

**HYPERTENSION 2012:  
EFFECTIVE MANAGEMENT IN PATIENTS WITH DIABETES**

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**HTN: DOMINANT CONTRIBUTOR TO GLOBAL MORTALITY**

**Increases RR by 2.0-4.0 fold for:**

- CAD, stroke, HF, PAD
- Renal failure, AF, dementia, ↓ cognition

**Attributable risk for HTN:**

- Stroke → 62%
- CKD → 56%
- HF → 49%
- MI → 25%
- Premature death → 24%

**Aftermath:**

- Shortens lifespan 5y
- \$93.5 billion/y in U.S.

Circulation 2012; 125:e12 | Hum Hypertension 2008; 22:63 | Hypertension 2007; 50:1006

**HTN: KEY CONTRIBUTOR TO DIABETES COMPLICATIONS**

**Framingham Study: DM ⊕ HTN vs DM alone**

	<b>Relative Risk of Complication</b>
<b>Total mortality</b>	↑ 72%
<b>CVD events</b>	↑ 57%

- **HTN → 44% of deaths and 41% of CVD events in DM!**
- ↑ risk of nephropathy/retinopathy/neuropathy 60-100%

Hypertension 2011; 57:891 | Lancet 2012; 380:601

**DIABETIC COMPLICATIONS ATTRIBUTABLE TO HTN**

	<b>% Attributable</b>
Stroke	75%
ESRD	50%
CAD	35%
Retinopathy	35%
Leg amputation	35%

Hypertension 2001; 37:1053 | Pub Health Reports 1987; 102:522

**HTN PREVALENCE: GENERAL vs DM POPULATIONS**

	<b>BP ≥ 140/90</b>	<b>BP ≥ 130/80</b>
<b>General population</b>	<b>30%</b>	---
• Utah	25%	---
• Age ≥ 60y	67%	---
• White	29%	---
• Black	41%	---
• Hispanic	26%	---
<b>Persons with DM</b>	<b>67%</b>	<b>76%</b>

- **HTN is more than twice as common in DM!**

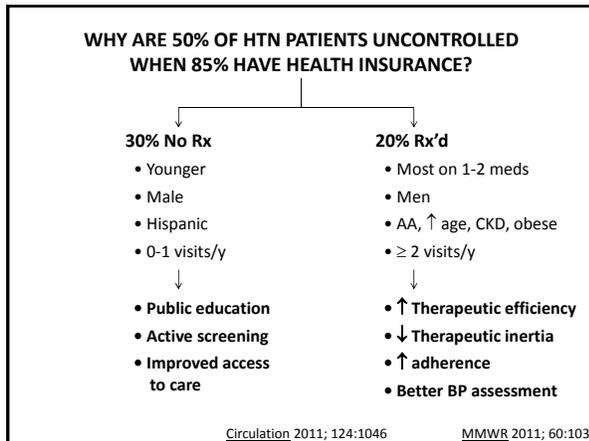
JACC 2012; 60:599 | Diabetes Care 2011; 34:1597 | Am J Med 2009; 122:443  
Utah State Health Department, 2012

**HTN CONTROL: GENERAL vs DM POPULATIONS  
NHANES, 2006-2010**

	<b>BP &lt; 140/90</b>	<b>BP &lt; 130/80</b>
<b>General population</b>	<b>47%</b>	---
• White	52%	---
• Black	43%	---
• Hispanic	30%	---
<b>Persons with DM</b>	---	<b>46%</b>
		(37% age ≥ 60y)
• White	---	49%
• Hispanic	---	49%
• Black	---	41%

- **Canadian DM control rates to < 130/80 = 56%!**

JACC 2012; 60:599 | Can J Card 2012; 28:367 | Diabetes Care 2012; 35:305



### GOAL BP IN DM: HOW LOW TO GO IN 2013?

**“There is no clear optimal target BP in diabetes.”:**

	Recommended Goal BP in Diabetes
JNC-7, 2003	< 130/80
Canada (CHEP), 2012	< 130/80
ADA, 2012	< 130/80
Meta-analysis, 2011:	130-135/70-80
<ul style="list-style-type: none"> <li>• 13 RCTs; 37,736 pts</li> <li>• <u>Circulation</u> 2011; 123:2799</li> </ul>	
Expert opinion, 2012:	< 140/85-90
<ul style="list-style-type: none"> <li>• <u>Lancet</u> 2012; 380:601</li> <li>• <u>Arch Int Med</u> 2012; 172:1304</li> </ul>	

### GOAL BP IN DM: HOW LOW TO GO IN 2013?

**“Newer guidelines for BP goals in patients with DM are likely to suggest a goal of < 140/90 mm Hg based on the totality of evidence.”**

- Reasonable data for diastolic BP < 80 – 3 RCTs
- ACCORD RCT, 2010; 4733 pts, 134 vs 119 mm Hg
  - No ↓ in CVD, MI, death, or microvascular complications
  - 41% ↓ in stroke, but small absolute benefit
    - Limit intensive BP control to high stroke risk subgroups?
- Meta-analyses of RCTs:
  - No ↓ in CVD below 130 mm Hg; 17% ↓ in stroke
- Retrospective analyses of RCTs:
  - Trend to ↑ CVD events below 115 mm Hg
- ↑ costs/↓ adherence: more drugs, visits, monitoring

Lancet 2012; 380:601    Kid International 2012; 81:586    Arch Int Med 2012; 172:1304

### HOW TO IMPROVE HTN CONTROL IN DM?

- Measure office BP accurately
- Detect/document “white-coat” HTN (WCH)
- Improve therapeutic efficiency:
  - Initial low-dose, 2-drug Rx for many
  - Optimize 2 and 3 drug regimens
  - Chlorthalidone as optimal diuretic for many
  - Individualize 4<sup>th</sup> drug ∝ patient characteristics
- Drug titration every 2-4 wks until BP controlled
- Address/improve patient adherence
- Office systems: HTN registries, team approach

### IMPROVE HTN CONTROL: MEASURE BP ACCURATELY!

**“Blood pressure reading does not seem to be done correctly in any clinic...It appears to be so simple that anyone can do it, but they can’t...”**

JAMA 2008; 299:2842

- 8 studies with 8400 patients, 1995-2011:

<b>Routine clinical practice</b>	vs	<b>Research quality</b>
<b>BP measurement</b>		<b>BP measurement</b>

- Accurate BP measurement ↓ BP ≈ 10/5 mm Hg!

Can J Card 2012; 28:341    Hypertension 2010; 55:195

### RESEARCH QUALITY vs ROUTINE OFFICE BP

Study	# of pts	Routine Clinical Practice BP	Research Quality Office BP	Difference
Myers, 1995	147	146/87	140/83	- 6/4
Brown, 2001	611	161/95	152/85	-9/10
Myers, 2009	309	152/87	140/80	-12/5
Graves, 2003	104	152/84	138/74	-14/8
Gustavsen, 2003	420	165/104	156/100	-9/4
Campbell, 2005	107	150/91	139/86	-11/5
Head, 2010	6817	150/89	142/82	-8/7
Burgess, 2011	181	145/85	132/79	-13/6

Accurate measurement ↓ BP by ≈ 10/5 mm Hg

Am J Hypertens 2005; 18:1522    Hypertension 2010; 55:195  
BMJ 2010; 340:1104    JASH 2011; 5:484

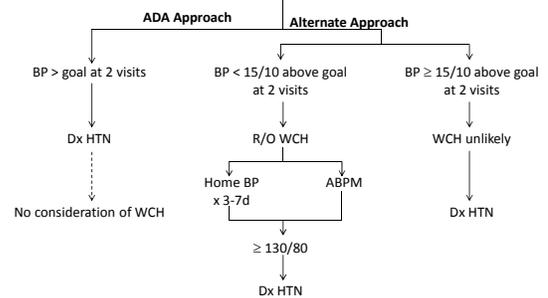


**IMPROVING HTN CONTROL:  
DETECT WHITE-COAT HTN = 20% OF OFFICE HTN**

**Out-of-office BP measurement to definitively R/O WCH:**

- **24-hour ambulatory BP monitor study (ABPM)**
  - Highly useful but less available
- **Standardized home BP monitoring for 3-7 days**
  - Dx of HTN
  - Monitoring/medication adjustment for HTN

**DX OF HTN IN DIABETES: CONTROVERSY**



Diabetes Care 2012; 35(Suppl 1):S11 | Hypertension 2011; 29:236

**HBPM MONITORS**

- **Must be validated: AAMI, BHS, and/or IP protocols**
  - Omron ([www.omronhealthcare.com](http://www.omronhealthcare.com))
  - A&D – Lifesource ([www.andmedical.com](http://www.andmedical.com))
  - MicroLife ([www.microlife.com](http://www.microlife.com))
  - [www.hypertension.ca/devices-endorsed-by-hypertension-canada](http://www.hypertension.ca/devices-endorsed-by-hypertension-canada)
- **Arm cuffs only (unless massive obesity)**
- **Correct cuff size for mid-arm circumference**
  - < 33 cm → regular cuff
  - 33-43 cm → large adult or self-adjusting
  - > 43 cm → wrist cuff (if wrist < 22 cm)

**HBPM MONITORS**

- **Features ∝ cost: \$50-\$110**
  - Average last 3 readings → \$70.00
  - 2-use mode → \$70.00
  - Self-adjusting cuff → \$90.00
  - **Automatic 3 readings ⊕ average** → **\$100.00**
  - AM/PM 8 wk averages → \$100.00
  - Software manager → \$110.00

**HBPM: PRECISE PREPARATION/MEASUREMENT TECHNIQUE**

**Same careful preparation/technique as required in office:**

- **Home BP technique video:**
  - [www.hypertension.ca/hypertension-videos](http://www.hypertension.ca/hypertension-videos)
- **Home BP technique written instructions:**
  - [www.hypertension.ca/measuring-blood-pressure](http://www.hypertension.ca/measuring-blood-pressure)
  - [www.hypertension.ca/chep-resources-and-downloads-dp1](http://www.hypertension.ca/chep-resources-and-downloads-dp1)
  - UUMC/VAMC Home BP Measurement handouts
- **Check technique in the office!**

**HBPM MONITORING PROTOCOLS**

**Designed to correlate with 24h ABPM, CVD outcomes:**

- **Optimal preparation (5 min rest, no talking or TV, etc)**
- **Duplicate/triplicate trough readings 1 min apart 6-9 AM ⊕ 6-9 PM**
  - Average 2/2 or 3/3
  - HBPM cuffs that take 3 readings, average them are useful
- **For 3, preferably 7 days**
  - 12-28 readings required
- **Discard Day 1, average last 2-6 days**
  - Do not consider isolated readings for decisions
- **Communicate mean BP to team: horizontal data recording**
- **Goal home BP:**
  - < 135/85 for DM if goal clinic BP < 140/90
  - < 130/80 for DM if goal clinic BP < 130/80

| Hypertension 2010; 28:226, 259 | Hypertension 2011; 57:1081 | Hum Hypertension 2010; 24:779

Home Blood Pressure Monitoring Data Sheet

Name: \_\_\_\_\_ Date This Sheet Started: \_\_\_\_/\_\_\_\_/\_\_\_\_

Date	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Day 8		Day 9		Day 10	
	AM	PM	AM	PM																
210																				
205																				
200																				
195																				
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50																				

Average BP last 6 days: \_\_\_\_/\_\_\_\_/\_\_\_\_

\* After reading 5 minutes, take your morning BP before 1 minute after before your medications and breakfast. Repeat this same procedure in the evening (6-8PM) before any medications. Do this for either 5 or 7 days as instructed by your clinician.  
 \* On the chart above, record the average AM and PM BP reading for the last six of the seven days. In each column, make an "x" as close as you can to your average systolic (top number) and a diastolic (bottom number) BP, as in the example on the far left side of the chart.  
 \* For patients with diabetes, your goal home BP is generally below 130/80 mm Hg (dotted lines). For all other patients, your goal home BP is below 135/85 mm Hg (solid lines).  
 Modified from University of Michigan Hypertension Center

# HYPERTENSION: THERAPEUTIC ISSUES

## LIFESTYLE MODIFICATION

↓ BP mm Hg

Weight loss/Kg	1/1
Low Na < 2.4 g/d	5/3
DASH Diet	11/5
↑ plant protein, ↑ monosat fat	8/4
ETOH ≤ 2 drinks/d	4/2
Cycling/swimming, 150 min/wk	5/4

- ↓ walking if neuropathy

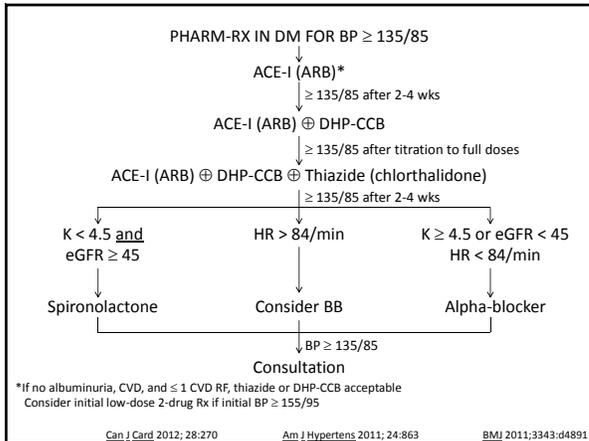
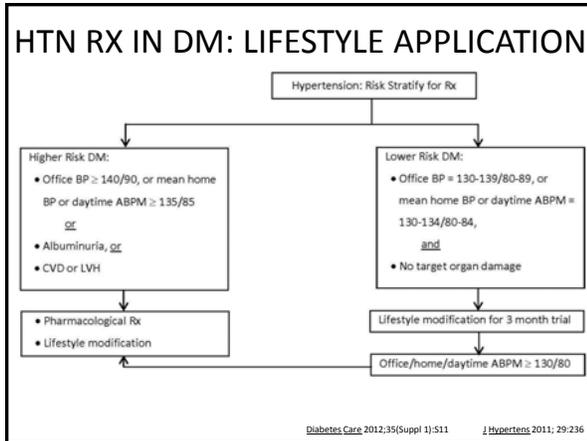
J Hypertens 2006; 24:269    Hypertension 2006; 47:296    Can J Cardiol 2010; 26:249

## LIFESTYLE MODIFICATION EDUCATION TOOLS

"Healthy Eating For Your Blood Pressure"  
[http://www.hypertension.ca/images/2011\\_HealthyEatingforYourBloodPressure\\_EN.pdf](http://www.hypertension.ca/images/2011_HealthyEatingforYourBloodPressure_EN.pdf)

Mayo Clinic abbreviated DASH  
<http://www.mayoclinic.com/health/dash-diet/H100047>

In Spanish:  
<http://www.wellnessproposals.com/nutrition/handouts/dash-diet/DASH-diet-eating-plan-spanish-version.pdf>



## PHARM-RX IN DM: CAVEATS

- **Initial low-dose, 2-drug Rx for many: 90% need  $\geq 2$  drugs**
- **Monitor standing BP q visit to detect orthostatic  $\downarrow$  BP**
- **ACE-I  $\oplus$  DHP-CCB at step 2:**
  - ACCOMPLISH RCT, 2008:  $\downarrow$  CVD/renal events vs ACE-I  $\oplus$  HCTZ
  - Recommended by 2012 Canadian, 2011 UK guidelines
- **Chlorthalidone, 12.5-25 mg/d, as optimal thiazide**
  - $\downarrow$  SBP by 6-9 mm Hg vs HCTZ, 12.5-25 mg/d
- **Spirolactone very effective at step 4, if tolerated**
  - Avoid if  $\uparrow$   $K^+$  risk; monitor  $K^+$  at 1, 4 wks
- **Consider chronoRx:  $\geq 1$  drug hs**

Can J Cardiol 2012; 28:270  
BMJ 2011;3343:d4891

Am J Hypertens 2011; 24:863  
NEJM 2008; 359:2417

Am J Med 2011; 124:896  
Lancet 375:1173

## ALDOSTERONE BLOCKADE AS STEP 4 RX

Spirolactone, 12.5-50 mg/d:

Study	# Patients	$\Delta$ BP
ASCOT, 2007	1411	-22/10
Engback, 2010	344	-26/11
DeSouza, 2010	175	-16/9
Lane, 2007	119	-22/9
Rodilla, 2009	88	-28/12
Nishizaka, 2003	76	-25/12
Mahmud, 2005	69	-28/13
Sharabi, 2005	48	-23/13
Alvarez-Alvarez, 2010 (RCT)	41	-32/11
Ouzan, 2002	23	-24/10

Eplerenone, 50-100 mg/d

Calhoun, 2008	52	-18/8
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## ALDOSTERONE BLOCKADE AS STEP 4 RX

### Clinical use:

- **Contraindicated if eGFR < 30 or  $K^+$   $\geq 5.0$** 
  - Caution if eGFR < 45 or  $K^+$  > 4.5
- **Minimize hyperkalemia risk:**
  - Low  $K^+$  diet; off  $K^+$ , salt substitute, triamterene
- **Dosing:**

	Initial	Final
Spirolactone	12.5-25 mg/d	$\geq 50$ mg/d (if PA)
Eplerenone	50 mg/d	50 mg bid
Amiloride	2.5-5.0 mg/d	10-20 mg/d

- **Adjust dose q 4 wk**
  - $\checkmark$   $K^+$  at 1 and 4 wks
    - DC if  $K^+$  > 5.5;  $\downarrow$  dose 50% if  $K^+$  = 5.0-5.5

J Am Soc Hypertens 2008; 2:462

Curr Hypertens Rep 2008; 10:496

## ADMINISTER $\geq 1$ HTN DRUG AT BEDTIME?

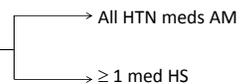
American Diabetes Association Standards of Medical Care – 2012:

“Administer one or more antihypertensive medications at bedtime (A Level of Evidence).”

Diabetes Care 2012; 35(Suppl 1):S11

## CHRONOTHERAPY AND CVD RISK IN T2DM $\oplus$ HTN

RCT: 448 pts, T2DM  $\oplus$  HTN  
5.4y FU

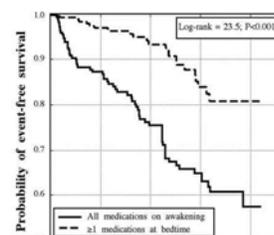


Final mean ABPM:	AM Meds	$\geq 1$ HS Meds	p value
Awake mean BP	127/71	127/71	0.861
Asleep mean BP	122/64	115/60	< 0.001
48-h mean BP	126/68	123/67	0.097

- **Significant 7/4 mm Hg  $\downarrow$  in sleep BP**

Diabetes Care 2011; 34:1270

## CHRONOTHERAPY AND CVD RISK IN T2DM $\oplus$ HTN



No. at risk	0	2	4	6	8
Awakening	232	198	119	76	
Bedtime	216	206	134	77	

- **67% reduction in CVD events with  $\geq 1$  drug hs**
- **Similar results in 661 pts with CKD**

JASN 2011; 22:2313

Diabetes Care 2011; 34:1270

IMPROVE HTN CONTROL:  
OPTIMIZE PATIENT ADHERENCE

- **Detect non-adherence:**
  - **Ask the patient – infrequently accomplished!**
    - “In the last week, how many days did you miss one or more doses of your medication?”
    - “Can you tell me how you are taking your \_\_\_\_?”
    - Structured questionnaires filled out in waiting room
  - **Pharmacy refill rates (Medication Possession Ratio)**
  - **Bring medication bottles to clinic**

[Trials](#) 2010; 11:95

IMPROVING HTN CONTROL:  
MULTI-PRONGED APPROACH TO ADHERENCE

- **Patient education: verbal and written**
  - Inform about total cardiovascular risk
  - Excellent written tools:
    - [www.hypertension.ca/chep-resources-and-downloads-dp1](http://www.hypertension.ca/chep-resources-and-downloads-dp1)
    - Spanish: [www.ash-us.org/For-Patients/ASH-BP-Your-Health-Booklet.aspx](http://www.ash-us.org/For-Patients/ASH-BP-Your-Health-Booklet.aspx)
- **Consider home BP monitoring with feedback**
  - Involve patients in self-management

IMPROVING HTN CONTROL:  
MULTI-PRONGED APPROACH TO ADHERENCE

- Once daily medications
- Fixed-dose combination pills
- Generic and formulary preferred medications
  - ↑ \$10/payment → ↓ adherence 30%
- 90 day rather than 30 day supply
- Ask if concerns about side effects

ANTIHYPERTENSIVE DRUG CLASS AND ADHERENCE

Meta-analysis of 17 studies:

	<b>1y Persistence</b>	<b>HR for Non-Adherence: ARB vs Other</b>
ARBs	65%	---
ACE-Is	58%	1.33
CCBs	52%	1.57
Diuretics	51%	1.95
BBs	28%	2.09

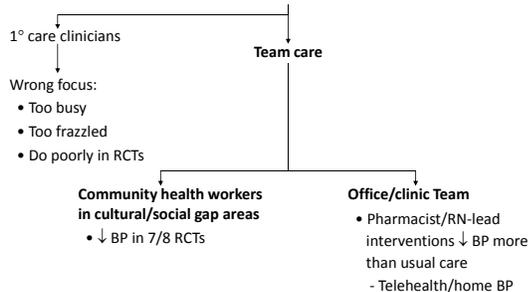
- Adherence poor - ≈ 50% persistent at 1y
- Adherence best with ARBs, ACE-Is – worst with diuretics, BBs

[Circulation](#) 2011; 123:1611

NEED NEW APPROACH TO HTN CONTROL!

Restructuring of health care system:

- Bridge adherence gap
- Reduce clinician inertia



[Circulation](#) 2010; 122:1141  
[Am J Hypertens](#) 2010; 23:949

[BMJ](#) 2010; 341:c3995  
[J Gen Intern med](#) 2010; 25:1090

UTAH CLINICIAN 2012 E-SURVEY:  
HYPERTENSION NEEDS ASSESSMENT

Utah Dept. of Health surveyed Utah clinicians:

- 259 responses (≈ 10%)
- 65% FP, 35% IM
- 1/3 each in practice < 6y, 7-15y, ≥ 16y

≥ 60% “Very comfortable” with:

- Accurate Dx using office/home/24h ABPM (77%)
- Lifestyle education Rx (74%)
- Choosing best 1<sup>st</sup> drug Rx (69%)
- Follow-up with serial office/home BP (70%)

**UTAH CLINICIAN 2012 E-SURVEY:  
HYPERTENSION NEEDS ASSESSMENT**

**“Uncomfortable Managing”:**

- Clinic registry of uncontrolled patients (43%)
- Organizing staff to assist in HTN care (31%)
- Rx of resistant HTN (25%)
- Integrating best practices into office flow (16%)
- Optimal 2/3 drug Rx (11%)
- Optimizing payment for above (36%)

**“Greatest challenges in HTN management”**

- Patient non-adherence (85%)
- Reimbursement for team care (20%)
- Guideline inconsistency (11%)

**UTAH STATE HEALTH DEPT/HEALTH INSIGHT:  
IMPROVING HTN CARE IN UTAH, 2013**

**JNC-8 HTN Guideline Roll-out for 2013:**

- **Education e-modules (with CME)**
  - Dx, Rx, management – each ≈ 20-30 min
  - Webinar format – available for later access
- **Case-study e-modules for Dx, Rx, management**
  - Local presentations by regional champions
  - Available for later e-access (with CME)
- **Hypertension patient registries for clinics**
  - Health Insight assistance
  - QI projects
- **? Telehealth consultation system, UUMC?**