Cardiovascular Disease Prevention and Control: Self-Measured Blood Pressure Monitoring Interventions for Improved Blood Pressure Control – When Used Alone

Summary Evidence Table – Economic Review

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
Author (Year): Arrieta et al. (2014) **Design:** Model **Economic Method:** Modeled Cost-Benefit. **Monetary Conversions:** Reporting year 2010 and base 2014 in US$.	**Location:** Mid-West region, USA **Setting:** One for profit HMO's members in primary care from 1 private employee plan and 1 Medicare Advantage plan. **Eligibility:** Plan members with diagnosis of essential hypertension. **Sample Size:** Employee plan 25478; Medicare 8253 in 2011. **Characteristics:** Plan members during 2008 to 2011. Male 53-59% Hypertension prevalence was 6.3% (age 20-44) and 33.5% (age 45-64) in employee plan and 60.2% in Medicare.	Home SMBP modeled from perspective of insurer located in Midwest (HBP). Assumed cost of device reimbursed and campaign conducted to raise awareness about HBP availability and HTN self-management to patients and PCPs. Decision tree plus Markov transitions from hypertension diagnosis, treatment, CVD events, death or exit from plan. Transitions in 3 month cycles. Primary data from 2008 to 2011 claims for 16,375 members with essential hypertension.	Effect of BP reduction on CVD from Prospective Studies Collaboration (2007). Transitions and cost for CVD based from claims. Since CBP is standard care in plan, effect of CBP is baseline transition probabilities calculated from claims data. Prevalence of hypertension from NHANES 2009-2010. Input values from Lovibond et al (2011) HTN Sensitivity CBP 85.60%; HBP 85.70% HTN Specificity CBP 45.90%; HBP 62.40% HBP induced mm Hg BP reduction based	**From plan perspective:** Reimbursement cost of HBP device Awareness campaign** *Assumed 5 year life. ** No training cost of patients and device validation because these costs are not reimbursed. Study provides HBP cost of intervention for diagnosis, treatment, and diagnosis + treatment. Reviewers report only the cost of HBP for diagnosis + treatment. **Cost per Member** <u>Employee Plan</u> Age 20-44 Year 1 $35.72 Year 5 $44.48 Year 10 $49.55 Age 45-64 Year 1 $38.54	Healthcare cost includes myocardial infarction; Stroke; Heart failure; transient ischemic attack; angina. Also includes cost of drugs based on adherence. Also includes physician visits based on diagnosis of hypertension. Difference for HBP and CBP for healthcare due to avoided events from diagnosis, treatment, and adherence. Parameter values based on plan's claims data. **Productivity:** No assessment done Annual insurance premiums from plan data: $8438. **Savings per Member**	**ROI* (Savings-Cost) per member** <u>Year 1 Employee Plan</u> Age 20-44 0.94 ($33.75) Age 45-64 0.85 ($32.65) <u>Year 10 Employee Plan</u> Age 20-44 8.37 ($414.81) Age 45-64 7.50 ($439.14) <u>Year 1 Medicare Advantage</u> Age =>65 3.75 ($166.17) <u>Year 10 Medicare Advantage</u> Age =>65 19.34 ($1364.27) All dollars discounted 3% *ROI = Return on Investment = (Savings-Cost/Cost) **Additional Results** <u>HBPM for Diagnosis Only</u>

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	Time Horizon: Modeled for 1, 3, 5, and 10 years.	**Comparison:** Usual care with clinic BP measurement (CBP)	on meta-analysis of Agarwal (2011): SBP -2.63; DBP -1.68	Year 5 $51.28 Year 10 $58.53 <u>Medicare Plan</u> Age =>65 Year 1 $44.26 Year 5 $61.22 Year 10 $70.53	**(Diagnosis and Treatment)** <u>Employee Plan</u> Age 20-44 Year 1 $69.47 Year 5 $289.83 Year 10 $464.37 Age 45-64 Year 1 $71.18 Year 5 $306.61 Year 10 $497.67 <u>Medicare Plan</u> Age =>65 Year 1 $210.42 Year 5 $908.07 Year 10 $1434.80	ALL ROIs positive and increasing from year 1 to 10 except for Medicare Plan in Year 1. <u>HBPM to Monitor Treatment</u> Age 20-44 negative ROIs, -0.87 in Year1 to -0.33 in Year 10. Age 45-64, ROI is -0.02 to +2.95 in Year 10. Age =>65, ROI is +4.37 in Year 1 to +18.54 in Year 10. **Conclusion on additional results:** HBPM more cost beneficial in diagnosis for younger adults and in treatment for older adults. Sensitivity: Cost beneficiality (CB) insensitive to variations in diagnostic effectiveness of HBP for those <65 while CB insensitive to variation in HBP treatment effects for =>65.

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						Comment: Diagnostic superiority of HBP is due to its higher specificity (less false-positives) and is best for younger age where prevalence is low. The treatment superiority of HBP is due to avoidance of CVD
Author (Year): Bosworth et al. (2009) **Design:** RCT with 3 arms **Economic Method:** Cost Analysis **Monetary Conversions:** Reporting year 2006 and base 2014 in US$	**Location:** Durham, NC **Setting:** Two Duke affiliated primary clinics **Sample Size:** 636 randomized from 2060 eligible **Characteristics:** Mean age-61 AfrAmer-49% Female-66% Low Income-19% 73% had adequate BP control at baseline Hypertension diagnosis and enrollment with GP at least 12 months prior; self-reported	Randomized to 4 groups: Usual Care; Bi-Monthly Nurse-administered tailored telephone behavioral interv (Beh); At home self BP monitoring (Mon); Combination (Mon-Beh) Stratified at baseline by enrollment site and health literacy. **Interventions:** **Beh** (n=160) Covered risk perception, hypertension education, provider relations, social support. Also adherence to recs for diet, smoking	Intent to treat analysis. Recommended BP: (Systolic BP < 140 & diastolic BP < 90 mmHg [<130 and <80 mmHg for patients with diabetes]) Primary outcome- BP control at 24 months (and at base, 6,12,18 months) **BP control vs usual care at 24 months:** Beh:4.3% (95% CI: −4.5%, 12.9); Mon: 7.6% (95% CI: −1.9%, 17.0%);	Calls attended by single nurse. Patients paid $25 at baseline and for each of 4 follow-up ($125 total) Beh – Nurse completed 1682 calls, 11 per patient, mean of 16 minutes. Beh-Mon – Nurse completed 1589 calls, 10 per patient, mean of 16 minutes. **2 Years Cost Per Person** Beh $345 Mon $90 Beh-Mon $416 (Sensitivity analysis cost for Beh-Mon was $208 to $811).	**Healthcare Cost:** Health care use in Duke system collected through 24 months. Mean outpatient encounters similar across groups; No difference in proportion hospitalized. Mean 2 year total health cost of $15,641 across all groups (SD=$25,769, median=$6698). **Productivity:** No productivity costs estimated or reported.	No summary economic measures reported. There was no difference in health care utilization across groups but there was improvement in health outcome for combination group. **Limitations:** Academic health center; 25% no 24 month data;73% controlled BP at baseline

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	anti-hypertensive medication; primary care provider appointment during the next 30 days; resident in area of health system. **Time Horizon:** 24 months intervention length - Dec 2005 through Jan 2008.	cessation/alcohol reduction, sodium intake. **Mon** (n=158)- Provided BP monitors, trained on use, 3 days a week readings, stamped envelopes to send logs every 2 months. **Beh-Mon** (n=159) **Comparison:** Usual Care (n=159)	Mon-Beh: 11.0% (95% CI: 1.9%, 19.8%). Note only combination had clinically significant effect. **SBP and DBP vs Usual at 24 months**: Mon: SBP:-0.6 (-3.6,2.3) DBP:-1.2 (-2.9, 0.4) Beh: SBP:+0.6 (-2.2,3.4) DBP:+0.4 (-1.1, 1.9) Mon-Beh: SBP:-3.9 (-6.9,-0.9) DBP:-2.2 (-3.82, -0.6) Other groups not significant.			
Author (Year): Boubouchairopoulou et al. (2014) Linked to Stergiou (2014) **Design:** Based on RCT **Economic Method:** Partial healthcare cost which includes	**Location:** Greece. **Setting:** Hypertension clinic in hospital. Eligibility: Age > 30 with elevated BP referred to hospital hypertension clinic. Exclude SBP/DBP > 180/110. Exclude stroke, CHD, heart failure, uncontrolled	Original study compared Home (HBP) versus Office plus Ambulatory (OABP) measurement. Treatment initiation and titration based on home measurement alone for HBP and on office plus ambulatory for OABP.	Main outcomes BP reduction, BP control, and target organ damage. The RCT **found no significant difference** in any of these outcomes HBP vs Clinic BP SBP 2.1 mmHg less DBP 1.4 mmHg less	No separate program cost provided. Components included in healthcare cost. 2.3 euros per month HBP cost. No details	**12 months healthcare cost:** Based on study records and protocol and Greek prices. HBP (OABP) Clinic Visits and BP Measurement E393.9 (E516.9) Labs and Tests* E709.0 (E709.0) Medication E233.1 (E247.6)	**Private sector perspective** **Summary Measure:** No summary measure estimated. **Author Discussions:** Assumptions for 5-year modeling may be too simplistic.

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program components. **Monetary Conversions:** Reporting year 2013 and base 2014 in Euros for Greece.	diabetes, kidney disease, pregnant. **Sample Size:** 116 with complete data at 12 month f/u included in analysis. HBP 59 OABP 57. **Characteristics:** Mean age 50.7 Males 59% **Time Horizon:** Intervention length is 12 months.	For HBP, SBP/DBP threshold at 135/85 and 130/80 for high risk. For OABP threshold at 140/90 and 130/80, respectively. Monthly clinic visits until BP controlled and then another visit after 6 months. Automatic BP devices with memory (Spacelabs 90207 or 90217, Microlife WatchBP 03). **Comparison:** Office-plus ambulatory BP measurement.			Total E1336.0 (E1473.5) Difference E137.50 less **5-Year healthcare** Cost was modeled over 5 years assuming following for year 2 onwards: 1 ABP and 3 clinic visits per year for OABP; 2 clinic visits per year for HBP; treatment as in end of year 1. Amortized cost of device included for HBP. HBP (OABP) Clinic Visits and BP Measurement E821.9 (E1252.9) Labs and Tests* E709.0 (E709.0) Medication E1200.5 (E1272.4) Total E2731.4 (E3234.3) Difference E502.90 less *Includes 12 lead ECG and echocardiogram for suspected white-coats only.	

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
Author (Year): Den Hond et al. (2004) Staessen et al. (2004) looks at same study and population **Design:** RCT **Economic Method:** Partial healthcare cost which includes program components. **Monetary Conversions:** Reporting year 2000 and base 2014 in Euros for Belgium.	**Location:** Belgium and Ireland. **Setting:** 56 PCP clinics, 3 hospital outpatient clinics in Belgium and 1 hypertension clinic in Dublin, Ireland. **Eligibility:** Age > 18 patients with DBP > 95 mmHg in clinic measurement. Exclude heart failure, hypertensive retinopathy, MI, cancer, cirrhosis, MH or SA, high serum creatinine. **Sample Size:** HBP 203 OBP 197. **Characteristics:** Mean age 54.3 Females 52.2% Previously treated 45.5% SBP 148.2 to 148.9 DBP 94 to 94.1 86.7% completed the trial. Mean follow-up was 350 days	Treatment of Hypertension Based on Home or Office Blood Pressure (THOP). Main objective to compare home BP (HBP) to office BP (OBP) as guide to initiate and titrate hypertension medication. Based on initial DBP, and same initial drug, treatment by single physician blinded to randomization was stepped thereafter every 2 months for 12 months. Omron HEM-705CP BP device for HBP. Ambulatory BP taken at baseline, 6, and 12 months but not used for treatment decisions. **Comparison:** Office BP measurement.	Threshold DBP at 80-89 mmHg Main outcomes DBP change and intensity of drug treatment. **Differences in SBP/DBP reduction HBP v OBP** 6.8/3.5 mmHg higher based on office 4.9/2.9 mmHg higher based on home 5.3/3.2 mmHg higher based on ambulatory Secondary Outcomes: No difference between groups in reductions in left ventricular mass.	Home monitoring cost component within healthcare cost provided as E4.23 per month	Monthly healthcare cost based on study records: HBP (OBP) per patient Clinic Visits PCP Fees E14.11 (E15.95) Medication E16.88 (E21.20) Total healthcare E30.99 (E37.15) Total (Plus cost of home monitoring) E35.22 (E38.75)	**Summary Measure:** No summary measure estimated. Also, full cost-benefit analysis not done given the intervention was not effective based on primary outcome. **Author Conclusion:** Authors state home BP measurement was NOT a better guide than office measurement for prescribing HTN medications because home based group had less BP control than office based group. However, the home group had slightly lower healthcare cost. Comment: Treatment adjustments were made based on DBP only. Authors state DBP determines CVD risk in younger populations and even older subjects.

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
	Time Horizon: Intervention length is 12 months. Trial period March 1997 through April 2002.					
Author (Year): Fukunaga et al. (2008) Linked to Funahashi et al. (2006) **Design:** Decision Tree Model **Economic Method:** Modeled change in healthcare cost for hypertension and break-even analysis. **Monetary Conversions:** Reporting year 2006 and base 2014 in US$.	**Location:** Japan **Setting:** Modeled for Japan based on primary care practice. **Sample Size:** Modeled for 1000 patients diagnosed with HTN based on clinic measurement. **Time Horizon:** Modeled 5 years.	Modeled based on outcomes of on the Ohasama Study cohort of hypertension and CVD that used both home (HBP) and clinic (CBP) measurements of BP. Objective to model the cost saving expected when using home BP monitoring (HBP) for newly detected hypertension. Assumed baseline (sensitivity) prevalence of white-coat 16.5% (8.2 to 24.7%). Incidence of new hypertensives at 7.4% (3.7 to 14.9%). Calculations over 5 years for cost of HTN treatment and break-even cost for introduction of HBPM using decision tree.	Effectiveness is not reported explicitly for this model. It is implicit the savings from healthcare is due to the detection of white-coat hypertension using the home device to monitor BP.	Cost of introducing HBPM assumed to be $0. Authors state devices are purchased by patients and not currently covered by insurance.	Important model input is the assumed annual cost to treat HTN (from national surveys) $2407. 5-year healthcare cost <u>Without HBP</u> $10.89 million per 1000 persons ($2178 per person per year). <u>With HBP</u> $9.33 million per 1000 persons ($1866 per person per year). Savings was $1.56 million per 1000 or $312 per person per year. Based on sensitivity analysis on prevalence of white-coat and new hypertensives diagnosed, the savings ranged from	**Summary Measure:** No summary measure estimated. Break-even analysis In the base case, the break-even is $312.40 per patient per year. Based on sensitivity analysis, the break-even ranged from $135 to $502. Per patient per year **Comments:** This study adds little to the original work done by the same team in Funahashi 2006. Of note, their 2006 study is not cited. However, in the present study the authors do draw the conclusion that there is economic support in cost savings for insurance plans to

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					$674,000 to $2.51 million	cover the cost of HBP devices.
Author (Year): Funahashi et al. (2006) **Design:** Decision Tree Model **Economic Method:** Modeled change in healthcare cost. **Monetary Conversions:** Reporting year 2003 and base 2014 in US$.	**Location:** Japan **Setting:** Modeled for Japan based on primary care practice. **Sample Size:** Modeled for 85.75 million individuals age 30 and above in 2003 Census. Treated/untreated high BP based on 2002 CVD survey and those with home BP devices based on Ohasama study (30 million devices currently in use in Japan). Estimated number of hypertensives age 30 and above is 22.9 million. **Characteristics:** Japan population over age 30 in 2003 **Time Horizon:** Modeled 1 year	Modeled based on outcomes of the Ohasama Study cohort of hypertension and CVD that used both home (HBP) and clinic (CBP) measurements of BP. Modeled outcomes were changes in physician treatment practices and treatment-related patient behaviors. Decision tree from diagnosis, treatment, to long term care for HTN and HTN complications for decile age groups and sex. Model assumes 80% of individuals get HBP measurements. Decision tree constructed with 36 x 4 scenarios based on CBP/HBP readings for treated/untreated at baseline and initiation/increase/de	High SBP/DBP set at 140/90 mmHg for clinic measure 135/85 for home measure. Undetected hypertension 6.2%, untreated hypertension detected by CBP (HBP) 28.7% (15.3%), white-coat hypertension 22.5%, uncontrolled hypertension detected by CBP (HBP) 14.4% (11.4%) Assumed CBP done for all. For those getting HBP, treatment based on HBP alone. Base case and sensitivity assumptions: Percent population using HBPM 40-80-100% Rate of consultation in untreated 15-30-45%	No separate program cost provided.	Healthcare cost assigned to various outcomes of decision tree based on expenditure panel survey of 2002. Included were drug costs, consultations costs, and cost of complications including those for cerebral infarction and hemorrhage, and ischemic heart disease, **Healthcare Costs Before (After) [Difference] Introduction of HBP in Billions US$** Medical costs for HTN $63.77 ($54.47) [$9.30] Medical costs of complications $6.56 ($6.54) [$0.028] Long term care for complications $7.53 ($7.49) [$0.039] **Total $77.87 ($68.50) [$9.37]** Per Capita Healthcare Savings based on 85.75	**Summary Measure:** No summary measure estimated. Healthcare cost saving per capita of $109.27 and $409 per hypertensive patient above 30 years of age. Sensitivity analysis demonstrated healthcare cost saving in all scenerios with smallest savings at about $56 per capita or $209 per hypertensive. **Comments:** Authors note most of the savings is from identification of white-coat hypertension. The savings from long term complication averted is largely from the identification of masked hypertension. **Limitations:** Quality life, adverse events

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		crease/maintenance of drug treatment. Also includes new consultations due to high BP reading and long term CVD complications. Parameter values based on various Japanese studies.	Change in prescription 20-40-60% Change in drug cost due to prescription change 30-60-90% Reduction in SBP by medication initiation or change 5-10 mmHg.		million population over age 30 was $109.27 or $409 per hypertensive above age 30.	avoided, patient time, assessing accuracy of devices, replacement of devices not considered. Only stroke and ischemic heart disease considered. 1-year modeled period.
Author (Year): Reed et al. (2010) Linked to Bosworth et al. (2009) **Design:** RCT **Economic Method:** Cost-effectiveness **Monetary Conversions:** Reporting year 2008 and base 2014 in US$.	**Location:** Durham, NC. **Setting:** 2 primary clinics in large academic health setting. **Eligibility:** Adults with hypertension from 2 primary care clinics. **Sample Size:** N-160; H-158; C-159; Usual-159 **Characteristics:** Mean age:62 Male:29-38% Caucasian:43-56% Diabetes:32-40% Employed:36-45% Systolic:124-126 Diastolic:70-72 **Time Horizon:**	Take Control of Your BP (TCYB) 3 intervention arms. Nurse-led tailored behavioral (N) – 12 bimonthly telephone encounters. Questions and education module software driven at each call. Modules included medication, diet, and knowledge. Home BP monitoring (H) – 10 minute training and free instrument to measure BP 3 times a week. Retraining if necessary. Combination (C) **Device:** Omron HEM 773AC	Usual care systolic BP unchanged. Change in mm Hg compared to usual care: For. H reduced by 0.6 For N increased by 0.6 For C decreased by 3.9	<u>Program Cost per Participant (24 Months):</u> N $345 H $90 C $416 Patient Time per Participant (24 Months): N $55 H $585 C $741. Intervention N components Primarily Nurse time and Patient materials (Fixed cost was $54404 per year for Nurse Intervention) Intervention H components BP Monitor and Nurse-led training Time (initial 10 minutes and 5	**Healthcare cost:** From health system data on claims. Health care includes outpatient and inpatient care. Excludes medication costs. Intervention C had highest outpatient and lowest inpatient costs. Per person cost in 24 months (Intervention Minus Usual Care) In-patient: N $1020; H $1194; C -$201 Out-patient: N -$110; H -$247; C $828 All Care: N $910; H $947; C $627 **Productivity:** No assessment done	**Summary Measure:** Incremental cost per person over 24 months (Program Cost + Patient Time + Medical Cost): N $1310;H $1622;C $1783 Incremental program plus patient time cost for Combination: $1157 Incremental cost per BP reduction=1157/3.9 =$297 per mm Hg. They use BP outcomes (reduction of 2.7/1.9 mm Hg) from the ASCOT-BPLA study to estimate incremental LY was 0.1. Hence based only on program cost,

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	Intervention year not provided. 24 month intervention with follow-up every 6 months.	**Comparison:** Usual Care (U).		minutes at follow-up). No telemetry since readings mailed.		CEA=416/0.1=$4160/LY. Assuming 12 year intervention sustained, and per year cost of $211, CEA=$23,000/LY If patient time is added to program cost, CEA=1157/0.1=$11,570/LY If sustained over 12 years and discounted by 3%, CEA=$64,000/LY **Comment:** Patient time costs are non-trivial. Medication costs not included
Author (Year): Rogers et al. (2001) **Design:** RCT **Economic Method:** Partial intervention cost. **Monetary Conversions:** Reporting year 2000 and base 2014 in US$.	**Location:** Syracuse, NY. **Setting:** General practices affiliated with New York Upstate Medical University- Internal Medicine. **Eligibility:** Patients age =>18 and not pregnant and with capacity to self-monitor BP. Diagnosed with essential	All patients received printed educational materials for non-pharma methods for BP control from National Heart Lung and Blood Institute (NHLBI). Printed JNC-6 materials available to physicians and staff. Intervention group **(HBPM)** received automatic blood pressure monitors for home,	Baseline and exit BP measured by ambulatory blood pressure readings by research nurse. Baseline and follow-up questionnaire determined number of prescription medications, physical activity, height/weight/BMI, BP, dietary intake, and smoking. <u>HBPM</u>	The 'service cost' for the intervention services was $24.95 per month. No details provided regarding components of cost estimate. Likely does not include cost of Primary Care Provider time and includes only cost of device, transmission, and weekly reports.	**Healthcare cost:** Change in healthcare not assessed. Authors note that there was no significant difference in number of outpatient visits. **Productivity:** No assessment done	**Summary Measure:** No summary measure estimated. **Author Conclusion:** HBPM is more effective in reducing BP than usual care. **Comment:** Mean arterial BP for African Americans (# HBPM=7, # U=4) was reduced 9.6 for HBPM and increased 5.25 in usual care.

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	hypertension and considered for change in therapy or with uncontrolled SBP/DBP > 140/90 or side effects or SBP/DBP > 180/110. Those with heart disease, diabetes, arterial disease, retinopathy, nephropathy with SBP/DBP => 130/85. **Sample Size:** HBPM 60; U 61 **Characteristics:** Mean Age 60-63 Men 43-56% White 80-91% Smoker 7 to 16% Diabates 22-26% CVD 13-20% Stroke 9-12.7% Mean BMI 29-31.5 Covered by private insurance or Medicare. Only BMI was statistically higher for HBPM at baseline. **Time Horizon:** Intervention length designed to be 8 weeks (2 months).	transmission of readings to central processing, and weekly reports to primary physician and patient. Transmission over phone lines. Physicians adjusted medications based on HBP through phone, office visit, or both. Automatic Device: Model 52500, Welch Allyn, Skaneateles Falls, NY. **Comparison:** Usual Care (U) for HTN based on JNC-6.	SBP reduced 4.9 mmHg DBP reduced 2.0 mmHg <u>Usual</u> SBP reduced 0.1 mmHg DBP increase 2.1 mmHg <u>Difference</u> SBP 4.8 mmHg less DBP 4.1 mmHg less When adjusted for patient characteristics, mean arterial BP reduced 2.8 mmHg for HBPM and increased 1.1 mmHg for Usual.			Medication change more common in HBPM than in usual care (33% v 7%).

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	Median length was 11 weeks. Recruitment during May 99 to April 00.					
Author (Year): Soghikian et al. (1992) **Design:** RCT **Economic Method:** Program cost and Healthcare cost **Monetary Conversions:** Reporting year 1986 and base 2014 in US$.	**Location:** San Francisco, CA **Setting:** 4 medical centers of Kaiser Permanente. **Eligibility:** Hypertensives with no CVD or other conditions that prevent home BP monitoring. **Sample Size:** Interv-215; Control-215. **Characteristics:** Mean age: 53.8 to 54.7 Taking BP Meds 81.9 to 88.4% Controlled DBP 59 to 60% Black 38.6 to 39.5% Other non-white 10.7 to 13.5% **Time Horizon:** Intervention length is 12 months. Recruitment in 1984 and 1985.	Intervention group received training on use of home device and asked to send reports to study office twice a week BP measurements, change in drugs, adverse events by mail every 4 weeks. Device Tycos self-check 7052-08. Data transferred to computer files and report generated for physicians. **Comparison:** Usual care with PCP.	94% of patients sent in reports (10.2 reports per patient with 7.5 readings per report). <u>Intervention</u> SBP Reduced by 1.4 from 137.4 to 135.9 DBP increased by 0.1 from 86.1 to 86.2 <u>Control</u> SBP Increased by 1.8 from 140.2 to 142.0 DBP increased by 1.7 from 86.3 to 88.0 Difference in Difference BP Change (Not Significant) SBP reduced 3.2 DBP reduced 1.6 Difference in Difference at 1-year follow-up was 3.3 reduction for SBP and 1.6 reduction for DBP	Amortized 5-year cost of device and training. Cost per patient per year was $27.83 Device $10 Training $2 Processing reports $10.20 ($1 per report) Postcards and F/U $5.63 No telemetry reported.	**Healthcare cost:** Abstracted from 2 years (1 year pre and 1 year during study) of patient medical records. Only outpatient services such as visits, labs, ECG as related to hypertension. Mean # office visits same for Control and Intervention in previous year but decreased by 1.7 for intervention and 0.8 for control. This is valued at $47.10 less for Intervention vs Control. Mean # calls went up by 0.9 for intervention and by 0.1 for control. This is valued at $8.52 more in Intervention vs Control. Medical procedures remained unchanged for both groups. Adjusted hypertension	**Summary Measure:** Program Cost Plus Healthcare Cost Intervention $27.83+$88.76= $116.59 Control $88.76+$35.42= $124.18 Net Benefit=$7.59 **Comments:** The authors note the difficulties that may arise in the US context of incentives and payment mechanisms for services that are obstacles to home monitoring of BP. **Limitations:** Authors mention patient time saved from averted visits is probable but the study did not account for it, on purpose.

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			There was no change in type of medication or frequency.		healthcare cost was $88.76 per patient per year for intervention ($35.42 less than for control). **Productivity:** Not considered or reported.	
Author (Year): Staessen et al. (2004) Den Hond et al. (2004) looks at same study and population **Design:** RCT **Economic Method:** Cost-benefit **Monetary Conversions:** Reporting year 2000 and base 2014 Euros for Belgium.	**Location:** Leuven, Belgium and Dublin, Ireland. **Setting:** 56 primary clinics and 3 hospital clinic in Belgium and one hypertension clinic in Ireland. **Eligibility:** Age => 18 patients with DBP > 95 mmHg in clinic measurement. Exclude heart failure, hypertensive retinopathy, MI, cancer, cirrhosis, Mental Health or Substance Abuse, high serum creatinine. **Sample Size:** HBP 203 OBP 197. **Characteristics:** Mean age 54.3 Females 52.2%	Treatment of Hypertension Based on Home or Office Blood Pressure (THOP) trial. Primary objective to compare home versus clinic measurement of BP to guide initiation and titration of HTN drug treatment. Based on initial DBP, and same initial drug, treatment by single physician blinded to randomization was stepped every 2 months for 12 months based on home DBP. Omron HEM-705CP BP device for HBP. Ambulatory BP taken at baseline, 6, and	Threshold DBP at 80-89 mmHg Main outcomes DBP change and intensity of drug treatment. **Differences in SBP/DBP reduction HBP v OBP** 6.8/3.5 mmHg higher based on office 4.9/2.9 mmHg higher based on home 5.3/3.2 mmHg higher based on ambulatory % who stopped medication due to BP control HBP 25.6%; OBP 11.3% Secondary Outcomes: No	Home monitoring cost per month per patient E3.33 (includes device)	<u>1-month Healthcare Costs</u> HBP (OBP) per patient Clinic Visits PCP Fees E15.10 (E17.59) Medication E16.88 (E21.20) Healthcare cost E31.98 (E38.75) Total (Plus cost of home monitoring) E35.22 (E38.75) **Productivity:** No assessment done	**Summary Measure:** No summary measure estimated. Also, no need for full cost-benefit analysis given the intervention was not effective based on primary outcome. **Author Conclusion:** Authors state home BP measurement was NOT a better guide than office measurement for prescribing HTN medications because home based group had less BP control than office based group. However, the home group had slightly lower healthcare cost. They conclude HBP should not be used

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
	Previously treated 45.5% SBP 148.2 to 148.9 DBP 94 to 94.1 86.7% completed the trial. Mean f/u 350 days **Time Horizon:** Intervention length is 12 months. Trial period March 1997 through April 2002.	12 months but not used for treatment decisions. **Comparison:** Office BP measurement.	difference between groups in reductions in left ventricular mass			alone to guide treatment. Comment: The cost components don't add up but the discrepancy is small. We report totals 'as is'. Treatment adjustments were made based on DBP only. Authors state DBP determines CVD risk in younger populations and even older subjects.
Author (Year): Verberk et al. (2007) **Design:** RCT **Economic Method:** Partial program cost and partial healthcare cost **Monetary Conversions:** Reporting year 2004 and base 2014 in US$	**Location:** Maastricht, Netherlands. **Setting:** PCP Offices and Health center in hospital. Eligibility: SBP/DBP>139/89. **Sample Size:** SP-216; OP-214. **Characteristics:** Mean age 55 Males 55% Untreated 30-32% SBP 143.4 to 143.7 DBP 88.1 to 88.4 No significant comorbid conditions.	Home versus Office Measurement, Reduction of Unnecessary treatment Study (HOMERUS) Objective to determine if Self-measured BP can reduce prescriptions without impairing BP control and target organ damage (TOD). Ambulatory BP (ABP) taken at beginning and end of trial. **Intervention:** Self-measured BP group	Target set at Primary outcomes were BP control and TOD. SBP/DBP=140/90 Adjustments for baseline BP, center, age, gender, BMI, smoking, drugs at baseline, and setting of patient recruitment. 94% of patients sent in reports (10.2 reports per patient with 7.5 readings per report). The ABPM measures were significantly lower for the OP	Only cost of monitor included. Monitor amortized over 3 years at 4.5% interest and 8% of purchase price for annual cost of maintenance. **Cost per patient per year was $59 for the device only.**	**Healthcare cost:** Only cost of medications, pharmacist fees, and out-patient considered. **Healthcare Cost Per Year Per Patient (SP/OP)** Medication $363/$498 Pharmacist $24/$33 Out-patient $679/$658 Total $1066/$1188 Difference $123 Savings	**Summary Measure:** Net benefit based on partial cost of program and healthcare cost. **Cost Per Year Per Patient (SP/OP)** Medication $363/$498 Pharmacist $24/$33 Out-patient $679/$658 Device $59/$0 Total $1124/$1188 **Difference $64 Savings** Overall Conclusion: The intervention led to no worse

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
	Time Horizon: Intervention length is 12 months.	(SP) took 3 measurements in morning and 3 in evening for 7 days prior to each clinic visit. Stepped treatment based on self-measured results. Measurements produced by patient to staff at clinic visit. No electronic transmission. Training not mentioned. No BP summary report. **Comparison:** Office-based BP group (OP) took measurement in clinic or hospital. Treatment based on office measurements. Device (Omron HEM-705 CP). Pill counts taken from medication bottles at each visit to determine adherence. Prescriptions picked up from patients' pharmacists who	(123.8/76.1) group than for SP (125.9/77.2) at end of trial. There was no significant difference between groups for BP based on clinic measurements. (Difference was SBP/DBP=1.6/1.0) Left ventricular mass index reduced for both groups with no difference between groups. No difference between groups for medication adherence. Study does not report % with BP control based on ABP.			effectiveness outcomes compared to control. However, it reduced healthcare cost measured as cost of BP medications.

Study	Study and Population Characteristics	Intervention & Comparison	Effectiveness	Program Costs	Healthcare Costs and Productivity Losses Averted	Economic Summary Measure
		were informed about study. **Comparison:** BP measurements in PCP clinics.				

Abbreviations

ABP, ambulatory blood pressure
BP, blood pressure
CB, cost-benefit
CBP, clinic-based blood pressure
CEA, cost-effectiveness analysis
CHD, chronic heart disease
CKD, chronic kidney disease
CV, cardiovascular
CVD, cardiovascular disease
DBP, diastolic blood pressure
DM, diabetes mellitus
GP, general practitioner
HBP, home-based blood pressure
HBPM, home-based blood pressure monitor
HTN, hypertension
JNC, Joint National Committee
LY, life year
MI, myocardial infarction
NHANES, National Health and Nutrition Examination Survey
OBP, office-based blood pressure
PCP, primary care practice
QoL, quality of life
ROI, return on investment
SBP, systolic blood pressure
SES, socioeconomic status