Disclaimer for sharing or use of any of this presentation

If you share or use this presentation, any parts of it, or any of the info in it is used, please ensure you always credit the Ohio Cardiovascular Health Collaborative (Cardi-OH) AND you provide a link to www.cardi-oh.org

Please also send the link to where it is being used to Cardi-OH using the contact email: OCHCinfo@case.edu

CARDI-OH
OHIO CARDIOVASCULAR HEALTH COLLABORATIVE

Keynote Speaker

Lawrence J. Appel, MD, MPH

C. David Molina Professor of Medicine with Joint Appointments in Epidemiology, International Health, and Nursing

Director, Welch Center for Prevention, Epidemiology & Clinical Research

CARDI-OH

OHIO CARDIOVASCULAR HEALTH COLLABORATIVE

Lowering Blood Pressure and Reducing Racial Disparities: Diet Matters!

Lawrence J Appel, MD, MPH
C. David Molina Professor of Medicine with Joint Appointments in Epidemiology, International Health, and Nursing

Director, Welch Center for Prevention, Epidemiology and Clinical Research

June 8, 2018

Disclosures

- UpToDate
- Resolve Cardiovascular Heath Initiative
- Sharecare

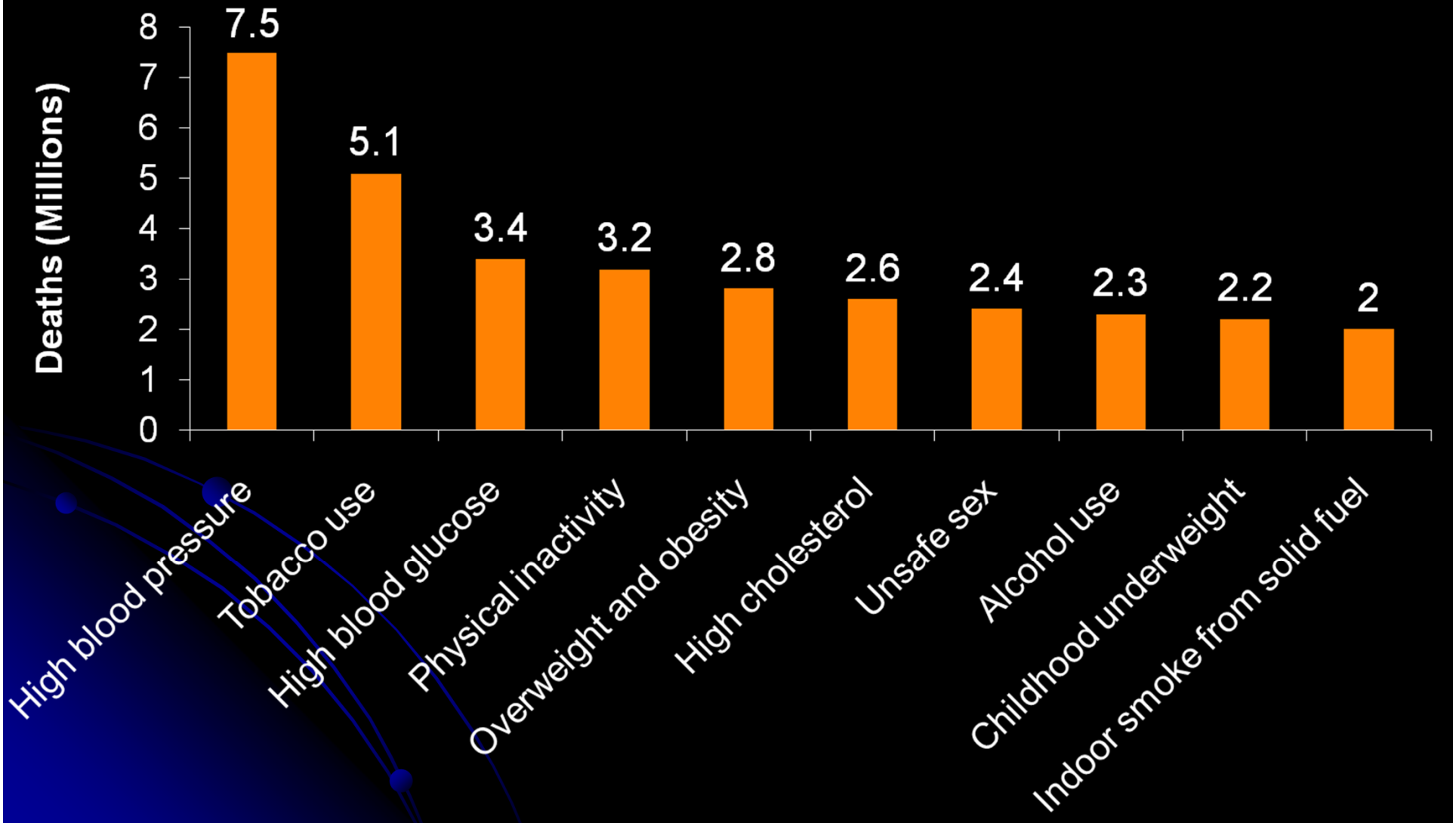
Topics

- Blood Pressure: A Few Basics
- Lifestyle Matters
  - Sodium
  - Potassium
  - DASH Diet
- Reducing Racial Disparities in BP
- Practical Strategies to Implement Lifestyle Change
- Novel Strategies (that Work)

Blood Pressure Classification

Category	Systolic BP		Diastolic BP
Normal	< 120	and	< 80
Elevated BP	120-129	or	80–89
Hypertension	Above Normal Blood Pressure (BP)		
Stage 1	130–139	or	80–89
Stage 2	≥140	or	≥90

Big Picture: *Worldwide, Elevated BP is the Leading Cause of Preventable Deaths*



Global health risks: http://www.who.int/healthinfo/global_burden_disease, WHO, 12/09

Magnitude of the BP Epidemic

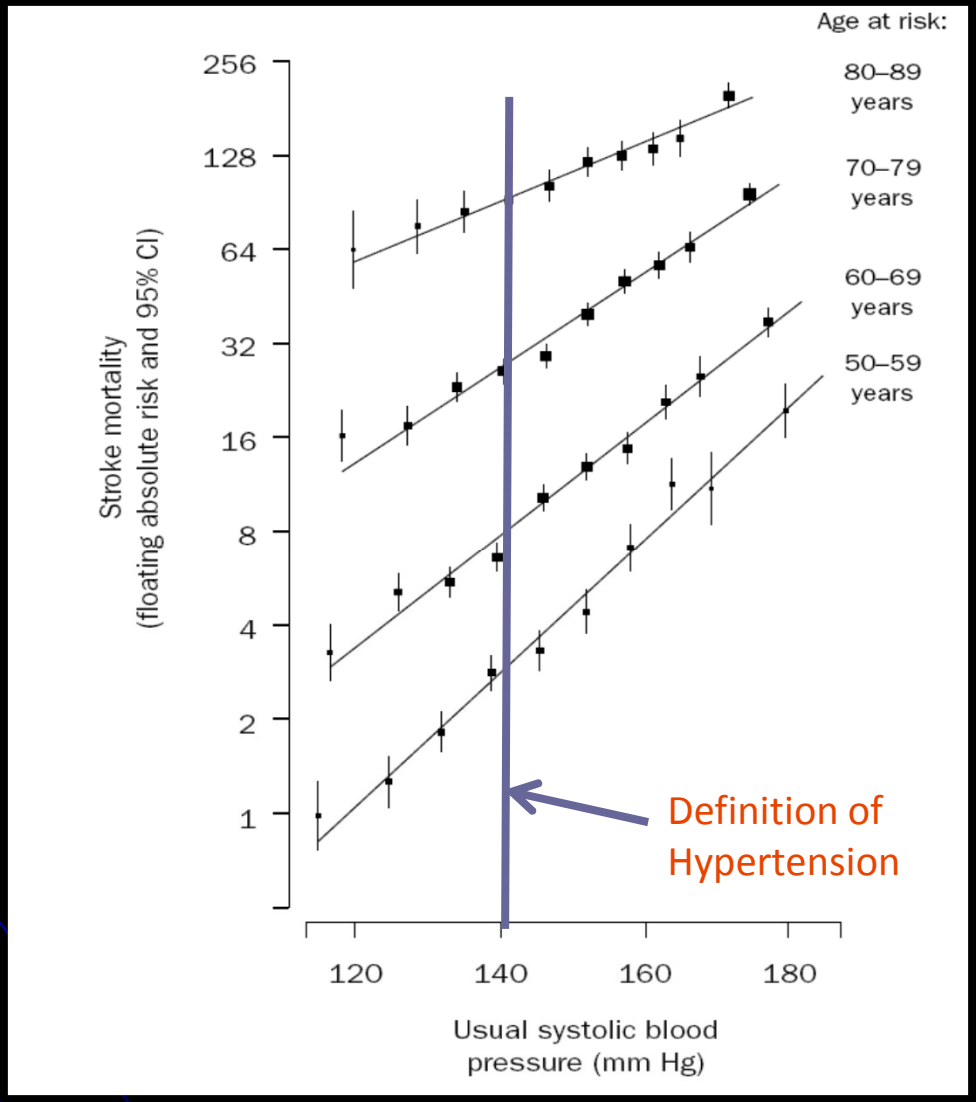
- 54% of strokes and 47% of coronary heart disease events attributed to elevated BP[1]
- 26% of adults worldwide (971 million) have hypertension[2]
- Lifetime risk[3] of developing hypertension is 90%

[1]Lawes CM Lancet 2008;371:1513

[2]Kearney Lancet 2005;305:217

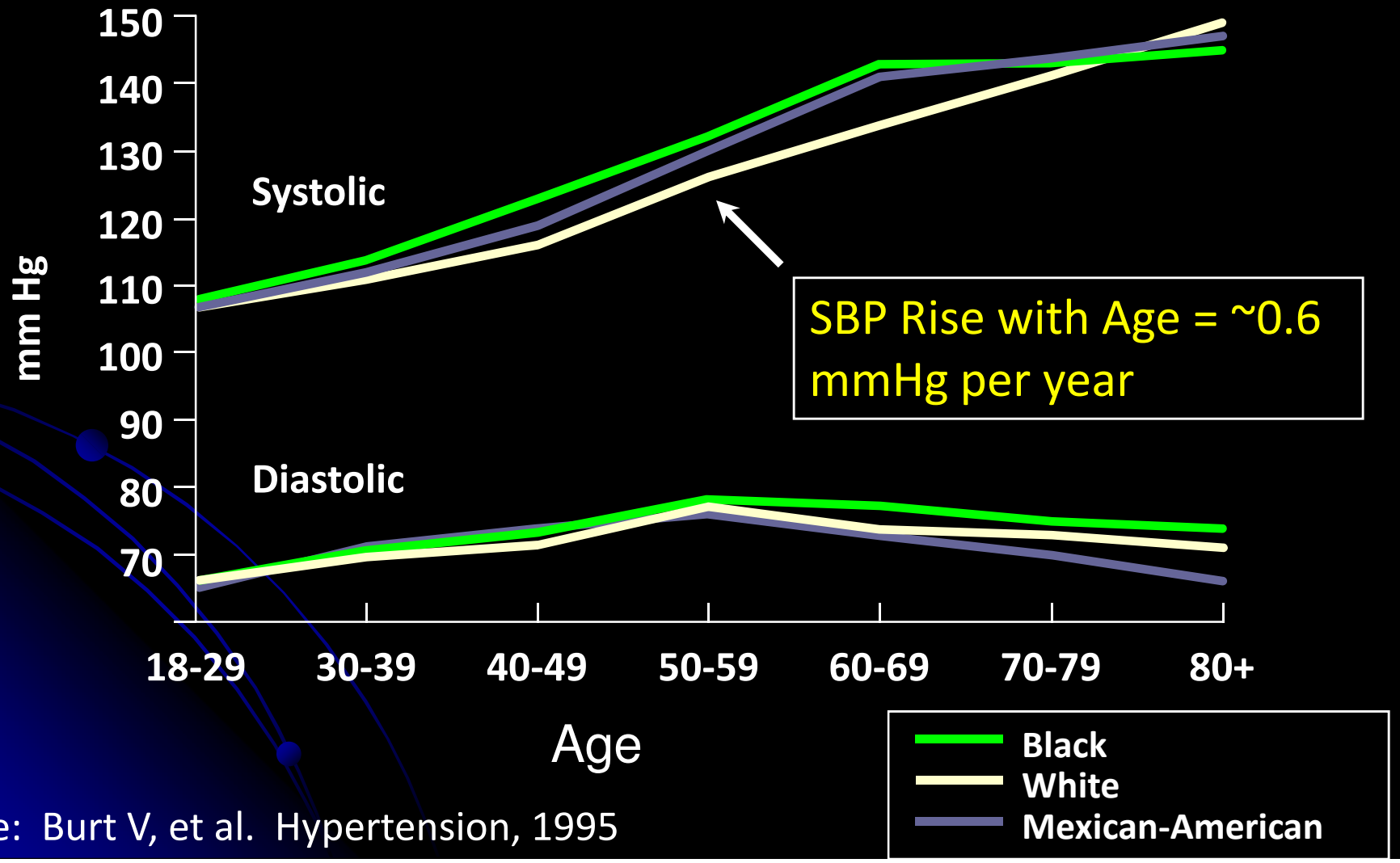
[3]Vasan JAMA 2002; 287:1003

Stroke Mortality by Level of Usual Systolic BP*



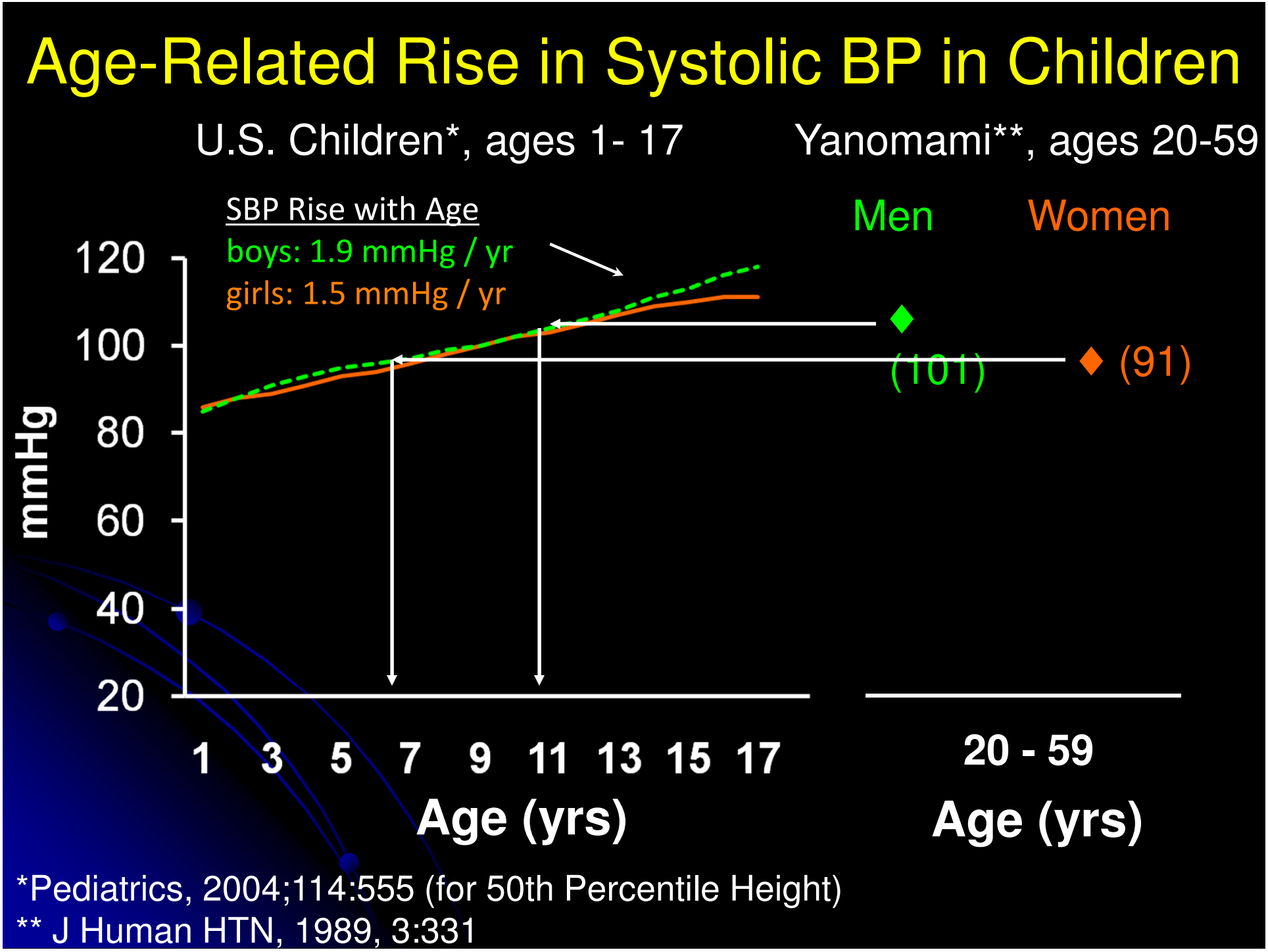
*Source: Prospective Studies Collaboration, Lancet, 2002: Meta-analysis of 61 prospective studies with 2.7m person-yrs, 11.9k deaths

Mean SBP and DBP by Age and Race/Ethnicity for Women, Age 18 Years and Older



Source: Burt V, et al. Hypertension, 1995

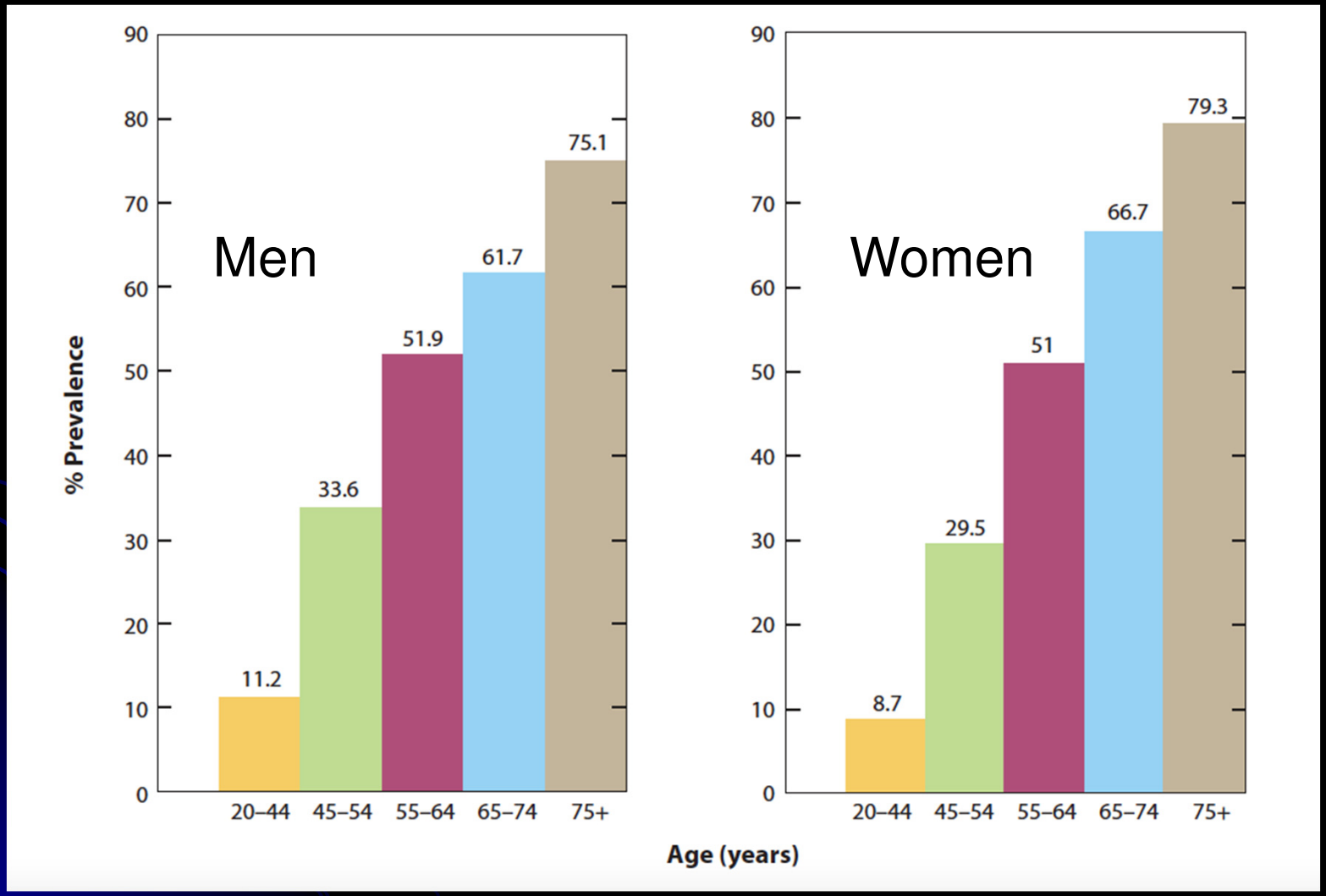
Age-Related Rise in Systolic BP in Children



*Pediatrics, 2004;114:555 (for 50th Percentile Height)

** J Human HTN, 1989, 3:331

Prevalence of Hypertension by Age in U.S. Adults: Age 20 and Older by Age and Sex (NHANES: 2009-12)



Whelton, Ann Rev Public Health 2015;36:109

Dietary Therapies that Effectively Lower Blood Pressure

- Weight loss
- Reduced salt (sodium chloride) intake
- Increased potassium intake
- Certain dietary patterns
  - DASH style diets
  - Vegetarian diets
- Moderation of alcohol intake
- (Partial replacement of carbohydrate with plant protein or monounsaturated fat)

Dietary Therapies – Ineffective or Uncertain Efficacy

- Calcium supplements
- Magnesium supplements
- Increased fiber intake
- Fish oil supplements*

* High doses of fish oil lower BP in hypertensive individuals but at levels that cause side effects,

Sodium Chloride (Salt)

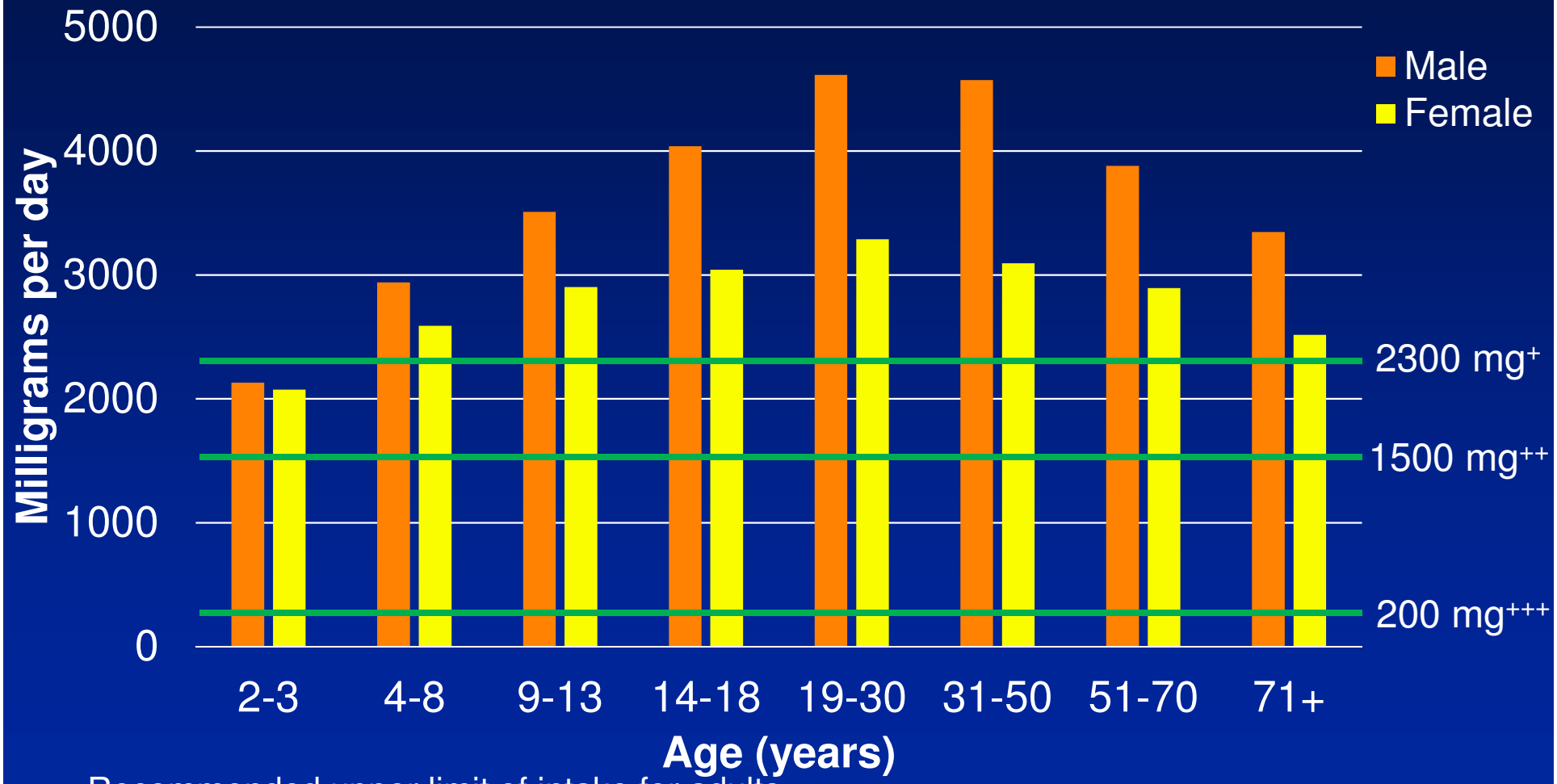
Useful Conversions

	Upper Level (UL)
Sodium (mg)	2,300
Sodium (mmol)	100
Sodium Chloride (g)	5.8

Forms of Sodium

- 90% of sodium consumed as sodium chloride (salt)
- Other forms:
  - sodium bicarbonate
  - sodium in processed foods, such as sodium benzoate and sodium phosphate

Estimated Mean Daily Sodium Intake in US, by Age/Sex Group, 2011-2

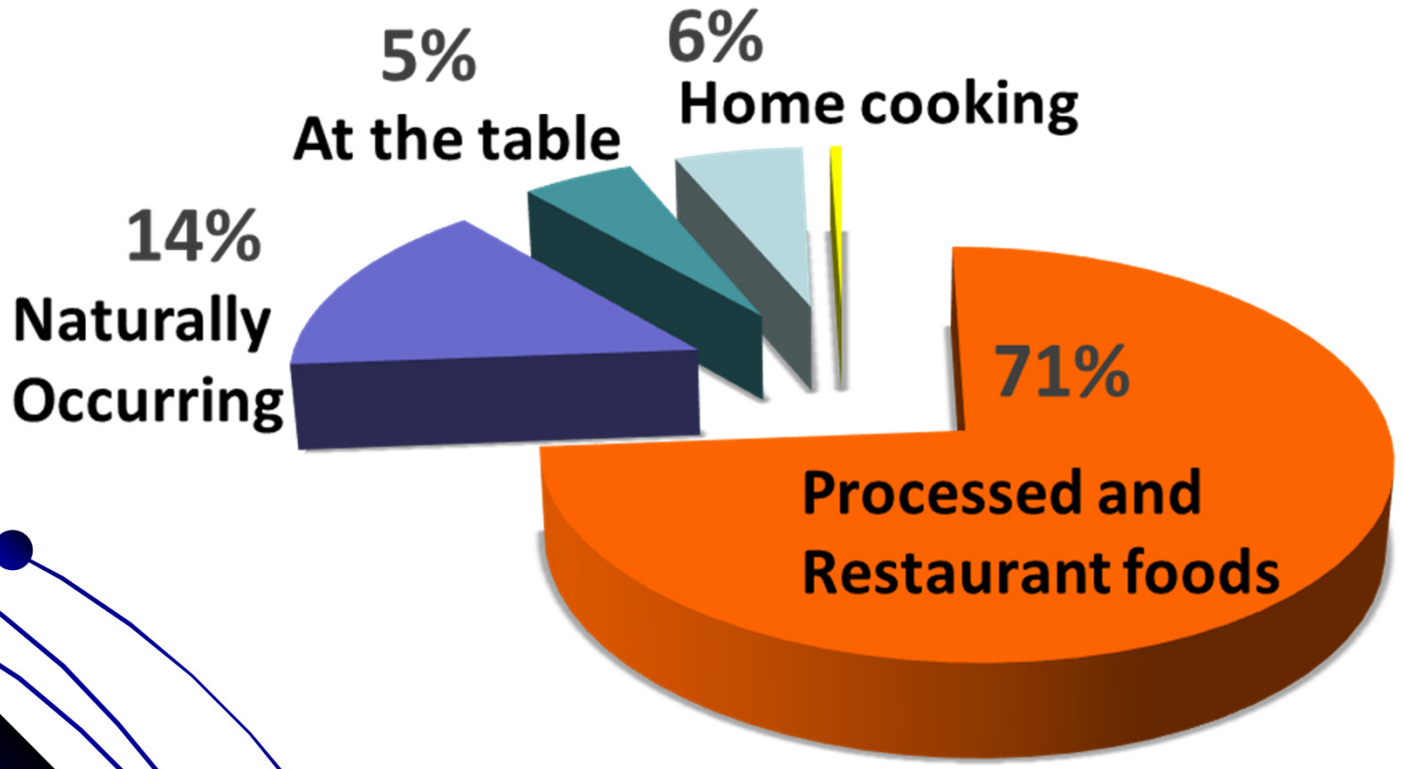


\+ Recommended upper limit of intake for adults

++ Recommended intake for blacks, hypertensives, and middle- and older-aged adults

+++ Needed to replace obligatory losses (Dahl, 1958)

In US, Most Sodium (>70%) Comes from Processed and Restaurant Food



Harnack LJ, et al. Sources of Sodium in US Adults from 3 Geographic Regions. Circulation. 2017;135:1775-1783.

Measurement of Na Intake

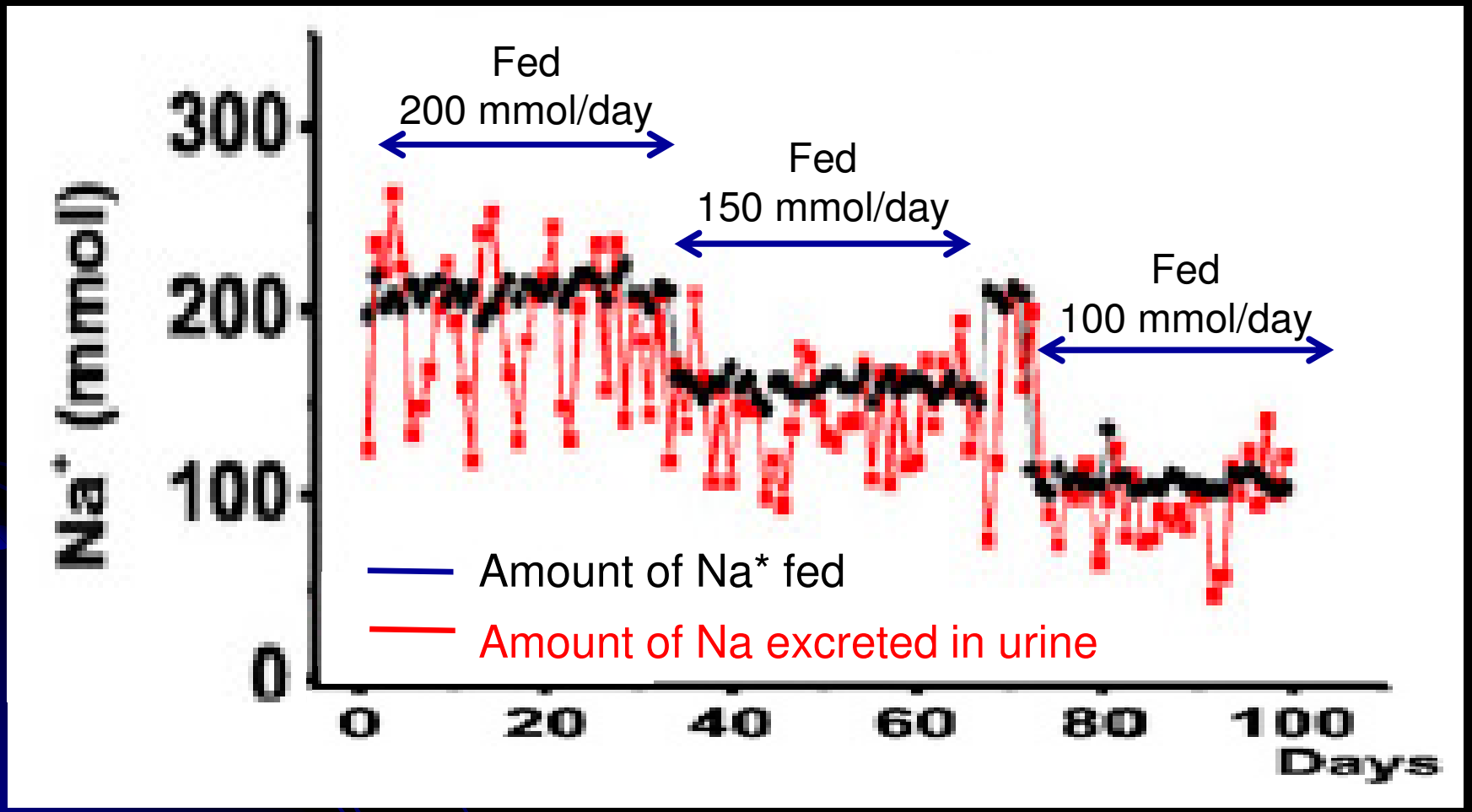
Optimal

- Multiple, *high quality* 24 hour urine collections

Suboptimal

- Single 24 hour urine collected with limited or no attention to quality control
- Spot, overnight or timed urines
- 24 hour dietary recalls
- Food frequency questionnaire

Extremely High Variation in Urinary Na Excretion, even on a Constant Intake, in a Cosmonaut Related to Physiologic Variation

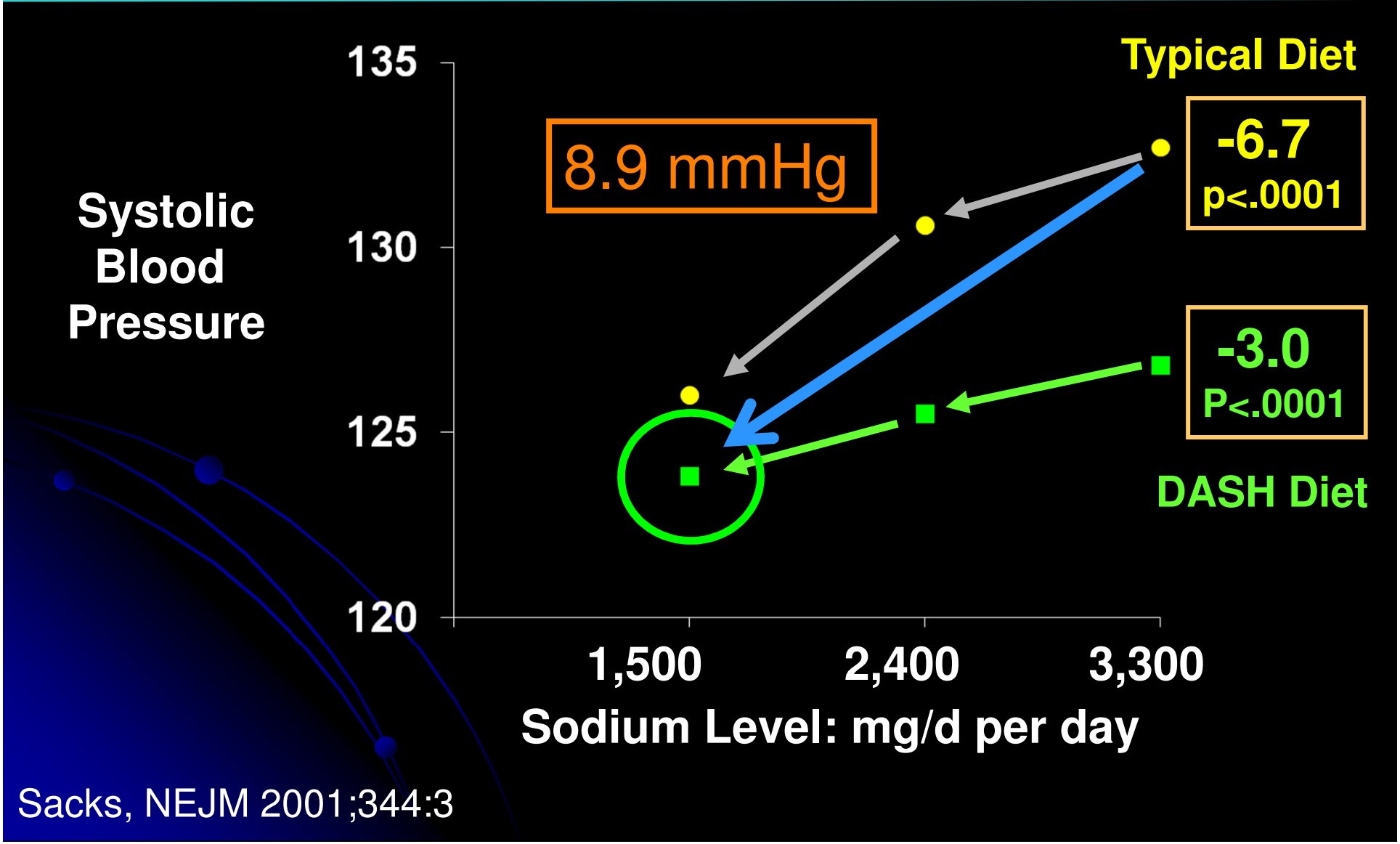


Rakova, Cell Metabolism, 2013;17;125–131

Sodium Reduction: Potential BP-Related and BP-Independent Effects

	BP-Related	BP-Independent
CVD	X	X
Stroke	X	X
Left Ventricular Hypertrophy	X	X
Kidney Disease Progression	X	X
Kidney Stones		X
Osteoporosis		X
Gastric Cancer		X

As Sodium Intake Is Reduced, So is Blood Pressure



Sacks, NEJM 2001;344:3

As Sodium Intake Is Reduced, So is Blood Pressure

Optimal diet approach to lower BP combines sodium reduction and improved diet

Sacks, NEJM 2001;344:3

Estimated BP Reductions from Lowering Sodium Intake

	Children[1]	Non-HTN[2]	HTN[2]	Resistant HTN[3]
SBP (mmHg)	-1.2	-2.0	-5.0	-22.7
DBP (mmHg)	-1.3	-1.0	-2.7	-9.1
Na (mg/d) Reduction	n/a	1,700	1,800	2,300

[1]He,HTN 2006;48:861 [2]Cochrane Review, 2006; [3]Pimenta, HTN 2009;54:475

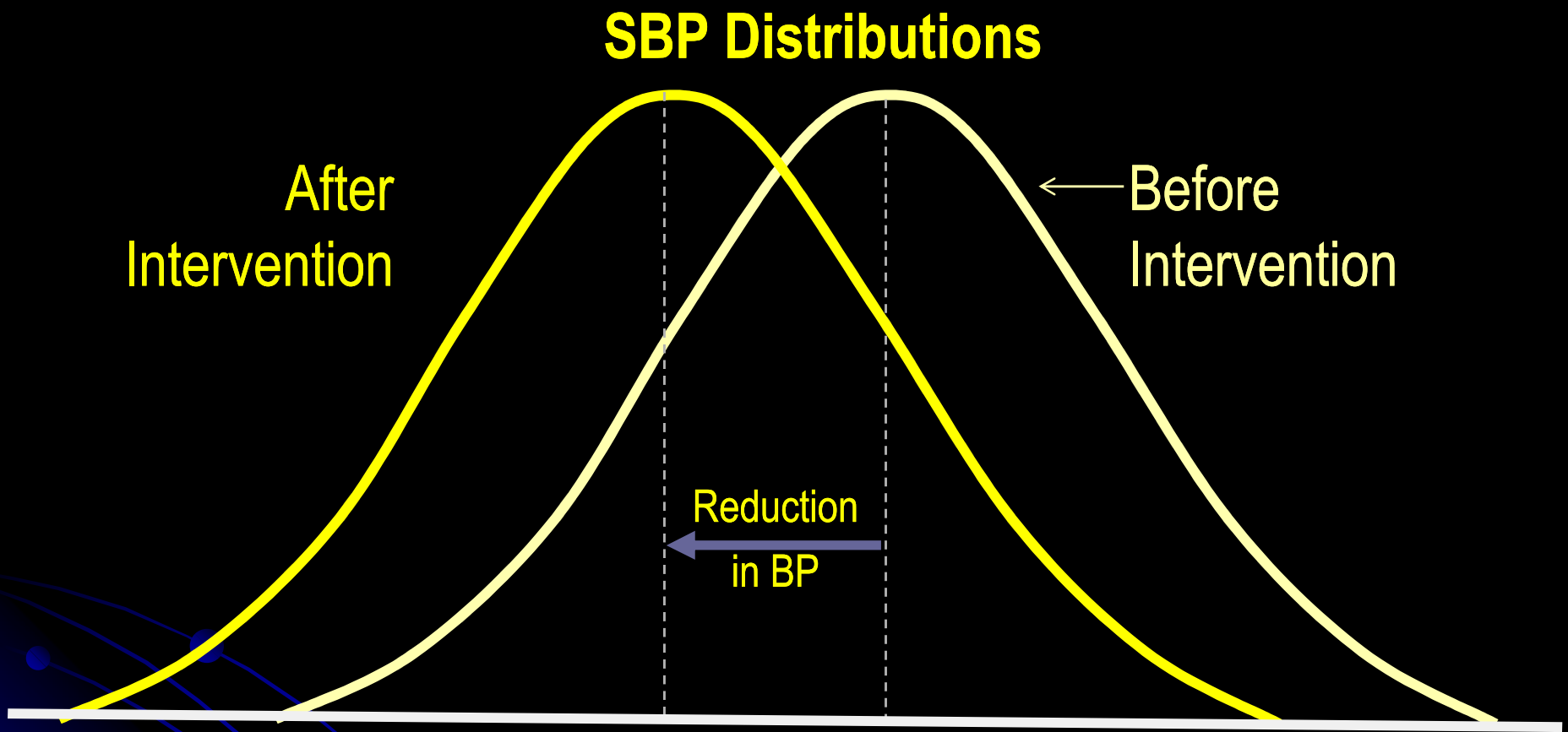
Salt Sensitivity

- Possible to identify ‘groups’ that have greater response to sodium reduction, BUT
  - Tremendous variability within group
  - Impossible to identify ‘salt sensitive’ individuals
- Irrelevant as a public health concept given the vast scope of the blood pressure and cardiovascular disease epidemics

Factors Associated with Increased Salt Sensitivity

- Fixed factors
  - African-Americans
  - Middle and older-aged persons
  - Genetic Factors
  - Individuals with Hypertension
- Modifiable factors
  - Low potassium intake
  - Poor quality diet

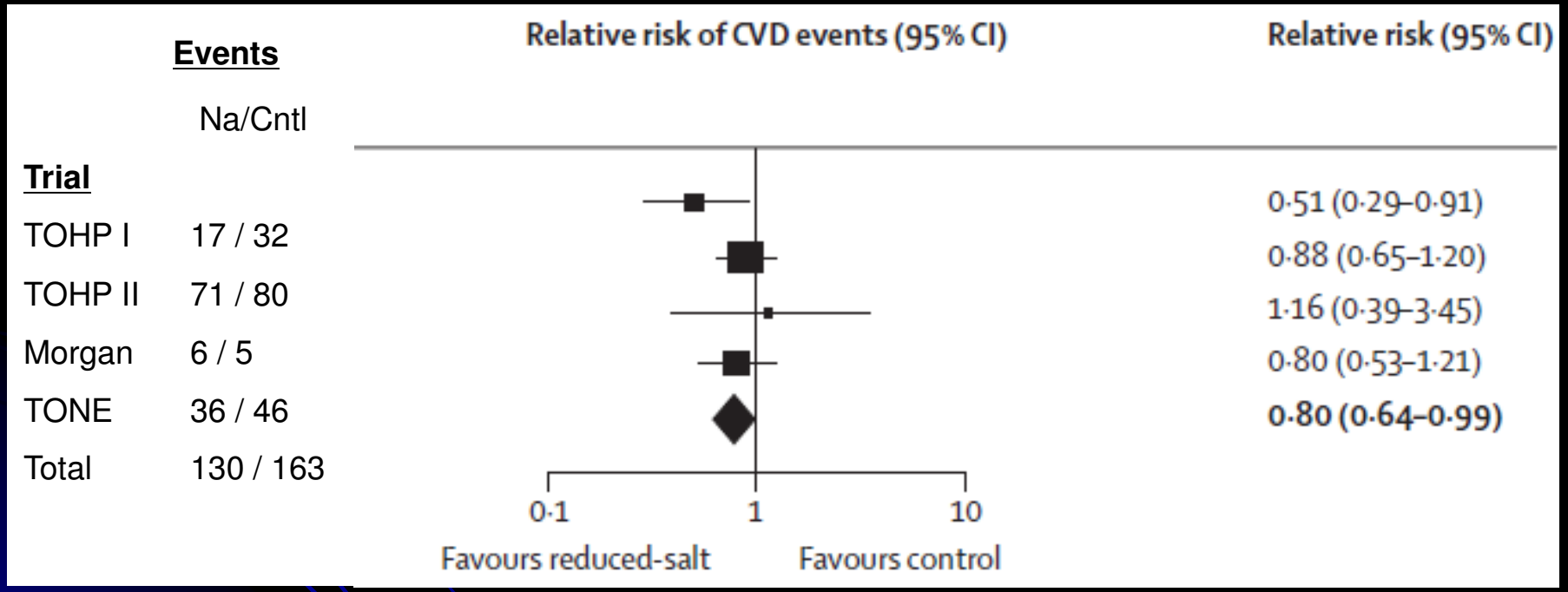
Population-Based Strategy



Reduction in SBP mmHg	% Reduction in Mortality Stroke	CHD	Total
2	-6	-4	-3
3	-8	-5	-4
5	-14	-9	-7

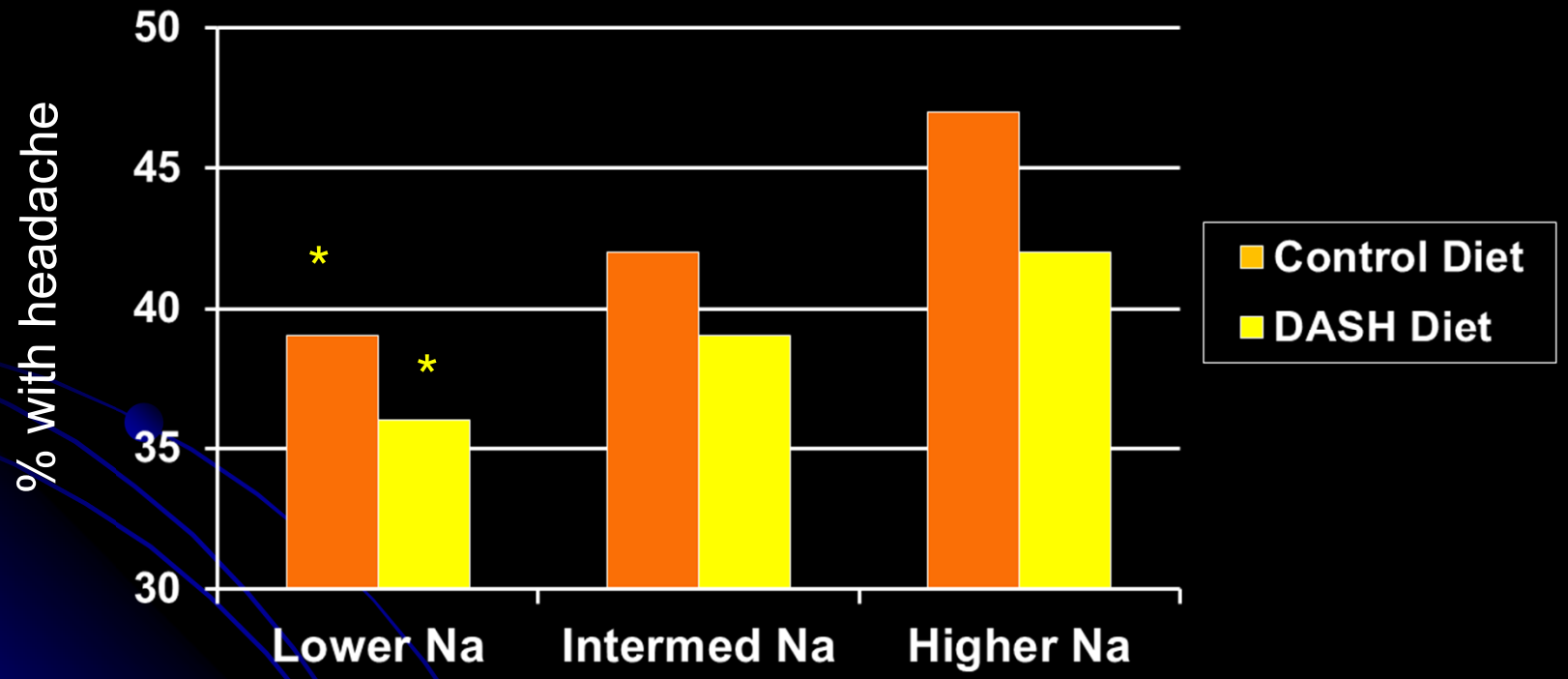
Stamler R. *Hypertension* 1991;17:I-16–I-20.

Sodium Reduction Lowers CVD Risk: Meta-Analysis of Trials



He FJ, MacGregor GA. *Lancet*. 2011;378:380–382

As Sodium Intake Rises, so Does the Risk of Headaches



**** p<0.05, lower compared to higher sodium intake***

Amer et al, BMJ Open 2014:4:e006671

Dietary

Approaches to

Stop

Hypertension

The DASH Dietary Pattern

Emphasizes:

Fruits, Vegetables, Low-fat Dairy Foods

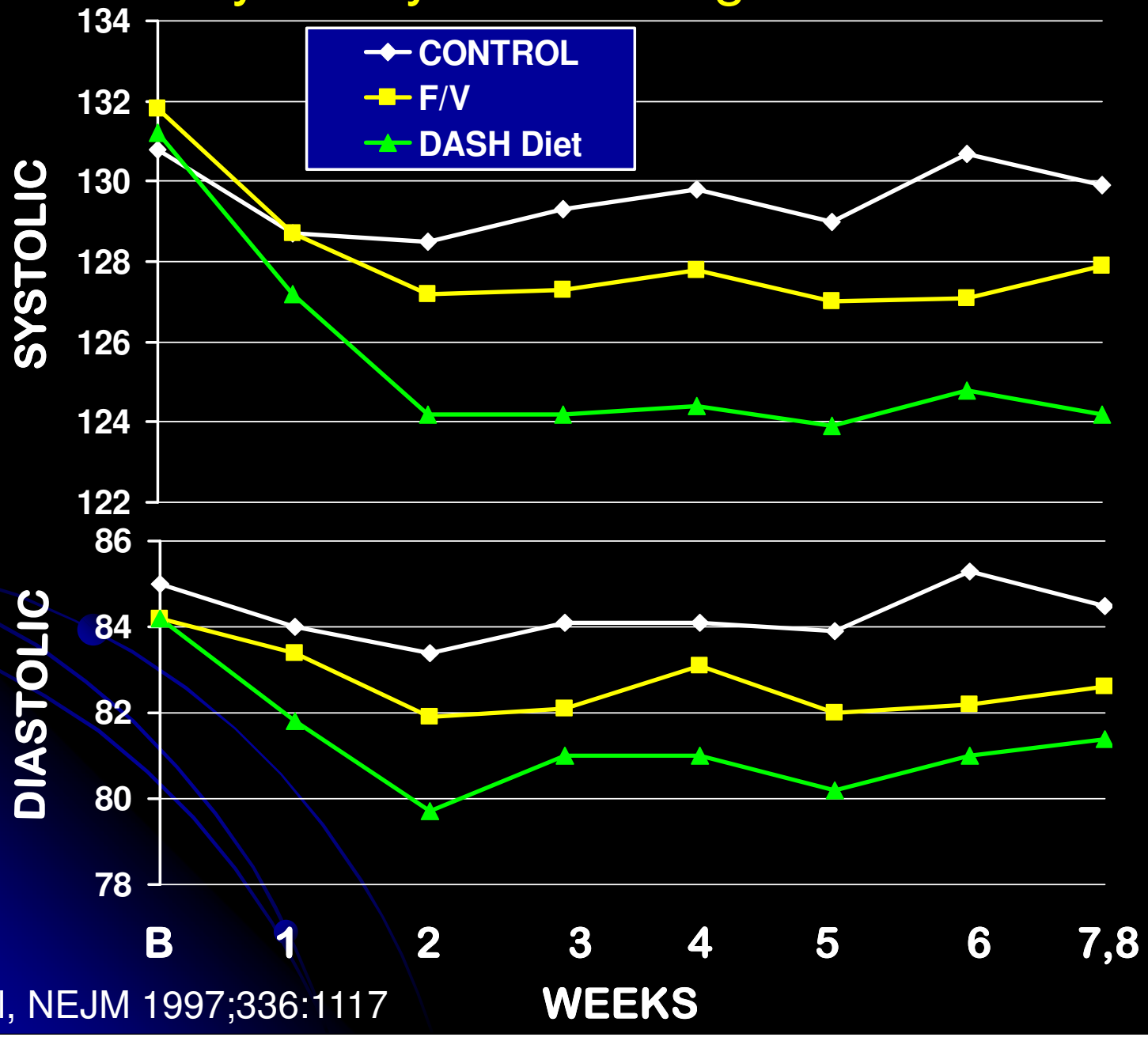
Includes:

Whole Grains, Nuts, Poultry, Fish

Reduced in:

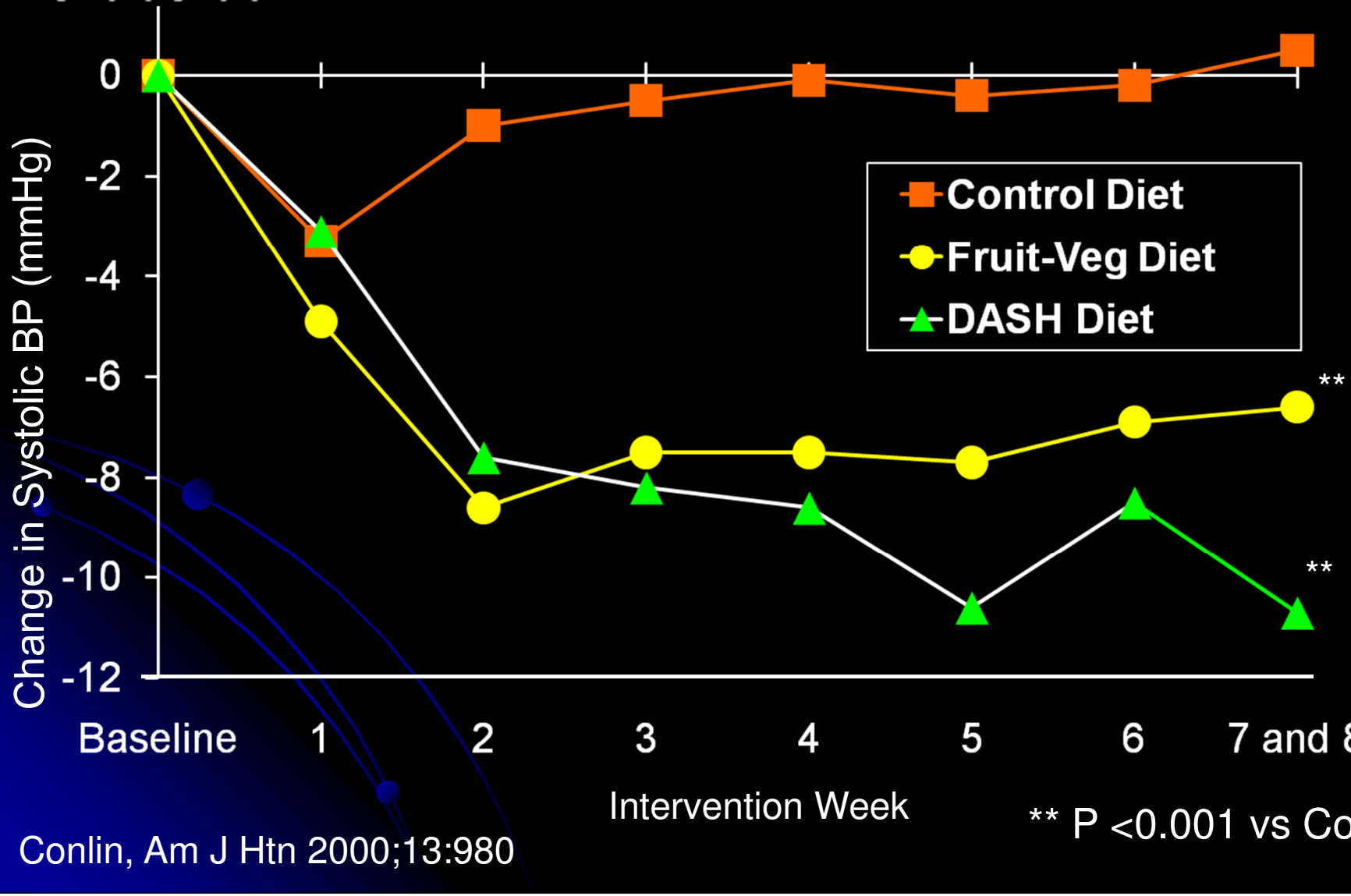
Saturated Fat, Red Meat, Sweets,
Sugar-sweetened Beverages

Weekly BP by Diet During Intervention Feeding



Appel, NEJM 1997;336:1117

Effects of DASH Diet On Systolic BP Over Time in Hypertensive Participants



** P <0.001 vs Control

Conlin, Am J Htn 2000;13:980

Why the Fuss Over Sodium?

Arguments Against Sodium Reduction

- Clinical trial of sodium reduction with hard clinical outcomes is needed
- Only ‘salt sensitive’ persons should reduce their salt intake
- Sodium reduction might be harmful

Argument
F

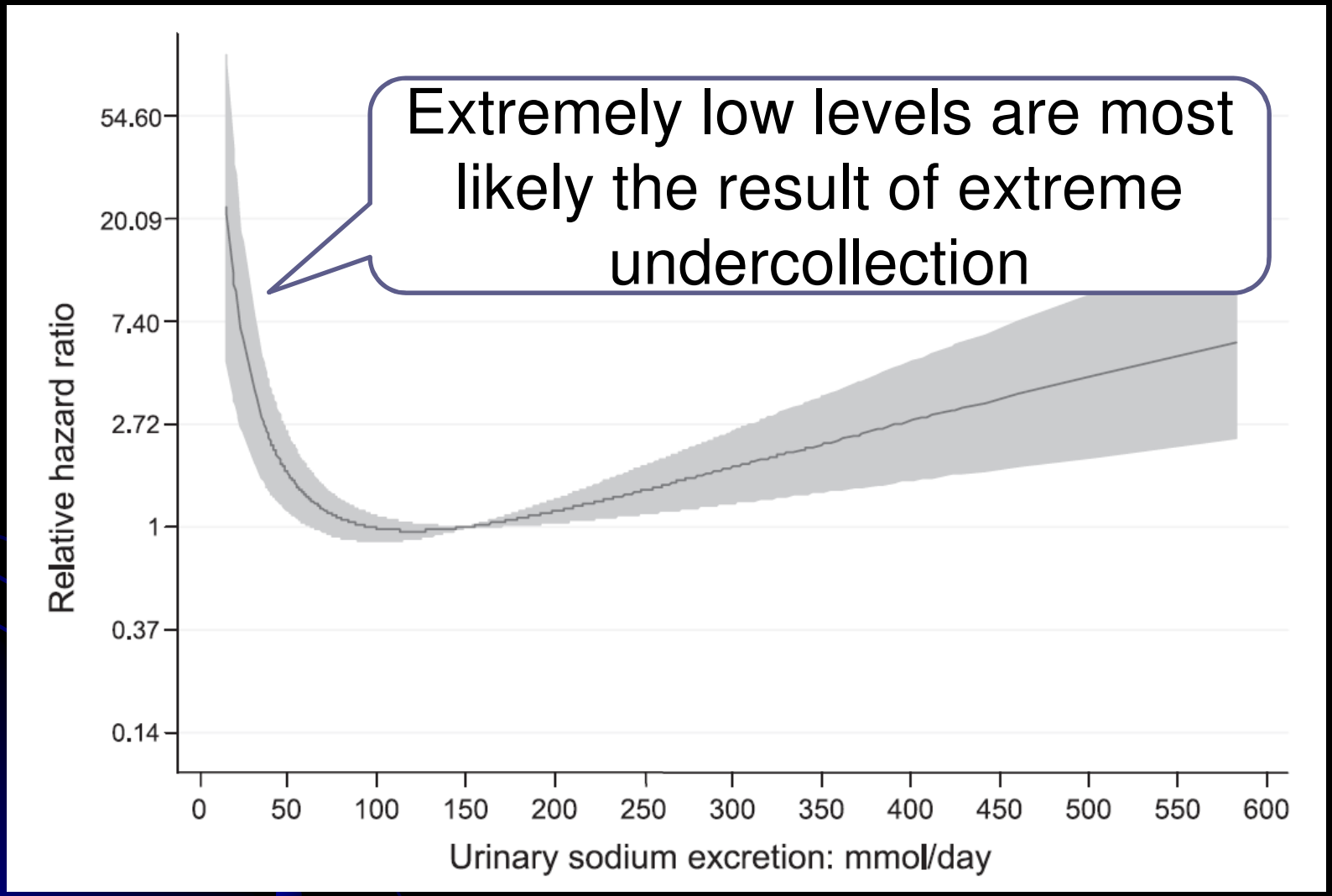
- Clinical trial of sodium reduction with hard clinica
- Only "salt s reduce thei
- Sodium reduction might be harmful

Such trials are impossible because of logistical, financial and ethical considerations.

No test available. Irrelevant given the massive scope of the blood pressure epidemic.

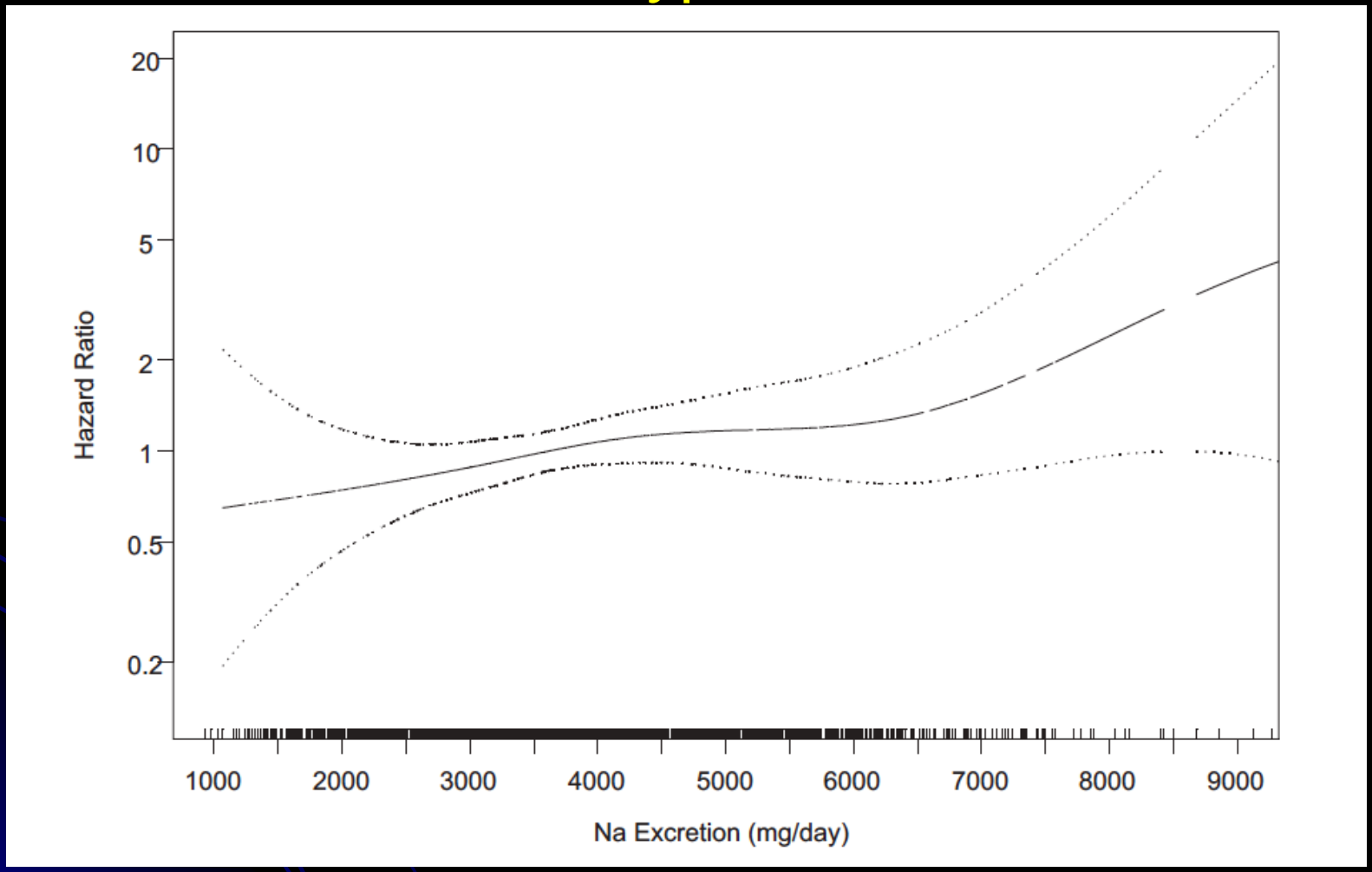
Extremely unlikely: 1) major methodological limitations of cohort studies + 2) over-interpretation of biomarkers

J-Shaped Relationship of Total Mortality with Urine Sodium Excretion in Patients with Type 1 Diabetes



Thomas, Diabetes Care 2011: 861-6

Direct, Progressive Relationship of CVD with Urinary Sodium Excretion* in 2,275 Individuals with Prehypertension



Cook, Circ 2014:129:981

*Based on 24 hr urine collections (median = 5)

Potassium

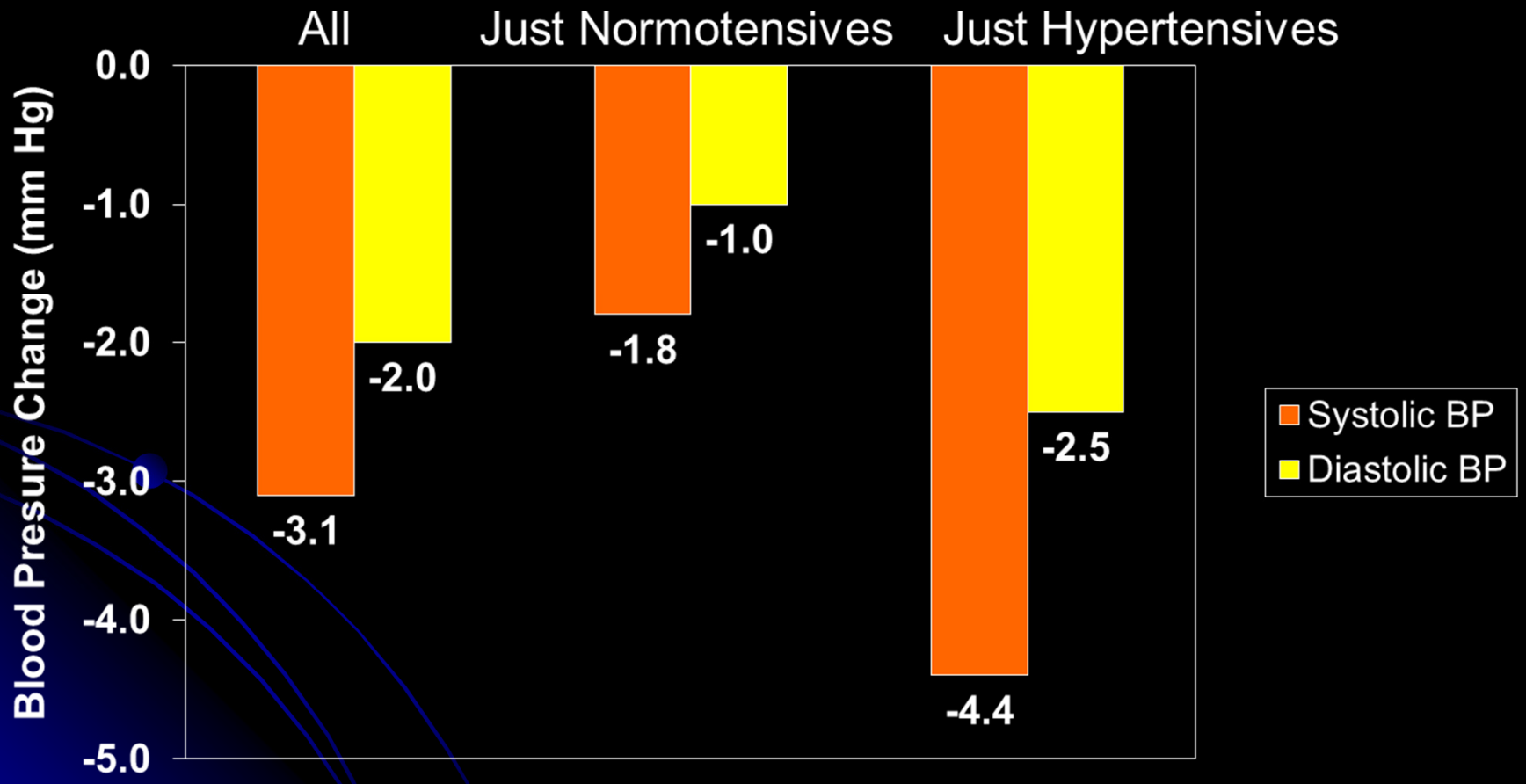
Severe Deficiency of Potassium

- Characterized by hypokalemia
  - a serum potassium concentration < 3.5 mmol/L
- Consequences of hypokalemia
  - cardiac arrhythmias
  - muscle weakness
  - glucose intolerance

Moderate Deficiency of Potassium

- Occurs without hypokalemia
- Adverse consequences of moderate deficiency:
  - increased blood pressure
  - increased salt sensitivity
  - increased risk of kidney stones
  - increased bone turnover

Meta-analysis of K supplementation and BP

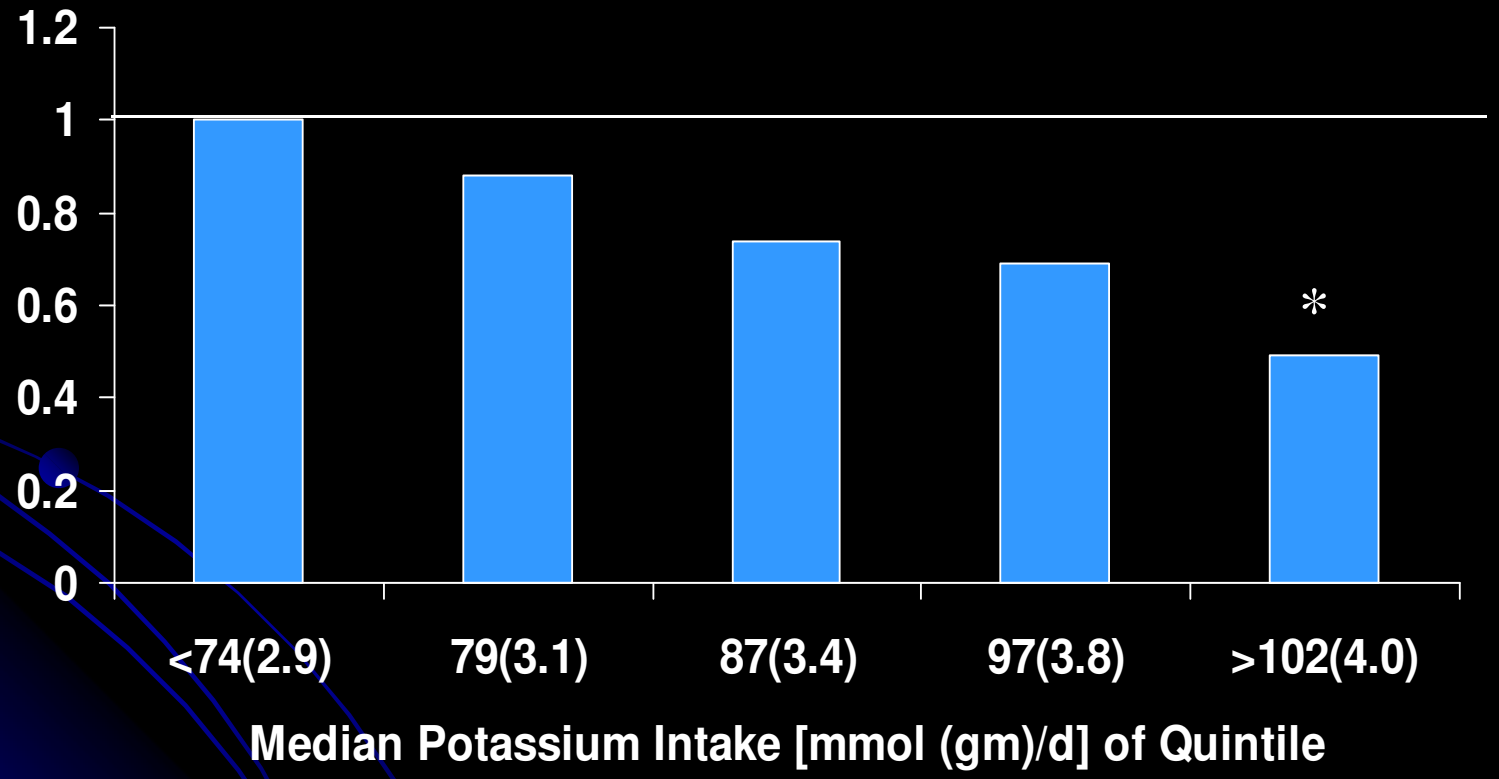


Whelton et al (JAMA, 1997)

Anion Matters

- Most K supplement trials have used potassium chloride (KCl)
- K in fruits/vegetables comes with bicarbonate and/or base precursor (e.g. citrate), not chloride

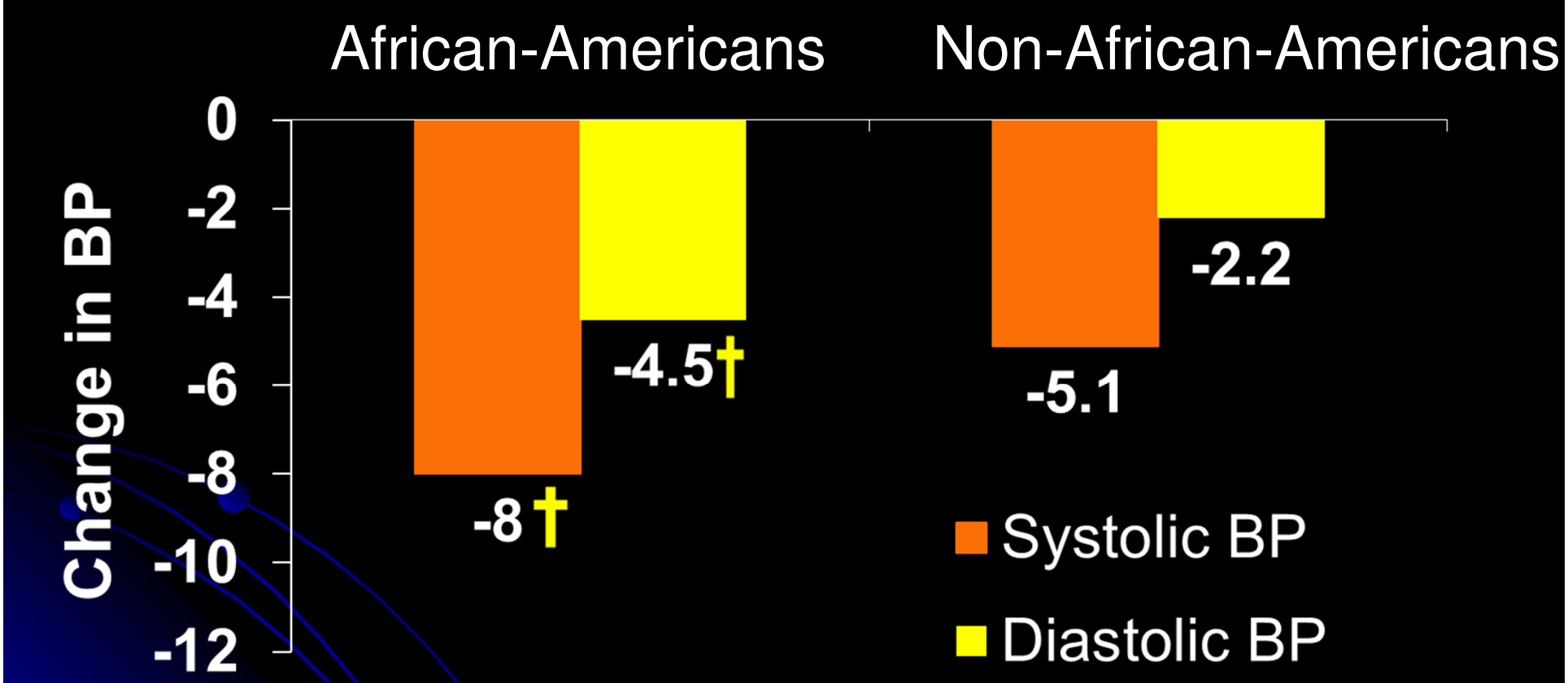
Relative Risk of Kidney Stones by Quintile of Potassium Intake in 45,619 Men (Health Professionals Follow-up Study, Curhan, 1993)



* P-trend < 0.001

Opportunities to Reduce Racial Disparities in BP through Dietary Changes

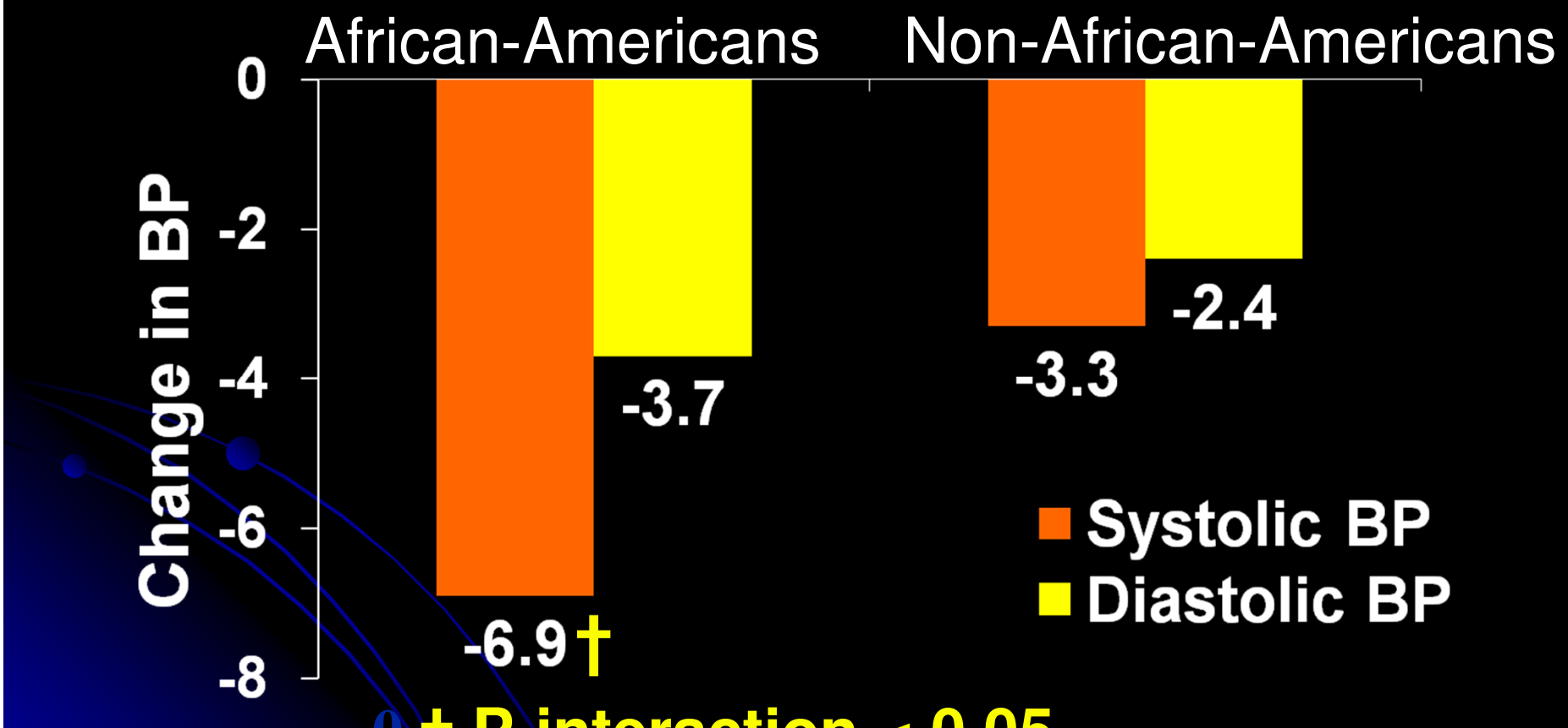
Reduced Sodium Intake Has Greater BP Effects in African-Americans



0 † P-interaction < 0.05

Vollmer, Ann Int Med 2001;135:1019

DASH Diet Has Greater BP Effects in African-Americans



Svetkey, Arch Int Med 1999; 159:285

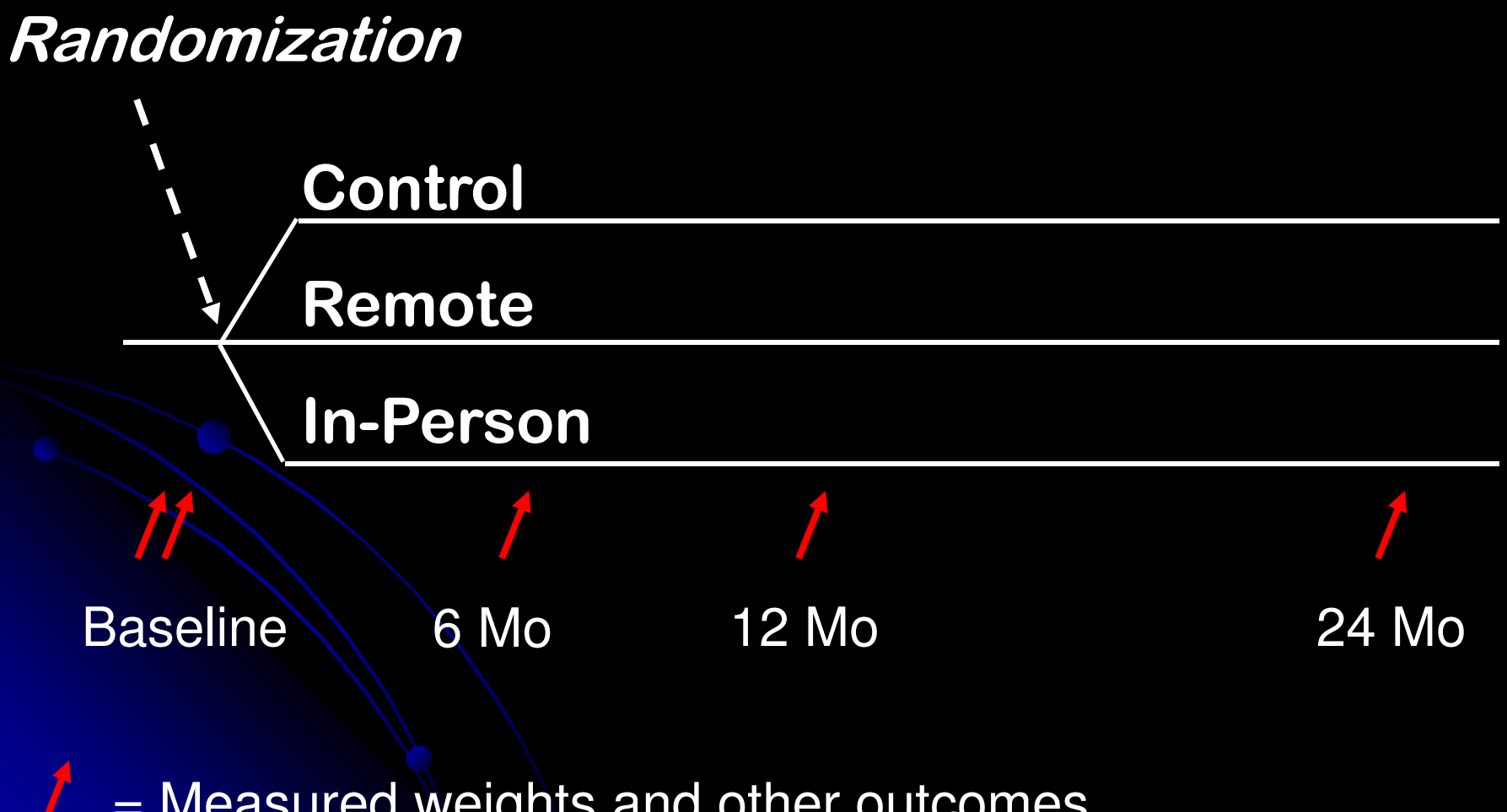
Strategies to Implement Lifestyle Modification in the Clinic Setting

Barriers to Implementation

- Barriers in the clinic
  - Lack of reimbursement for paraprofessional services (dietitians, health educators)
  - Inadequate physician training
  - Time pressure (multiple medical problems, limited time)
  - Measurement difficulties (sodium, diet, exercise)
- Societal and cultural barriers
  - Few options for routine physical activity
  - Massive addition of salt to foods
  - Cheap calories, heavily promoted

JOHNS HOPKINS POWER TRIAL

Design



= Measured weights and other outcomes

JOHNS HOPKINS POWER TRIAL

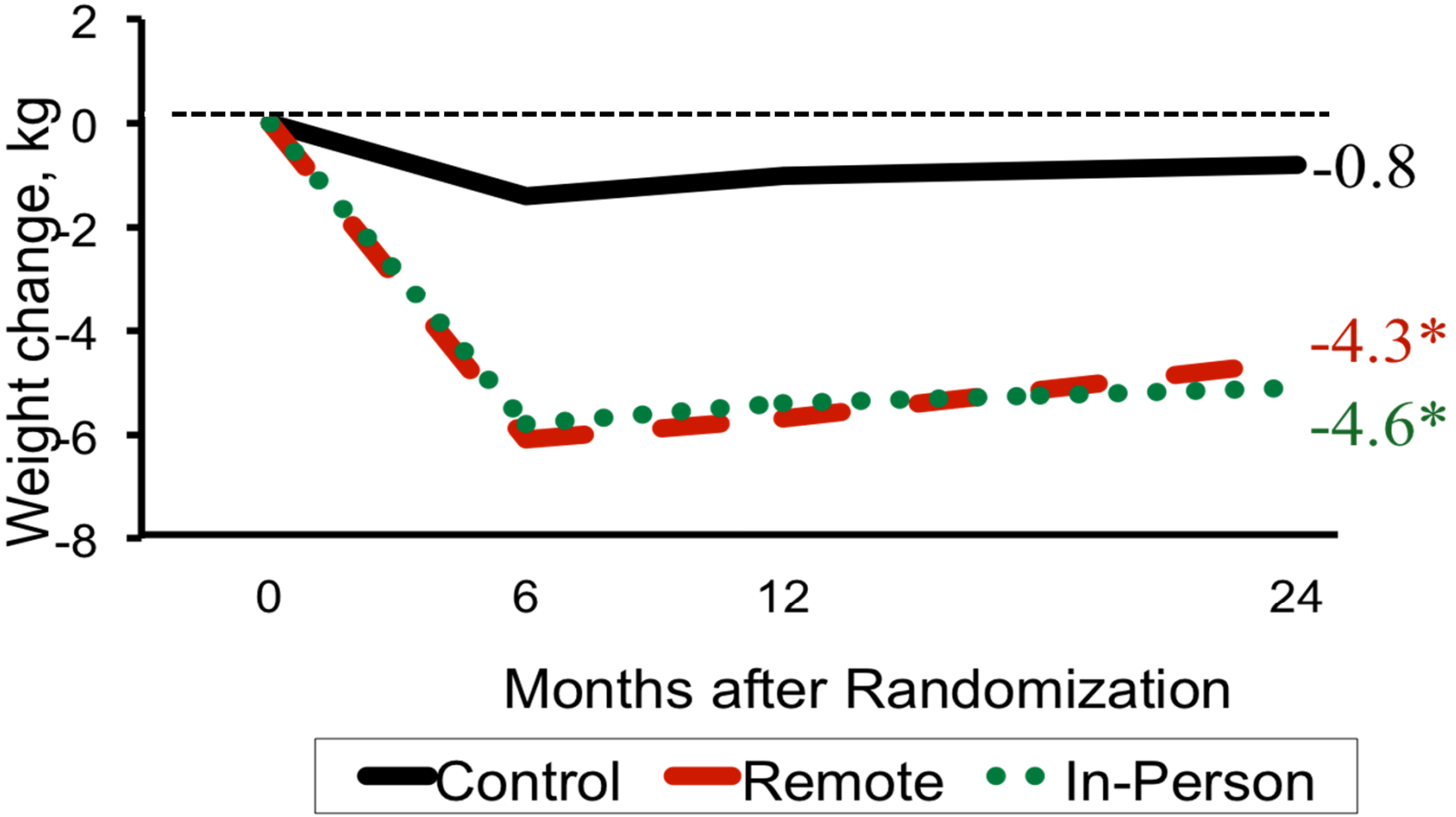
Interventions

	Remote	In-Person
Mode of Delivery	Telephone only	Group meetings Individual meetings Telephone
Coach	Healthways	Hopkins
Coach support	Case management	
Study website	Educational modules Self-monitoring tools Tailored emails	
Physician Roles	Supportive Review weight progress reports	

Strategies for 3 Min Counseling on Weight Loss

- Triage, focusing on those ready to make change
- Emphasize that weight loss:
  - Is challenging
  - Requires conscious efforts
- Encourage
  - *Reduced calorie intake (liquid calories, desserts, portion size, mindless eating)
  - Increased physical activity
  - Self-monitoring of weight, physical activity (minutes or steps), and calories
  - Accountability by engaging partner and reporting to PCP
- Review progress on behaviors and wt from logs

Mean Weight Change (kg) by Randomized Group



Appel et al, NEJM 2011;365:1959-68

*P <0.001 (vs control)

Sample Weight and Exercise Log of Your Speaker

December

EXERCISE AND WEIGHT

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Dec 2013 193 40m Donald 80 pts	2 193 — —	3 190 15 min 30 pts 85	4 — 85	5	6 15	7 193 32 m 50
8 194 50m Davidson 40m walk Donald 20m shovel 180 pts 50	9 194 —	10 — 30	11 193 30 min 60 pts 30	12 193 — 15	13 194 15m tread 30 pts	14 190 55 min Donald 50
15 191 35m 3 walls 70 pts	16 192 — —	17 192 — 15	18 192 15 min 30 pts 30	19 193 32 min Donald 64 pts 30	20 192 — 75	21 192 35 min 70 pts 50
22 15 m tread 30 pts 50	23 192 —	24 192 30m 2 kall 60 pts	25 192 47m run Donald 94 pts 40	26 192 32 min Donald 64 pts 30	27 30m run Betty 50m Pilates 110 pts	28 41m Betty Run 82 pts
29 30 min tread bike 60 pts	30 30m run Betty 64 pts	31 191 40m Donald 80 pts	1 Jan 2014	2	3	4

My Approach

- **Record weight each day**
- **Record min of mod and vig activity**
  - **1 point/min of mod activity**
  - **2 points/min of vig activity**
- **Goal: 180 points/wk**

Novel Interventions (that work)

Objective and Setting

- Objective: Determine the effectiveness of an 18-month tailored behavioral weight loss intervention in adults with serious mental illness

- Setting: Psychiatric Rehabilitation Facilities

ACHiEVE
HEALTHY LIFESTYLES TRIAL
JOHNS HOPKINS

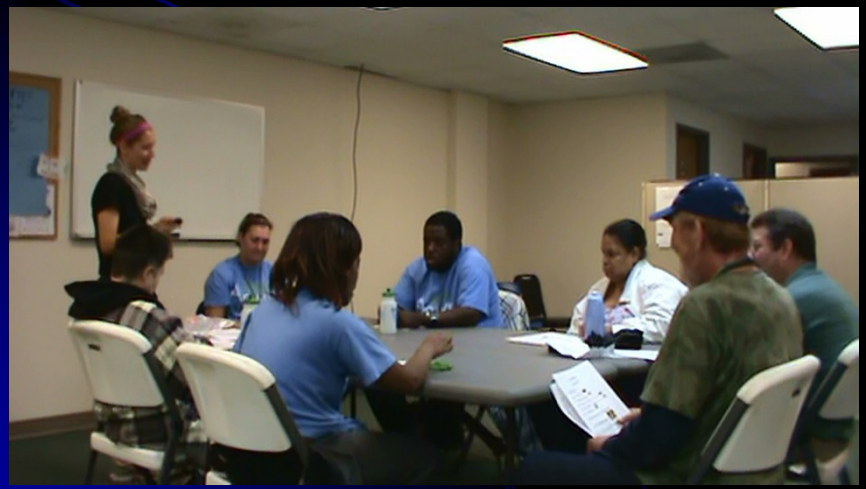
Comparison of Dietary Recommendations

PREMIER Trial	ACHIEVE
Reduce alcohol consumption	Drink Water, No “Sugar Drinks”
Eat 9 Fruits and Vegetables/day	Eat 5 Fruits and Vegetables/day
Calories from fat ≤ 30%	Avoid Junk Food
Calories from saturated fat ≤ 10% Reduce sodium intake ≤ 2400 mg Eat 2-3 servings of dairy/day	Choose “Smart” Snacks
Individual target calorie goals	Choose “Smart” Portions

ACHiEVE
HEALTHY LIFESTYLES TRIAL
JOHNS HOPKINS

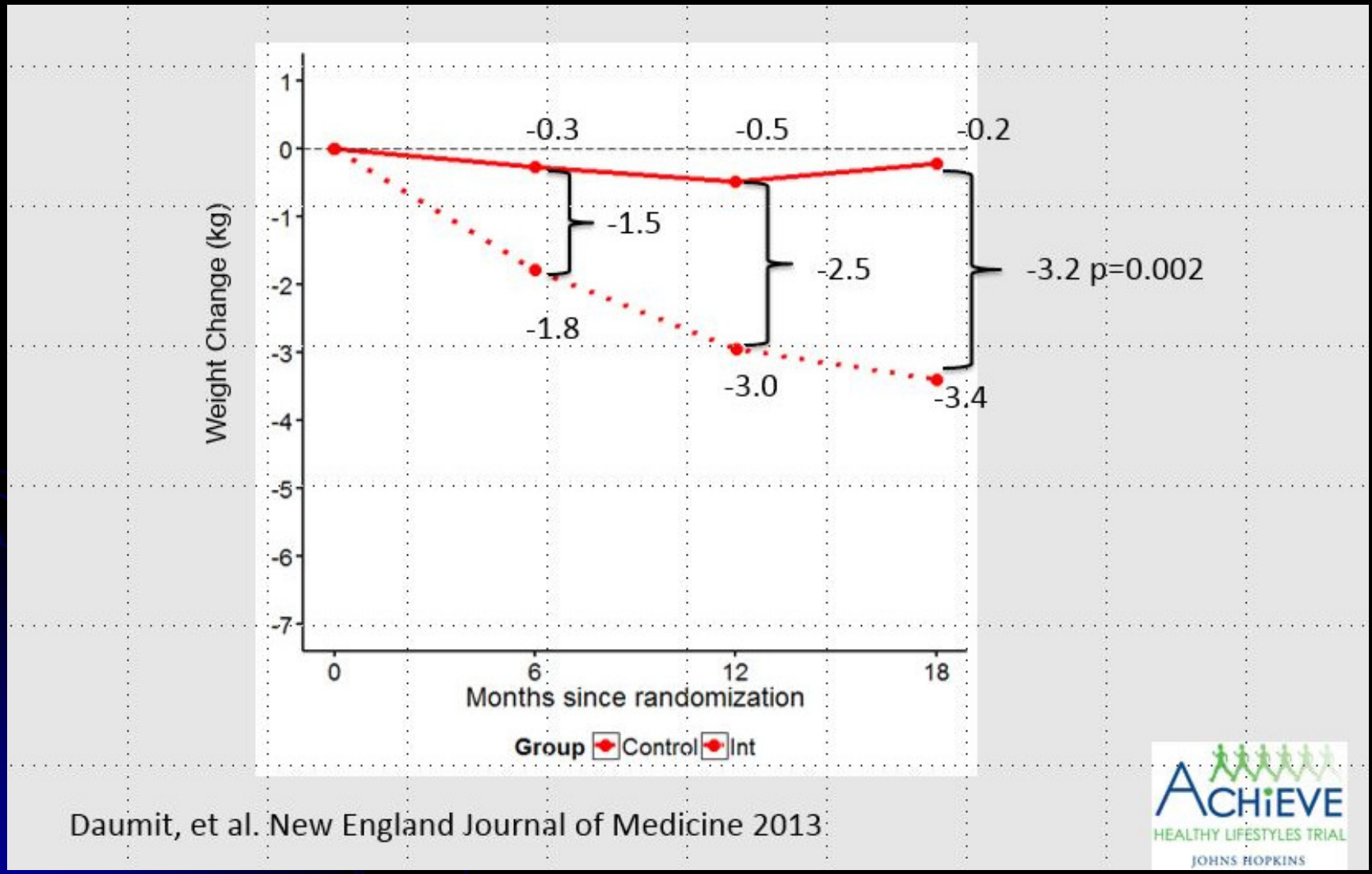
Types and Number of Intervention Contacts

	6 months	7-18 months
Group weight management	Weekly	Monthly
Individual weight management	Monthly (alternating with group)	Monthly (alternating with group)
Group physical activity	3 times per week all lead by intervention staff	3 times per week 1 then 2/week by rehab staff with video
Weigh-in	Every week	Every 2 weeks



ACHiEVE
HEALTHY LIFESTYLES TRIAL
JOHNS HOPKINS

Mean Weight Change (kg) According to Study Group



Daumit, et al. New England Journal of Medicine 2013

ACHIEVE
HEALTHY LIFESTYLES TRIAL
JOHNS HOPKINS

Parents As Teachers National Home Visiting Program

Prenatal to kindergarten

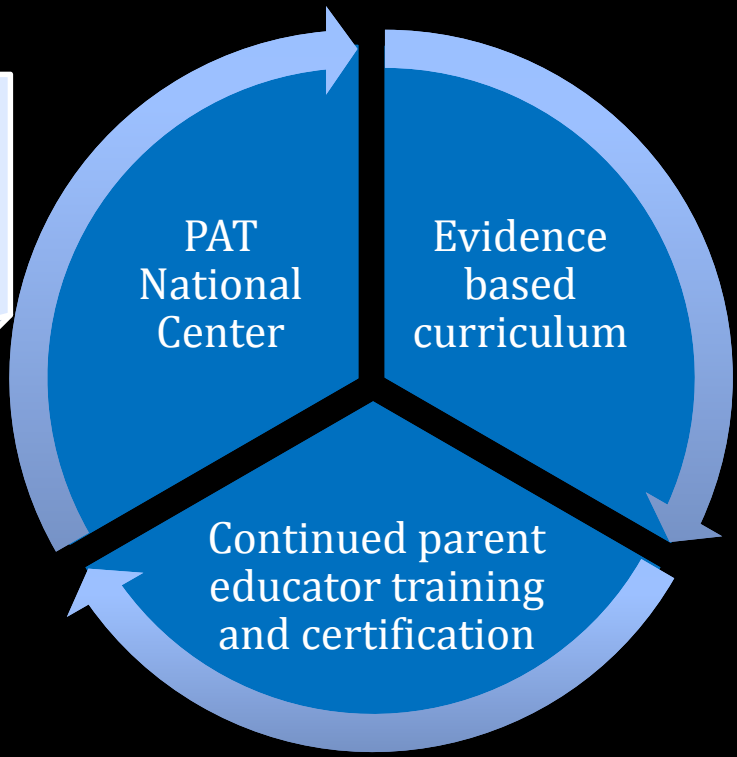
1,292 organizations across 50 states

5,736 parent educators

Free to parents Through state & federal $$ support

193,200 parents

227,238 children



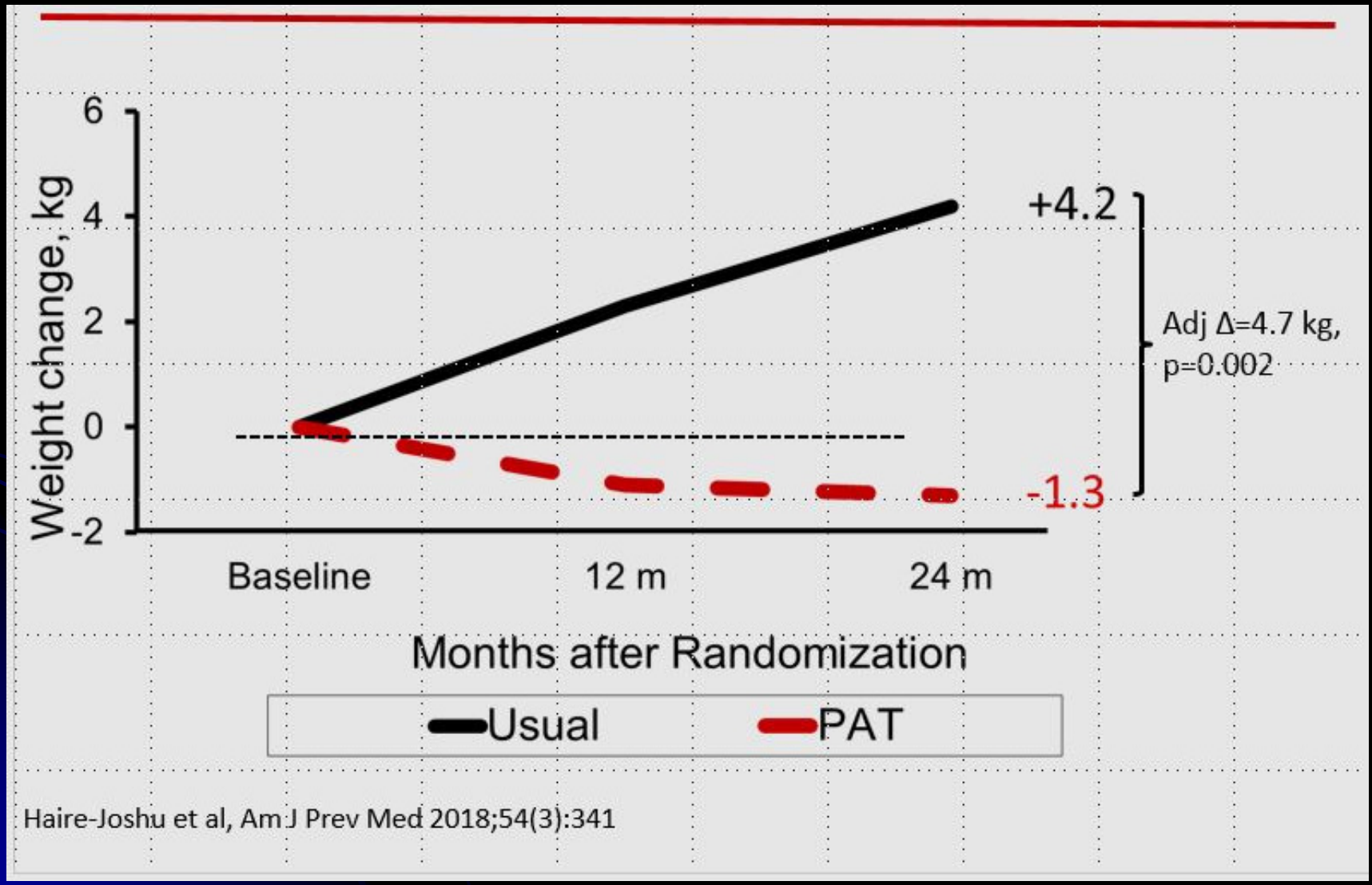
Parents As Teachers Curriculum

- Average ~8-10 visits per year; ~60 minutes in length
- Home visit materials for up to 25 visits (for high needs)
- Each visit stand-alone, selected by parent educator and parent
- Visits emphasize parental modeling and parent-child interaction
- Parent educator training and certification materials for curriculum

Healthy Eating And Active Living Taught At Home (HEALTH): What to embed within routing practice

- Simple ‘real world’ behaviors taught by ‘non-health’ parent educators
- Eating: e.g. SSB, healthy snacking, portion control
- Activity: e.g. Exercise with child, walking, limit TV
- Parenting: e.g. lack of sleep and appetite, eating out, food cost, introducing healthy foods to child
- Skills: e.g. recipe modification, food labels

Effects of a Modified “Parents as Teachers’ (PAT) Home-based Intervention



Haire-Joshu et al, Am J Prev Med 2018;54(3):341

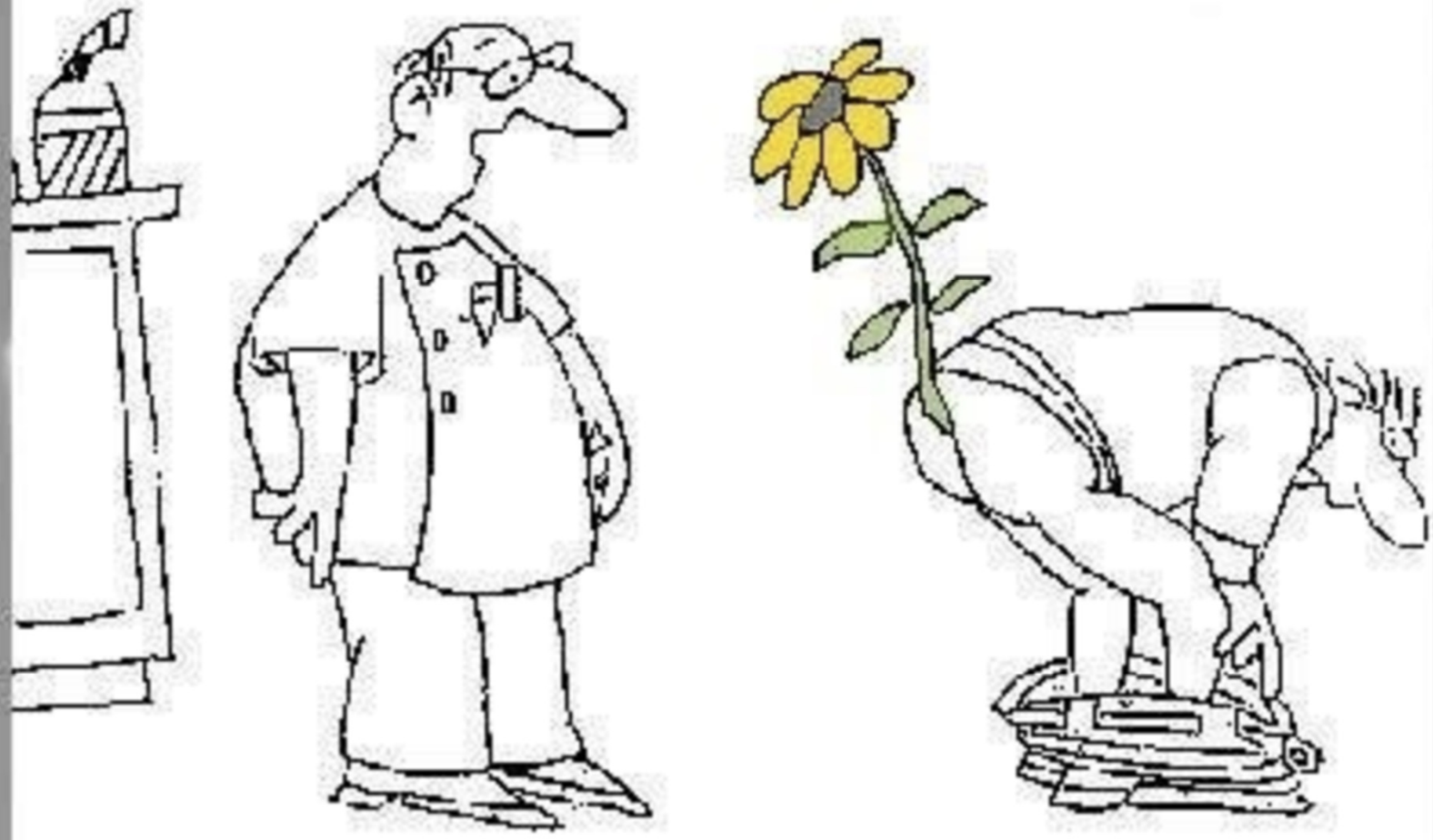
Summary

- BP epidemic and its CVD consequences are massive problems that will require both public health and clinical approaches
- Optimal dietary approach to lower BP is combination:
  - Reduced sodium
  - Improved diet (DASH or vegetarian)
  - Weight control
- Steep age-related rise in BP in children warrants focus on lifestyle improvements at young ages
- Dietary changes have tremendous potential to:
  - prevent BP-related CVD
  - reduce racial disparities

Simple Advice* for Your Patients (and Yourself)

- Eat less
- Eat right
- Move more

** Adapted from Neil Stone and others*



"You're eating too much fiber."

Reaction Panel

Moderator

Clint Koenig, MD
Medical Director, Ohio Department of Health

Panelists

Mamle Anim, MD

Lawrence Appel, MD

Diane Gatto Barrett, MSSA

Donald Wharton, MD

CARDI-OH
OHIO CARDIOVASCULAR HEALTH COLLABORATIVE