduction, the hypertension control rate, and the regression of target-organ damage achieved after the first 12 months of treatment based either on HBPM alone or on office BP measurement combined with occasional use of ABPM.[11] The cost evaluation of resources utilized in this study was performed from the private sector's perspective.

Study Participants

A total of 116 untreated subjects aged >30 years with elevated BP were included in the study after a 2-week run-in period during which the following tests were performed: (1) BP evaluation using office measurements, HBPM, and ABPM; (2) blood sample for full blood count, glucose, total, low-density lipoprotein and high-density lipoprotein cholesterol, triglycerides, serum potassium and sodium, uric acid, creatinine, urine microscopy and dipstick, urinary albumin:creatinine ratio (morning spot), and 12-lead electrocardiogram. Echocardiography was performed only in suspected white-coat hypertension defined as elevated office BP and normal HBP or ABP, according to the European hypertension guidelines.[7]

Design

Participants were randomized to use either HBPM alone (arm A) or clinic BP measurements combined with occasional use of ABPM as a confirmatory method (arm B) for antihypertensive treatment initiation and titration. In arm A treatment decisions for hypertension management were exclusively based on HBP measurements, whereas in arm B on office and ABPM. Each HBPM session was performed using validated electronic arm devices with automated memory and personal computer link, for 7 days within 2 weeks with duplicate self-measurements in the morning and the evening after 5 minutes of sitting rest and 1 minute-intervals between measurements.[5] The average of all HBPM readings was calculated after discarding those of the first day.[5] In the HBPM arm, the goal of treatment was home BP < 135/85 mm Hg for low- and/or moderate-risk patients and <125/80 mm Hg for high-risk patients, whereas in the ABPM arm clinic BP <140/90 mm Hg and awake ABP <135/85 mm Hg for low- and/or moderate-risk patients and <130/80 mm Hg and <125/80 mm Hg, respectively for high-risk patients. Details for the study protocol and the BP changes have been published.[1,5,7,11] Participants attended clinic visits at monthly intervals until BP control was achieved and then after 6 months. Complete BP and organ damage evaluation was repeated after 12 months follow-up as performed before randomization. A total of 116 subjects with complete data after 12 months of follow-up were included in the final analysis and were considered in the present cost analysis. Details on the study selection criteria, design, and procedures have been published.[11]

Cost Estimation

The analysis was performed from the private sector perspective and involved all costs related to the first year of hypertension management. The cost estimation comprised three main categories of expenditures related to: (1) BP measurements and outpatient visits; (2) laboratory and other tests; and (3) pharmaceutical therapy. To estimate the indicated cost, the frequency of each treatment or health service used was multiplied by the associated charge. All costs were evaluated in Euros and in accordance to the latest price bulletin in Greece (2013). A 5-year projection