



A4M

Analytics4Medicine

To better: Define, Diagnose,
Measure, and Manage
Hypertension

Hypertension Clinical Decision Support Tool

Analytics4Medicine- because in science truth is a moving target

Questions



Is elevated BP a sign, a definition or a diagnosis of Hypertension (HTN)?

When and where is elevated BP significant?

Are office-based BPs the best measurement for diagnosis and follow-up?

What is uncontrolled HTN, apparent resistant HTN, resistant HTN, masked HTN?

Is Hypertension a definitive diagnosis?

Is it a Singular Disease?

If not, does it require a different nosology (disease classification)?

Why can one group have 2-3X the stroke rate with the same level of BP?

Do renin and aldosterone matter? Is BP level or renin/aldosterone level more important?

Most of us think HTN is easy to manage, if only the patients would take their meds.

Why is the control rate 48.3% in the US? Is it unimportant?



Is Hypertension Important or not?

Overview:

1. **Common Problem** (103.3 Million people in US)
2. **Significant Morbidity/Mortality** (500,000 deaths/year)
3. **Expensive** (\$318 - \$444 Billion/year) (\$1,048/hypertensive/year)
4. **Consumes a significant amount of provider management time** (42 Million visits/year).
5. **Poorly Defined** (45% mislabeled, 20-22% misdiagnosed)
6. **Poorly Managed** (only 48.3% are at goal 140/90)

What is usual care?

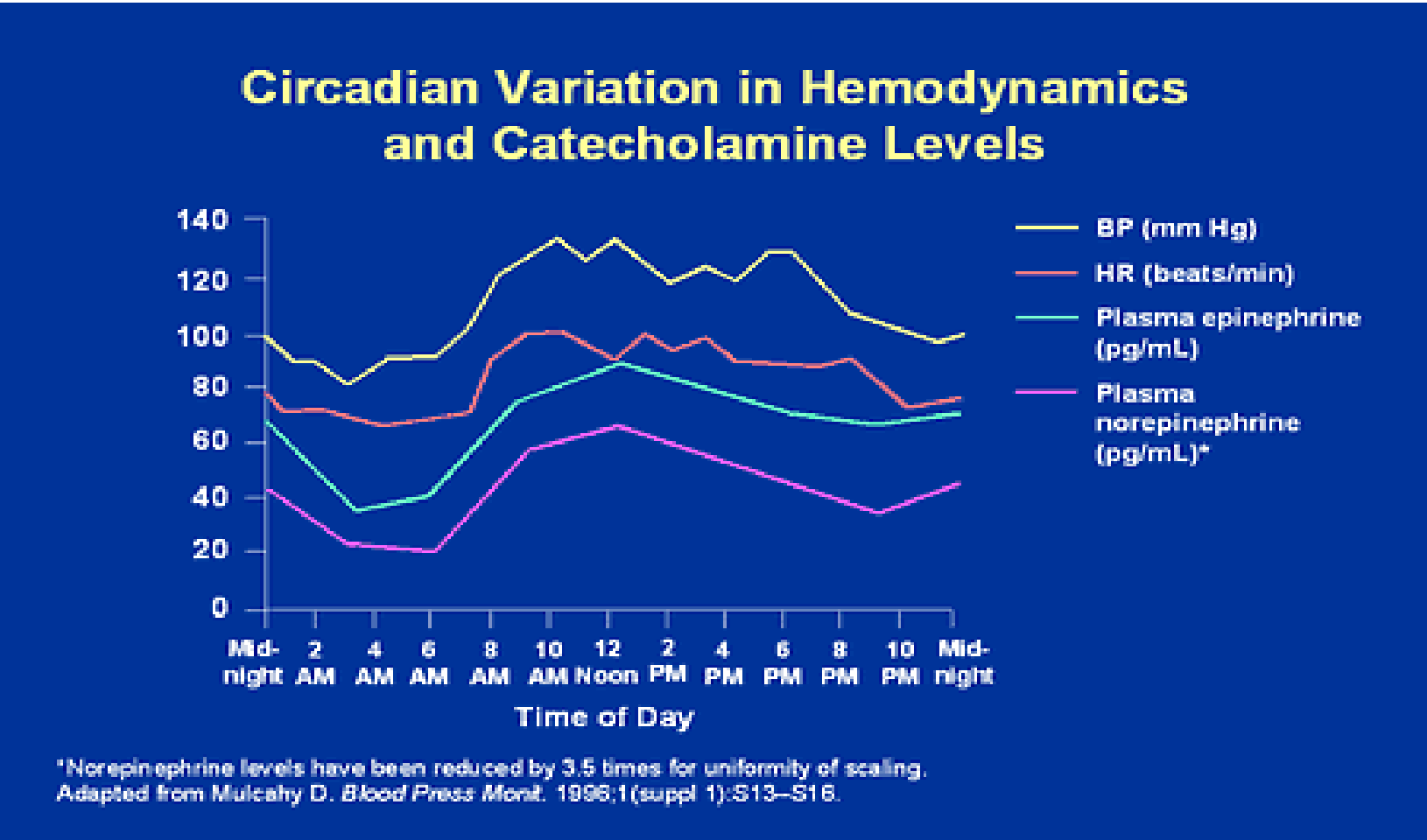
- If the BP is above goal in the office, we have them come back 2 or 3 times
- If it remains elevated, we make the diagnosis of HTN and start with lifestyle changes
- After that fails, we start a diuretic (Are they the same?)
- If that fails, we try in any order ACE, ARB, CCB and add them to maximal tolerated doses following the Guidelines
- There is no systematic workup for secondary causes
- This approach fails in over half the patients (48.3% controlled)

Where do we go wrong?

1. Definition & Measurement

- An office diagnosis of “uncontrolled HTN” is unreliable
 - Uncontrolled HTN = apparent resistant HTN (aHTN) + true resistant HTN (rHTN)
 - Apparent resistant HTN (aHTN) is white coat HTN (a false +), defined as high in office and normal at home. 20-45% of patients are mislabeled with a problem they don't have.
 - rHTN is defined as BP over goal on 3 or more anti-hypertensives (one is a diuretic) treated for more than 1 month.
- Once a day measurement misses-
 - 20% with AM masked HTN (false -) normal in office but high at home in AM, and misses 22% with PM masked HTN, normal in AM but high in PM
- Better- Diurnal home BP monitoring- measure twice a day at the peaks of daily BP (8AM-Noon and 4PM -8PM)

DIURNAL BP VARIATION - PEAK BPs



G. Bakris MD Medscape Education

Where do we go wrong?



2. Diagnosis

- HTN is treated as a singular disease
 - If BP is over goal = a diagnosis of Hypertension
 - High BP is a sign – it is not a diagnosis. Primary HTN (Box 5) means you ruled out the other 50 causes.

Better- The 50+ secondary causes or mechanisms of HTN can be systematically sorted out using a 9-category Renin-Aldosterone (RAS) classification system. Laragh 1972

RAS Class	Low Aldosterone	Normal Aldosterone	High Aldosterone
Low Renin	1. Low renin-low aldosterone HTN	2. Low renin-normal aldosterone HTN	3. Low renin-high aldosterone HTN
Normal Renin	4. Normal renin-low aldosterone HTN	5. Normal renin-normal aldosterone HTN	6. Normal renin-high aldosterone HTN
High Renin	7. High renin-low aldosterone HTN	8. High renin-normal aldosterone HTN	9. High renin-high aldosterone HTN

Where do we go wrong??



3. Control

- **Lifestyle issues**

- Obesity, drugs (oral contraceptives, NSAIDs, alcohol) sedentary lifestyle

- **Compliance / Adherence**

- Patient & Provider compliance to a relatively asymptomatic problem is suboptimal

- **Diagnostic inertia**

- Failure to look for secondary causes (>20% of patients)

- **Therapeutic inertia**

- Failure to increase meds when goals aren't reached or match mechanism of HTN to drugs

- **Fatigue- a large time commitment**

- #2 office visit, > 42 Million visits/year, consumes > 14,000,000 provider hours/year

Ref: Spence JD. Controlling resistant hypertension. Stroke and Vascular Neurology. 2018;0:e000138.

SOLUTION- There is an app for that,



The **A4M** HTN Clinical Decision Support Tool (CDST)

- Educational Material (for Lifestyle issues)
- Home BP monitoring with automated every 10-day follow up (for better definition, measurement, & compliance)
- Diagnostic Matrix (to systematically sort >50 causes of HTN)
- Drug sequencing algorithm (to match the mechanism of HTN, to the mechanism of action of the anti-hypertensive drugs: Aldosterone Antagonists for hyperaldosteronism. Diuretic sequencing for low renin HTN. ACE for high renin HTN. Amiloride for ENaC disease, etc. (Ref: Egan)
- Templated Virtual Visits (to cut management time > 50%)

The CDST improves Access, Quality & Cost



TeAM-HTN PILOT STUDY- CDST RESULTS

- BP control rates improved from:
 - 0% to 58% in resistant HTN (rHTN) & 76% for uHTN.
- Provider Time Management was reduced by
 - 17% for rHTN & 76% for uHTN (45% had aHTN)
- 45% had abnormal renin or aldosterone levels (Triggers workup)
- Home BP monitoring is critical to define true population rates of control
 - 45% mislabeled with HTN by office measurement (White coat HTN)
 - >20% misclassified as normal with once-a-day measurement (Masked HTN)

TeAM-HTN- Technology Assisted Management of HTN. Military Medicine Oct 2020

CDST ADVANTAGES – The Triple AIM



- **Access-** Reduces Provider Management Time
 - Improves Access for other visits (> 7,000,000 million provider hours/year)
 - Increases Billing for those additional services
- **Quality-** Improves the rates of BP control:
 - Makes the diagnosis- giving Better Outcomes - Happier Patients- Better HEDIS Quality Indicators- Less legal liability
- **Cost-**
 - Reduces CV events: saving \$1,048/Hypertensive/year (after 5-10 years)
 - Frees up provider time immediately
 - Potentially lowers drug costs (with progressive single drug elimination)
 - ROI >20:1

ABBREVIATIONS



HTN: Hypertension

aHTN- apparent resistant HTN- White-coat HTN

rHTN- true resistant HTN- uncontrolled on 3 or more meds > 1 month

uHTN- uncontrolled HTN- high BP in the office (aHTN + rHTN)

HEDIS: Healthcare Effectiveness Data & Information Set

ACE: Angiotensin Converting Enz. Inhibitor

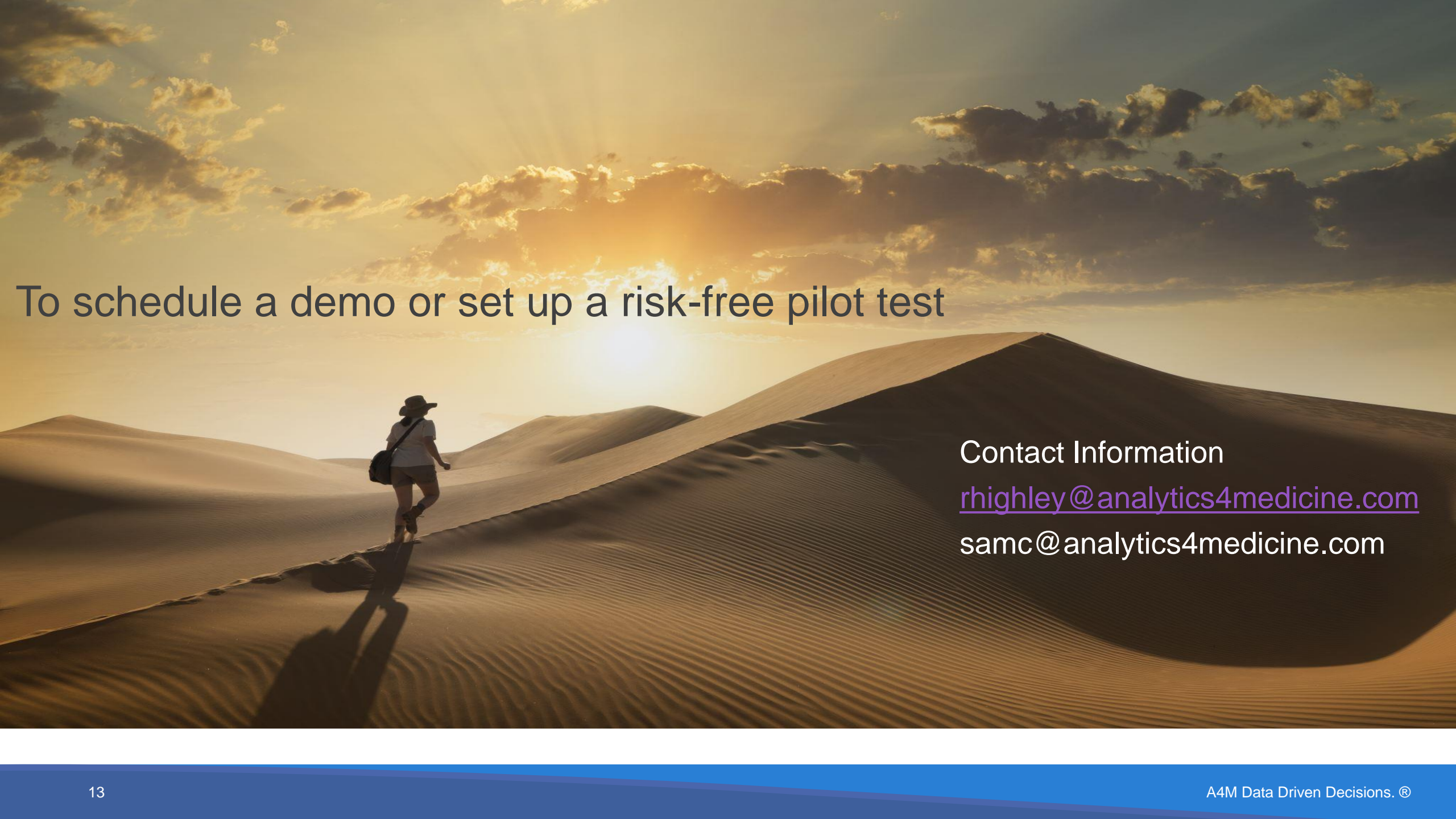
AA: Aldosterone Antagonist

ENaC- Epithelial Sodium Channel

ROI- Return on Investment

References:

1. Spence JD. Controlling resistant hypertension. *Stroke and Vascular Neurology*. 2018;0:e000138. doi: 10.1136/svn-2017-00013
2. Egan BM, Basile JN, Rehman SU, Davis PB, Grob CH, Riehle JF, et. Al. Plasma Renin test-guided drug treatment algorithm for correcting patients with treated but uncontrolled hypertension: a randomized controlled trial. [Am J Hypertension](#). 22(7):792-801. Published online 2009 Apr 16. doi: 10.1038/ajh.2009.63.
3. Siaki L, Lin V, et al. Feasibility of a Clinical Decision Support Tool to Manage Resistant Hypertension: Team-HTN, a Single-arm Pilot Study. *Mil Med*. Usaa255, Oct 3 2020. <https://doi.org/10.1093/milmed/usaa255>



To schedule a demo or set up a risk-free pilot test

Contact Information
rhighley@analytics4medicine.com
samc@analytics4medicine.com