

Return on Investment of Self-Measured Blood Pressure: An Economic Model from the Insurers' Perspective

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FINANCIAL DISCLOSURE:

No relevant financial relationship exists

Outline

- Background & Objective
- Self-measured blood pressure (SMBP) Utilization Stages
- SMBP ROI & NPV
- Methodology: Decision Analytic Model
- SMBP ROI model & results
- Conclusions
- Future Research

Background & Objective

- Half of the 75 million adults with hypertension in the U.S. do not have their BP controlled (*Merai, et al. 2016*).

- 12-50% of the general population have white coat hypertension (*Franklin et al. 2013*), 19-21% have masked hypertension (*Pickering et al. 2002*).
- Using SMBP devices is an effective strategy to more accurately diagnose hypertension and improve BP control than using clinic-based blood pressure measurement (CBPM) alone.
- However: most insurers remain unconvinced that the cost of the devices would yield a positive *financial* return.
- Objective: estimate the ROI & NPV of SMBP when used to diagnose hypertension, select treatment, and manage BP.

Merai R, et al. CDC Grand Rounds: A Public Health Approach to Detect and Control Hypertension. *MMWR Morb Mortal Wkly Rep* 2016;65:1261–1264; Franklin S, et al. (2013) White-Coat Hypertension, New Insights From Recent Studies, *Hypertension*. 62:982–987; Pickering T, et al. (2002) Masked Hypertension. *Hypertension*, 40(6), pp. 795–796.

Use of SMBP

Stages of SMBP use

1. Diagnosis of hypertension
2. Treatment intensification, titration
3. Ongoing management of blood pressure

Strength of evidence on the efficacy - SMBP vs CBPM wrt ROI:

- BP Management (adherence to treatment leading to reduced BP)
- Diagnosis (identifying white coat & masked hypertension)
- Treatment intensification, titration

Strength of evidence on the efficacy of SMBP vs CBPM:

BP Management (adherence to treatment leading to reduced BP) >

Diagnosis (Identifying white coat & masked hypertension) >

Treatment selection (Identifying appropriate treatment)

Research concentration:

BP Management > Treatment Selection > Diagnosis (paucity of research)

SMBP ROI & NPV

- Perspective: Commercial insurer
- Comparison group: Usual care = CBPM
- Return on investment (ROI) of SMBP relative to CBPM; the ratio of net benefits to net costs.
- Net present value (NPV) of SMBP relative to CBPM; savings from SMBP minus the SMBP cost converted to present-date dollars.

| SMBO utilization stage | Investment (SMBP device + education) | Sources of savings |
|------------------------|--|--|
| Diagnosis | SMBP to <u>normotensives</u> and <u>new patients</u> | Better accuracy → Identify: White coat HTN, avoid HTN treatment Masked HTN, avoid CVD events |
| Treatment | SMBP only to <u>newly</u> diagnosed | Faster therapeutic selection → achieve equilibrium (control) quicker; Fewer visits |
| BP Management | SMBP to <u>all</u> diagnosed (new and previous) | Better adherence → BP reduction, avoid CVD events |

Decision Analytic Model

- Cohorts of (1,000) insured individuals, 7 age groups from age 25 to 85+
- Two part model:
 - Decision tree: Diagnosis and management
 - Markov model: CVD events
- Key assumption about SMBP diagnosis (Dx):
 - If currently Dx hypertensive (D_x HT) → Not be retested, keep Dx
 - If currently Dx normotensive (D_x NT) → Retested with SMBP, Dx may change
 - If never Dx (~D_x) → Tested with SMBP, new Dx

Part 1: Decision tree

[Graphic showing Part 1: Decision tree]

Part 2: Markov model

[Graphic showing Part 2: Markov model tree]

SMBP ROI model and results

- Decision analytic model in Excel (*AMA's SMBP ROI Calculator*)
- CV outcomes + lifetime projections of costs and savings for the U.S. population
 - Framingham risk predictions: age-related probabilities associated with annual transitions from non-CVD states to CVD states
 - NHANES 2013-14 U.S. population: characteristics and previous diagnostic history by age group, hypertension prevalence, treatment adherence rates
 - Costs and health parameters from the literature
 - Commercial insurance cost and utilization from Truven Marketscan data

[No slide title]

| Input Variable | Parameter | Uncertainty Range | Reference |
|---|------------|-------------------|------------------------|
| Key probabilities, annual | | | |
| Probability of no diagnosis | 0.8-10.7% | Age-dependent | NHANES 2013-14 |
| Probability of HT diagnosis | 16.2-83.8% | Age-dependent | NHANES 2013-14 |
| Probability of MI | 0.41-3.2% | Age-dependent | D'Agostino et al. 2008 |
| Probability of stroke | 0.37-2.8% | Age-dependent | D'Agostino et al. 2008 |
| Diagnosis accuracy | | | |
| CBPM – Sensitivity | 85.6% | No uncertainty | Hodgkinson et al. 2011 |
| CBPM – Specificity | 45.9% | No uncertainty | Hodgkinson et al. 2011 |
| SMBP – Sensitivity | 85.7% | No uncertainty | Hodgkinson et al. 2011 |
| SMBP - Specificity | 62.4% | No uncertainty | Hodgkinson et al. 2011 |
| Adherence to anti-hypertensive medication | | | |
| CBPM – adherence rate | 30.7-89.6% | Age-dependent | NHANES 2013-14 |

D'Agostino RB, et al. (2008) General cardiovascular risk profile for use in primary care: the Framingham Heart Study. *Circulation* 117: 743-753.

Hodgkinson J, et al. (2011) Relative effectiveness of clinic and home blood pressure monitoring compared with ambulatory blood pressure monitoring in diagnosis of hypertension: systematic review. *Bmj* 342: d3621.

SMBP ROI and NPV, by time frame

| Age Group | Return on Investment (ROI) (per individual) | | | | Net Present Value (NPV) (per individual) | | | |
|----------------------|---|------------|------------|--------------|--|------------|------------|-----------|
| | 1-Year ROI | 3-Year ROI | 5-Year ROI | Lifetime ROI | 1-Year NPV | 3-Year NPV | 5-Year NPV | Total NPV |
| Age 25-34 | 492% | 466% | 454% | 403% | \$318 | \$384 | \$427 | \$487 |
| Age 35-44 | 445% | 418% | 407% | 365% | \$276 | \$332 | \$366 | \$408 |
| Age 45-54 | 359% | 329% | 317% | 277% | \$223 | \$269 | \$297 | \$332 |
| Age 55-64 | 160% | 133% | 123% | 99% | \$102 | \$118 | \$128 | \$136 |
| Age 65-74 | 76% | 55% | 49% | 35% | \$48 | \$50 | \$51 | \$48 |
| Age 75-84 | 34% | 17% | 12% | 5% | \$21 | \$15 | \$12 | \$6 |
| Age 85+ | -64% | -73% | -75% | -78% | -\$37 | -\$60 | -\$70 | -\$80 |
| Total Per Individual | | | | | \$186 | \$222 | \$244 | \$272 |

NPV, by source of savings

| Age Group | BREAKDOWN OF TOTAL NPV BY ORIGIN OF THE SAVINGS (per individual, lifetime) | | | | |
|----------------------|--|--|---|---|-------------------|
| | SMBP Device and Education Investment | Hypertension Diagnosis & Treatment Selection | Ongoing Hypertension Management after Diagnosis | Treatment of Future Hypertension-Related CVDs | Insurance Premium |
| Age 25-34 | -\$125 | \$327 | \$285 | \$0 | \$0 |
| Age 35-44 | -\$115 | \$285 | \$239 | \$0 | \$0 |
| Age 45-54 | -\$123 | \$238 | \$218 | \$0 | \$0 |
| Age 55-64 | -\$141 | \$139 | \$138 | \$1 | \$0 |
| Age 65-74 | -\$140 | \$93 | \$91 | \$3 | \$0 |
| Age 75-84 | -\$126 | \$71 | \$60 | \$1 | \$0 |
| Age 85+ | -\$106 | \$21 | \$8 | -\$2 | -\$1 |
| Total Per Individual | -\$127 | \$210 | \$188 | \$0 | \$0 |

NPV, by use of SMBP

| Age Group | BREAKDOWN OF TOTAL NPV BY TYPE OF SMBP USE (per individual, lifetime) | | |
|----------------------|---|-----------------------------------|--------------------------|
| | Used for Diagnosis Only | Used for Treatment Selection Only | Used for Management Only |
| Age 25-34 | \$242 | \$25 | -\$119 |
| Age 35-44 | \$203 | \$22 | -\$110 |
| Age 45-54 | \$187 | \$18 | -\$118 |
| Age 55-64 | \$117 | \$12 | -\$135 |
| Age 65-74 | \$73 | \$9 | -\$129 |
| Age 75-84 | \$44 | \$7 | -\$117 |
| Age 85+ | \$4 | \$3 | -\$108 |
| Total Per Individual | \$159 | \$17 | -\$121 |

Conclusions

- The primary economic value of SMBP stems from its diagnostic role in ruling out white coat hypertension.
- If SMBP is used solely to manage (but not to diagnose) hypertension, its incremental effects on blood pressure reduction and cardiovascular event rates were not large enough to produce positive financial gains.

Call for future SMBP research

- Past SMBP research on HTN management has emphasized BP control and avoidance of CVD events, but the advantage of SMBP compared to CBPM is small.
- Future research should focus on measurement accuracy, across the stages of SMBP use (ie, diagnosis, treatment intensification & titration, management), where SMBP has the highest-value attribute.

Refocus SMBP research on its effects on measurement accuracy across all three stages of utilization

| Stage of SMBP use | Expected Effects of Better Measurement Accuracy | Value Proposition |
|-------------------|---|--|
| Diagnosis | <u>More accurate diagnosis</u> , Improved identification of “White-Coat” and “Masked” HTN | Patients with “White-Coat HTN” avoid unnecessary treatment, “Masked HTN” receives needed treatment – avoids future CVD events, Lower costs |
| Treatment | <u>More accurate measurement of</u> | Quicker treatment |

| | | |
|---------------|---|---|
| | <u>treatment effects</u> , Improved efficiency in identifying appropriate treatment regiment | intensification & titration, Fewer office visits, Lower costs |
| BP Management | <u>More accurate measurement of true BO trends and fluctuations</u> in those with “White-Coat Effect” | Patients with “White-Coat Effect” receive more accurate dosing, Fewer adverse drug events, Fewer office visits, Lower costs |

Thank you for your attention.

Questions?