



Module 3:

Hypertension, Sodium, and Lifestyle

Case Development & Disclosures

Case Author

Luc Trudeau , MD, FRCPC

- Assistant-Professor of Medicine
- Cardiovascular Prevention Centre, Jewish General Hospital, McGill University
- Specialty: Internal Medicine

Case Series Editor:

Sheldon W. Tobe, MD, MScCH
HPTE, FRCPC, FACP, FASH,

CHEP Continuing Education Committee

- Sol Stern, MD MCFP
- David Dannenbaum, MD CCFP
- John Hickey MD, CCFP
- Karen Mann, BN, MSc, PhD

Additional Reviewers

- Debra Reid, PhD, RD

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Outline of Today's Activity

- Introduction
- Case Presentation
- Key Learnings & Questions
- Wrap Up

Module 3: Sodium and Lifestyle

Lavani

A 56 year old woman presents
to your office for worsening hypertension



Learning Objectives

Upon completing this activity, participants should be able to:

1. Apply the Canadian Hypertension Education Program (CHEP) recommendations for the management of hypertension in association with sodium and lifestyle
2. Explain the relationship between hypertension and sodium, how to prevent and manage hypertension with lifestyle modifications, and a multi-pronged approach
3. Recognize high sodium content food items and lower sodium options

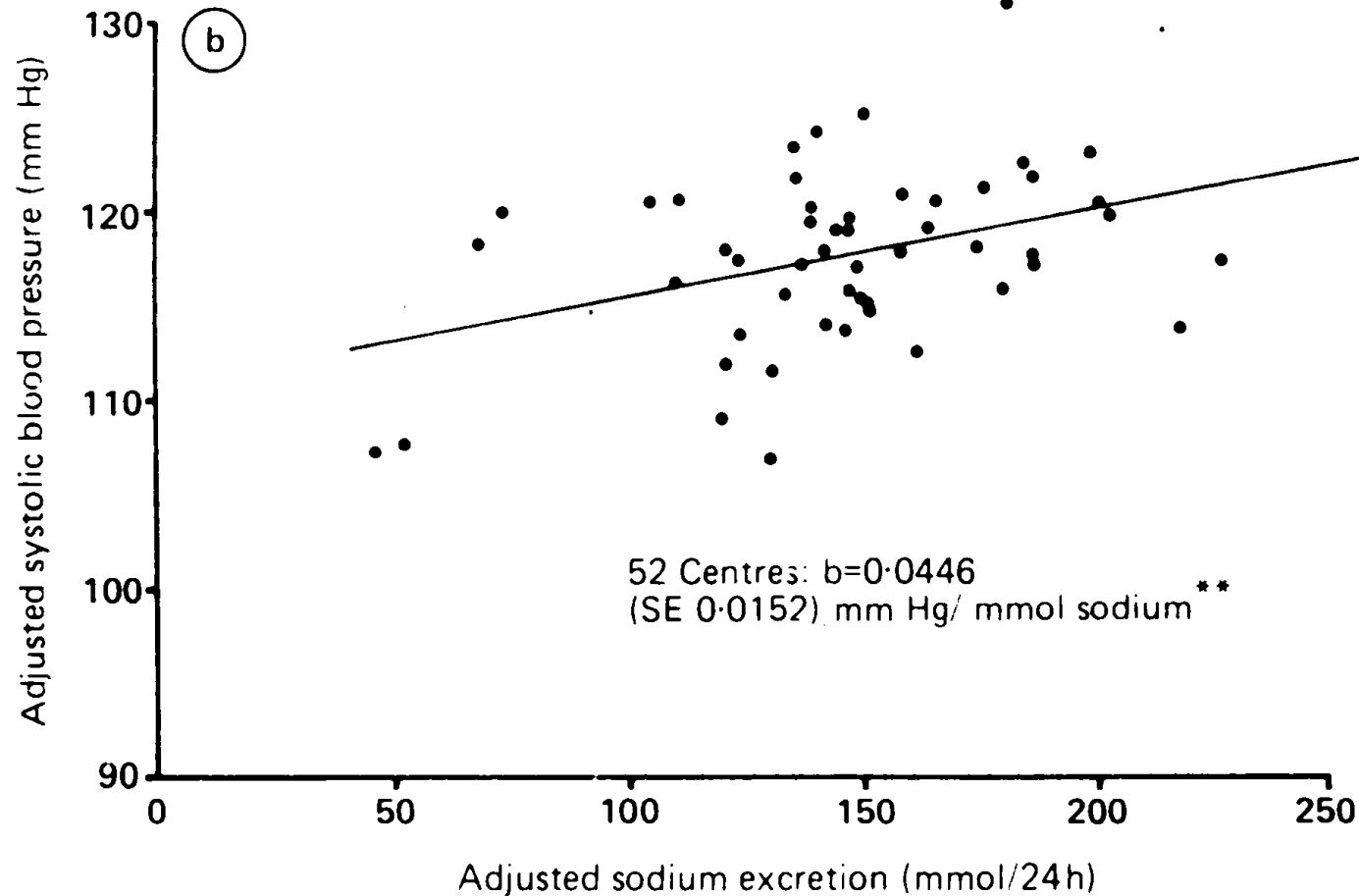
Statement of Need

“My greatest challenge as a health care provider in the management of patients with hypertension is
_____”

Risk Factors for Hypertension

- High dietary sodium intake
- Obesity
- High alcohol intake
- Sedentary lifestyle
- Smoking
- Inadequate vegetable and fruit intake
- Inadequate milk product intake

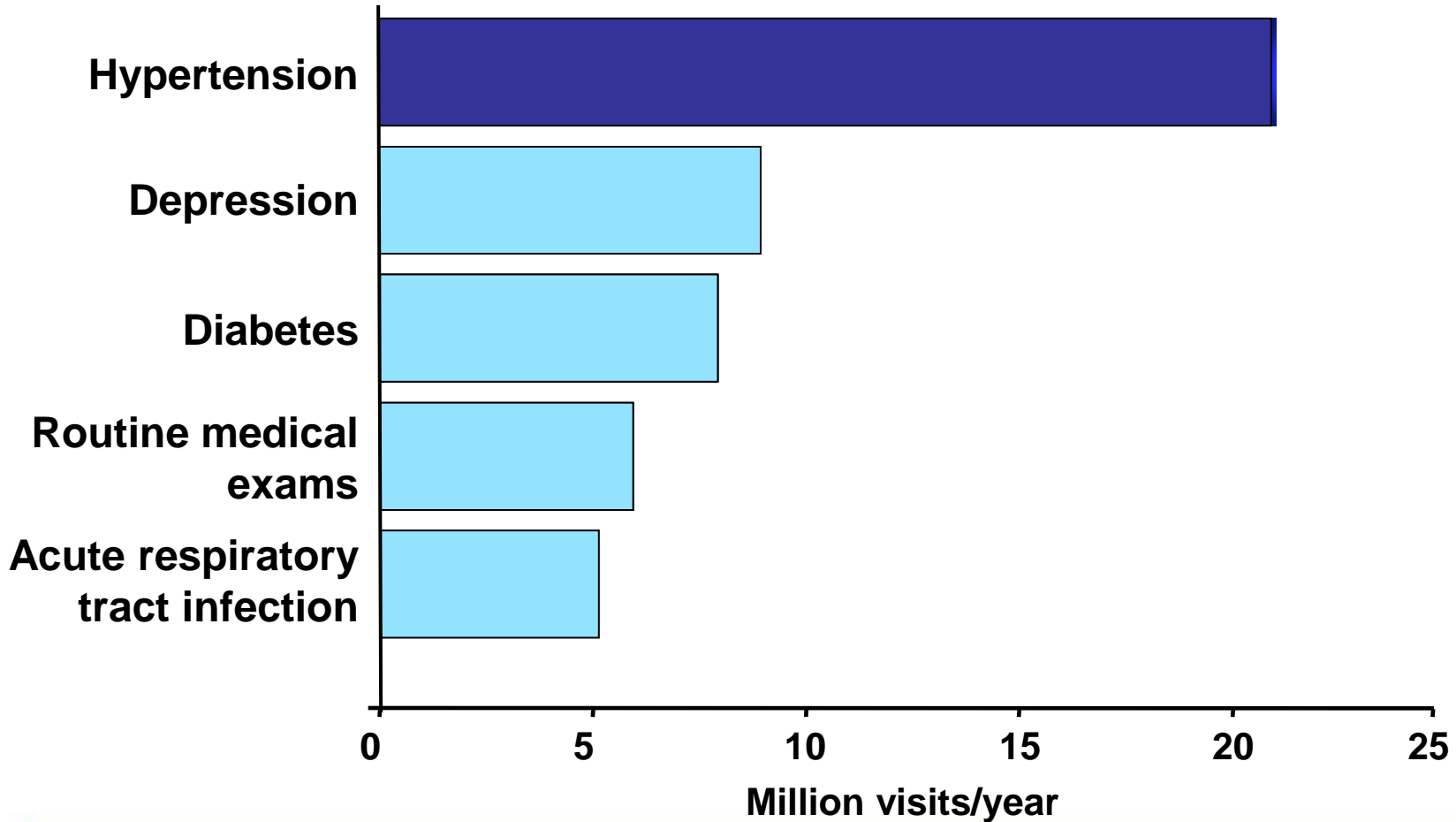
Relationship Between Salt Intake and BP



Hypertension as a Risk Factor

- Hypertension is a significant risk factor for:
 - Cerebrovascular disease
 - Coronary artery disease
 - Congestive heart failure
 - Renal failure
 - Peripheral vascular disease
 - Dementia
 - Atrial fibrillation

Leading Diagnoses Resulting in Visits to Physician Offices in Canada



History of Present Illness

- Lavani is a 56-year-old woman that presents to your office for worsening hypertension
- Born in India and now living in Canada for 8 years
- Housekeeper
- Married; 2 children
- Dresses and eats in a traditional fashion

History of Present Illness

- Patient concerned about higher BP readings at home (140-154/88-94 mmHg)
- Average office BP = 158/98 mmHg
- No symptoms (dyspnea, chest discomfort, orthopnea, change of vision, ankle edema)
- Denies snoring
- Still performs all daily activities
- Weight stable

Past History

- Hypertension for the last 5 years
- Has taken the same medications ever since
- Does no specific physical activity, but has no symptoms after going up a flight of stairs
- Some lower back pain when standing up for a long time preparing meals
- Only surgery was a cholecystectomy

Family History

- Father
 - Hypertension, passed away from CHF at age 60
- Mother
 - Hypertension, suffered a fatal CVA at age 76
- No history of diabetes or hypercholesterolemia

Current Medications

- Ramipril 5 mg OD
- HCTZ 12.5 mg OD
- ASA 80 mg OD
- Ibuprofen 200 mg q 8 hours PRN
- Natural products imported from India: rock salt, Indian pickles, gooseberries

Physical Examination

- Height: 158 cm
- Weight: 64 kg
- BMI: 25.6 kg/m²
- Waist circumference: 86 cm
- BP (left arm, seated):
 - 156/94 mm Hg using an automated device
- Pulse: 80/m regular
- Lungs: clear
- Heart: normal
- Abdomen: no bruit
- Vascular: strong pulses, no ankle edema

Discussion Question 1

What is your treatment plan for this patient?

Discussion Question 1) What is Your Treatment Plan?

- a) Increase dosage of ramipril
- b) Increase dosage of HCTZ
- c) Increase dosage of both ramipril & HCTZ
- d) Recommend improvements in lifestyle habits

Note: Discussion questions do not necessarily have only one correct answer

a) Increase dosage of ramipril

- Increasing dosage of ramipril to 10 mg/day could further decrease BP

b) Increase dosage of HCTZ

- Increasing dosage of HCTZ to 25 mg/day could further decrease the BP

c) Increase dosage of both ramipril & HCTZ

- Increasing both medications to full dosage will give a larger reduction in BP
- Both medications have complimentary mechanisms (better in one tablet)

d) Recommend improvements in lifestyle habits

- Understanding Lavani's lifestyle habits
 - Review the sodium content of traditional diet
 - Limiting sodium intake will decrease BP in itself and will render medications more effective.
 - Discuss the benefits of physical activity
 - Remind the patient to avoid NSAIDs or to use them only PRN at a low dose. Acetaminophen could be a better choice

Lifestyle Recommendations for *Prevention* and Treatment of Hypertension

To reduce the possibility of becoming hypertensive, reduce sodium intake to less than 2000 mg/day

Healthy diet	High in fresh fruits, vegetables, low fat dairy products, dietary and soluble fibre, whole grains, and protein from plant sources, low in saturated fat, cholesterol, and sodium in accordance with Canada's Food Guide
Regular physical activity	Accumulation of 30-60 minutes of moderate intensity dynamic exercise 4-7 days per week in addition to daily activities
Low risk alcohol consumption	≤2 standard drinks/day, <14/week for men and <9/week for women
Attaining and maintaining ideal body weight	BMI 18.5-24.9 kg/m ²
Waist circumference	Men <102 cm; Women <88 cm
Tobacco free environment	

Lifestyle Recommendations for Hypertension: Physical Activity

Should be prescribed to reduce blood pressure

F Frequency - Four to seven days per week

I Intensity - Moderate

T Time - 30-60 minutes

T Type
Cardiorespiratory Activity
- Walking, jogging
- Cycling
- Non-competitive swimming

Exercise should be prescribed as an adjunct to pharmacological therapy

III. Assessment of the Overall Cardiovascular Risk

- Over 90% of hypertensive Canadians have other cardiovascular risks
- Assess and manage hypertensive patients for dyslipidemia, dysglycemia (e.g. impaired fasting glucose, diabetes), abdominal obesity, unhealthy eating and physical inactivity

Laboratory Investigations

Test	Results	Normal Values
Glucose	5.9 mmol/L	4.0-8.0 mmol/L
Urea	7.8 mmol/L	3.0-7.0 mmol/L
Creatinine	88 μ mol/L eGFR 63 ml/min	44-106 μ mol/L
K	4.1 mmol/L	3.5-5.0 mmol/L
Hb	134 g/L	115-165 g/L

- Note that labs are done prior to the next visit

Laboratory Investigations

Test	Results	Normal Values
LDL	2.55 mmol/L	<2.50 mmol/L
Total chol	4.98 mmol/L	<5.20 mmol/L
TG	1.7 mmol/L	<1.70 mmol/L
HDL	1.35 mmol/L	>0.99 mmol/L
TC:HDL	3.7	High risk target: <4.0 Mod risk target: <5.0 Low risk target: <6.0

Case Progression: At the Dietitian

Survey of a typical day's diet for Lavani

- Breakfast
 - Puri, chole, halwa
- Lunch
 - Paneer sandwich with canned fish
- Dinner
 - Chicken tikka, basmati rice, gulab jamun, and basil tea

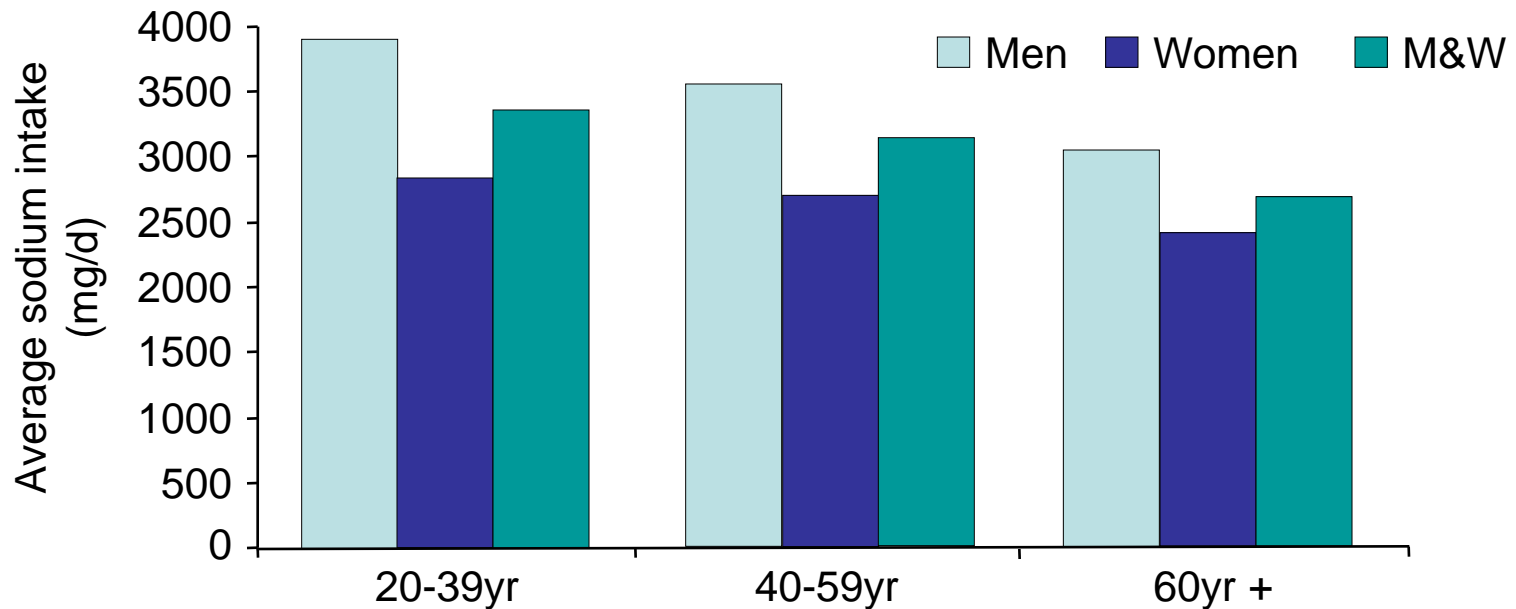
Case Progression: At the Dietitian

Lavani's sodium intake on a typical day is reviewed

Breakfast	Sodium
Bread, chickpeas from a can, semolia pudding	1100 mg
Lunch	
Cottage cheese, butter, salt to taste, soft bread, ½ can of salted dry fish	1400 mg
Dinner	
Rice, chicken, butter, tamarind chutney, onion rings, yogurt, mix of spices with canned tomatoes, Indian pickle, baking soda, tea	2500 mg
Grand total	5000 mg

Sodium Intake* Among Canadian Adults

**CCHS-Nutrition survey results:
average Canadian diet contains 3500 mg/d of sodium¹**



Average sodium intake in India²: 3370 mg

*Does not include sodium added at the table or during home cooking

1. Garriguet. *Health Reports* 2007;18:47-52;
2. Radhika et al. *J Assoc Physicians India* 2007;55:405-11

Indian Hypertension Prevalence Studies (BP 140/90)

First author	Year	Age group	Place	Sample size		Prevalence (%)	
				Men	Women	Men	Women
Urban							
Gupta R	1995	20–75	Jaipur	1415	797	29.5	33.5
Gupta	1999	18–60	Mumbai	40067	59522	43.8	44.5
Joseph	2000	20–89	Trivandrum	76	130	31.0	41.2
Anand	2000	30–60	Mumbai	1521	141	34.1	
Mohan	2001	20–70	Chennai	518	657	14.0	
Gupta R	2002	20–75	Jaipur	550	573	36.4	37.5
Rural							
Gupta R	1994	20–75	Rajasthan	1982	1166	23.7	16.9
Malhotra	1999	16–70	Haryana	2559		3.0	5.8

Gupta. *J Hum Hyperten* 2004;18:73–8

Recommendations for adequate daily sodium intake

2,000 mg sodium (Na)
= 87 mmol sodium (Na)
= 5 g of salt (NaCl)
~1 teaspoon of table
salt



- **80% of average sodium intake is in processed foods**
- **Only 10% is added at the table or in cooking**

Sodium: Meta-analyses

<u>Average reduction of sodium</u> 1800 mg/day 2300 mg/day	Hypertensives <u>Reduction of BP</u> 5.1/2.7 mm Hg 7.2/3.8 mm Hg
<u>Average reduction of sodium</u> 1700 mg/day 2300 mg/day	Normotensives <u>Reduction of BP</u> 2.0/1.0 mm Hg 3.6/1.7 mm Hg

The Cochrane Library 2006;3:1-41

To Reduce Blood Pressure

Advise patient to:

- Follow DASH diet principles
 - Similar to Canada's Food Guide
- Reduce sodium in the diet
 - Sea salt, Kosher salt, “fleur de sel” are high in sodium and not better than table salt

DASH: Dietary Approaches to Stop Hypertension

The DASH Diet

Advise patient to:

- Eat healthy diet according to Canada's Food Guide
 - 7-8 servings of vegetables and fruit each day
 - Have more whole vegetables and fruit than juices
 - 2 servings of low fat milk products each day
 - 1% or skim milk and yogurt, low-fat cheeses
- Use whole –grain, higher -fibre grain foods
 - Breads, rice, cereals, pastas
- Small amounts of lean meats, poultry and fish
 - Cooked without added fat (or salt)
- Frequent use of legumes, seeds and nuts
 - Lentils, chick peas, dried beans, etc.

To Reduce Dietary Sodium

Advise patient to:

Buy lower sodium foods

- Common **high sodium** culprits: vegetable juices, soups, bouillons, sauces, deli meats, prepared meals, snack foods, breads, crackers, and bakery products

Read the information on food packages

- Compare food labels
- Look for foods that contain low amounts of sodium, less than 120mg of sodium per serving
- Use the '**% Daily Value**' on food labels to choose foods with less than **5%** Daily Value of sodium

Prepare home cooked meals using little or no salt

- Reduce salt in bread recipes and do not use in home baking recipes
- Use more spices and yogurt to flavour foods
- Rinse canned vegetables and canned beans to wash away some of the sodium

To Reduce Dietary Sodium

Advise patients to:

- Use less salt and high sodium foods at the table
 - Common high sodium culprits: ketchup, mustard, pickles, chutneys, soy sauce, olives, salad dressings, gravies, and sauces
- Eat less restaurant meals or take out foods
 - Ask for menu nutrition information to choose lower sodium options

Advise patients NOT to:

- Add table salt (sea salt, Kosher salt, fleur de sel) in cooking and at the table
- Eat foods with more than 360 mg of sodium or more than 15% Daily Value per serving

Discussion Question 2

How does excess sodium intake
(>2000 mg/d) increase BP?

Discussion Question 2) How Does Excess Sodium Intake (>2000 mg/d) Increase BP?

- a. Renal retention of fluid (acutely)
- b. Renal sodium excretion threshold reset (chronically) →
↓ sodium excretion
- c. Increases peripheral resistance
- d. Decreases endothelial vasodilation

Note: Discussion questions do not necessarily have only one correct answer

a) Renal retention of fluid (acutely)

- The immediate effect of a dietary sodium excess is to promote water retention and expand extra-cellular (circulating) volume

b) Renal sodium excretion threshold reset (chronically) → ↓ sodium excretion

- After months of sodium dietary excess, the capacity of sodium excretion diminishes as the excretion threshold is adjusted upwards

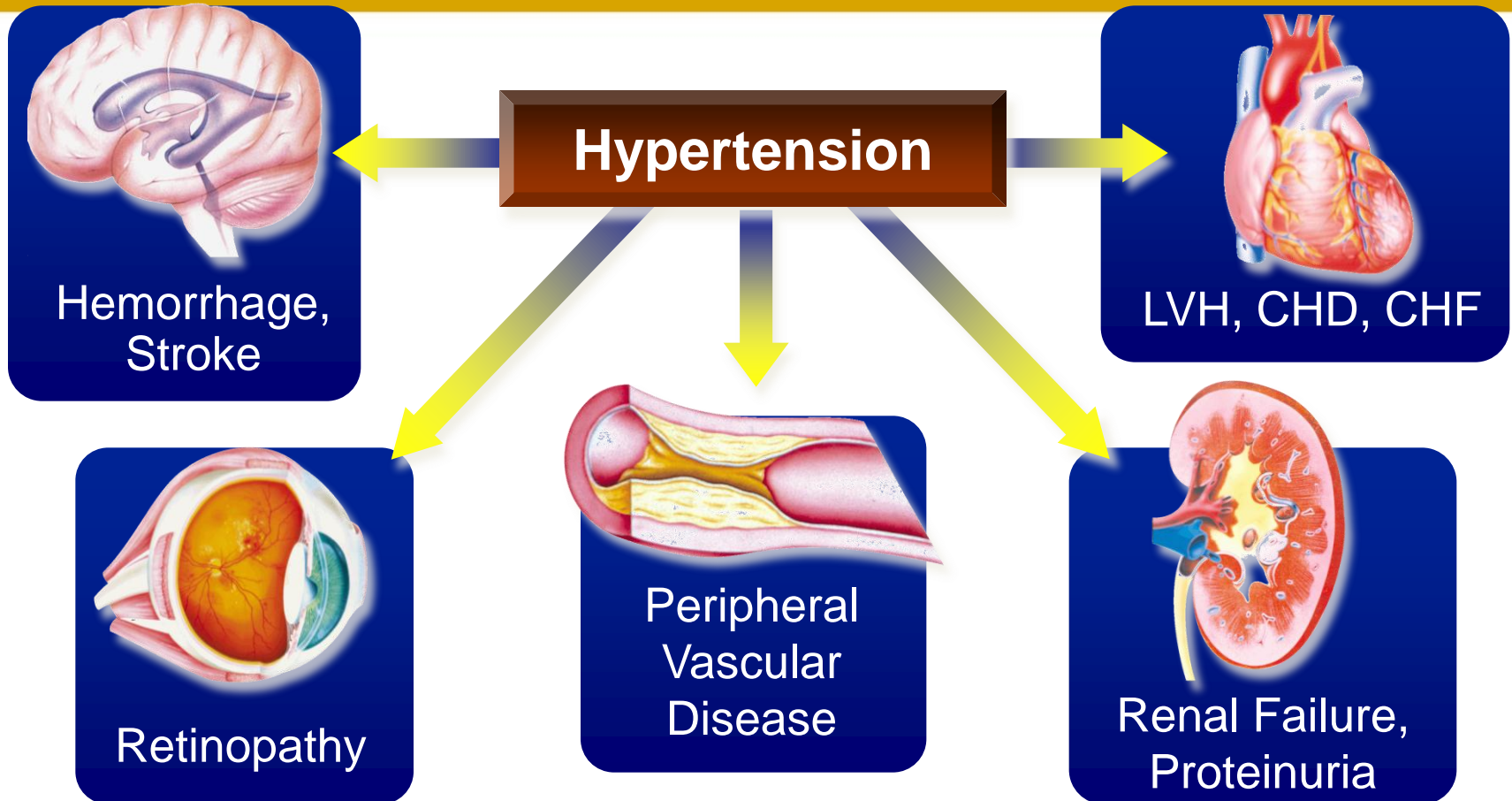
c) ↑ **Peripheral resistance**

- A direct effect of excess sodium exposure is to decrease arterial compliance independently of BP level

d) ↓ Endothelial vasodilation

- Excess sodium will bring on endothelial dysfunction and therefore decrease the vasodilatory capacity.

Organ damage related to hypertension



CHD = coronary heart disease ; CHF = congestive heart failure; LVH = left ventricular hypertrophy

Discussion Question 3

Independent from its effect on BP, can excess sodium intake cause organ damage?

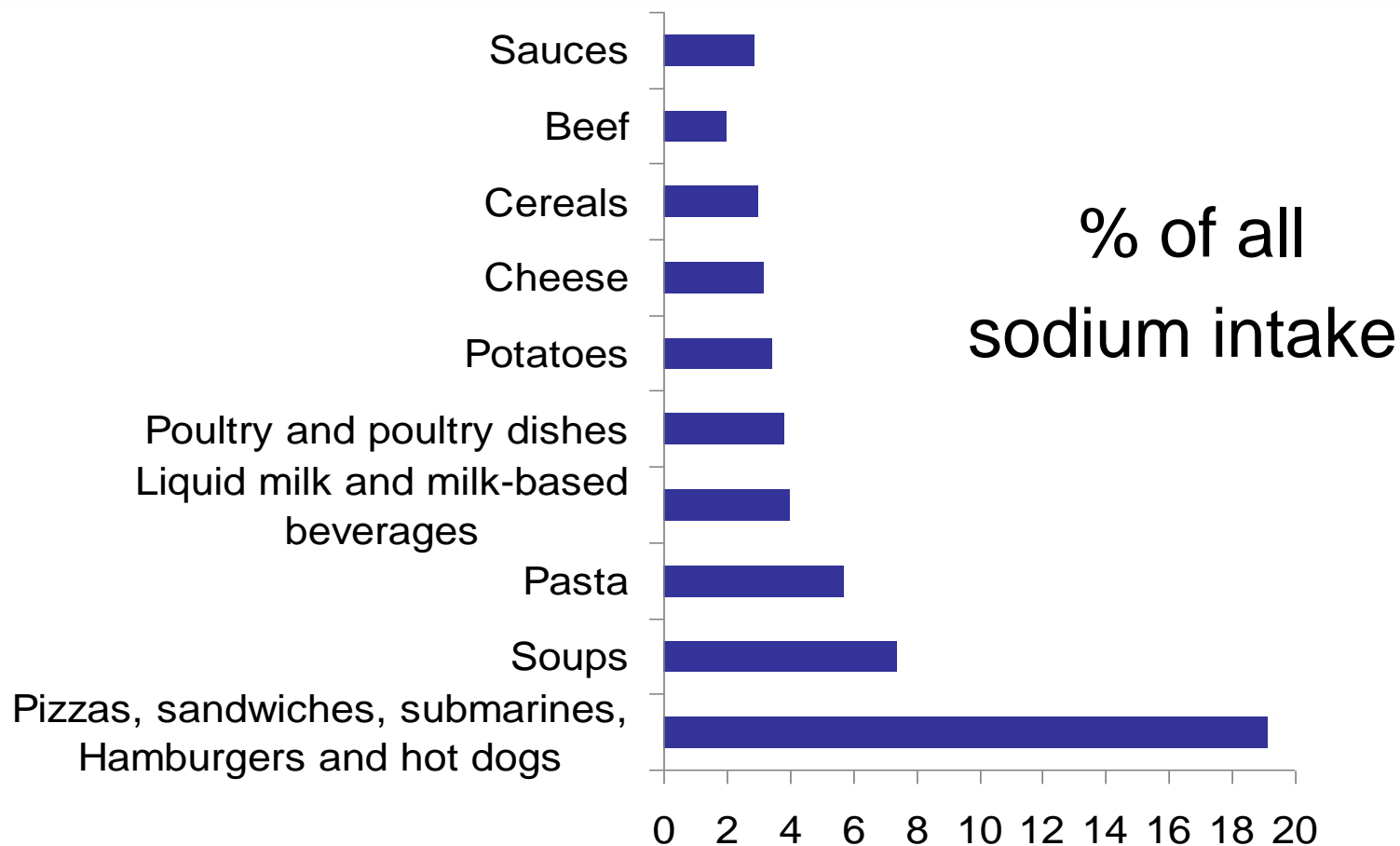
Discussion Question 3) Independent From its Effect on BP, Can Excess Sodium Intake Cause Organ Damage?

- a) Yes
- b) No

Discussion Question 3) Independent From its Effect on BP, Can Excess Sodium Intake Cause Organ Damage? YES

- Endothelial dysfunction and aortic stiffness
- Left ventricular hypertrophy
- Chronic kidney disease

Sources of Sodium Within “Processed Food” Categories in Canada



Case Progression

After counselling with Lavani on lifestyle modifications and the impact of high sodium intake on BP, she has committed to:

- Avoid canned foods
- Limit sauce and condiment intake
- Not to use salt freely and discard baking soda
- Change to small amounts of unsalted butter
- Eat more fresh fruits and vegetables

ABPM done 3 weeks after dietary counselling:

→ 24-hour average = 136/84

→ Daytime average = 142/86

Case Progression

3 months after her original visit, Lavani:

- Walks 30 minutes, 3-4 times/week
- Continues to apply dietary changes
- Has no complaints
- Weight = 62 kg
- BP average in clinic = 140/88 mm Hg
- Rest of her physical exam is remarkable

Impact of Lifestyle Therapies on Blood Pressure in Hypertensive Adults

Intervention	Intervention	SBP/DBP
Reduce sodium intake	-1800 mg/day sodium Hypertensive	-5.1/-2.7
Weight loss	per kg lost	-1.1/-0.9
Alcohol intake	-3.6 drinks/day	-3.9/-2.4
Aerobic exercise	120-150 min/week	-4.9/-3.7
Dietary patterns	DASH diet Hypertensive	-11.4/-5.5

Padwal et al. *CMAJ* 2005;173:749-51

Meta-analysis (53 studies): Average Change in SBP and DBP Going From Sedentary to More Active Status

Table 1. Mean Net Changes in Systolic and Diastolic Blood Pressure according to Different Exclusion Criteria

Variable	Systolic Blood Pressure			Diastolic Blood Pressure		
	Trials Examined	Net Change (95% CI)	P Value	Trials Examined	Net Change (95% CI)	P Value
	<i>n</i>	<i>mm Hg</i>		<i>n</i>	<i>mm Hg</i>	
All trials	53	-3.84 (-4.97 to -2.72)	<0.001	50	-2.58 (-3.35 to -1.81)	<0.001
Exercise supervised*	45	-4.13 (-5.21 to -3.05)	<0.001	42	-2.68 (-3.55 to -1.81)	<0.001
Antihypertensive medication not administered†	49	-4.23 (-5.42 to -3.05)	<0.001	46	-2.91 (-3.69 to -2.13)	<0.001
Single intervention between groups‡	47	-4.39 (-5.68 to -3.10)	<0.001	44	-2.97 (-3.82 to -2.12)	<0.001
Blood pressure as primary outcome§	37	-4.39 (-5.93 to -2.86)	<0.001	36	-2.87 (-3.91 to -1.84)	<0.001

* Trials that did not require supervised exercise intervention were excluded (19, 25, 27, 31, 44–46).

† Trials in which antihypertensive medications were administered were excluded (25, 32, 33).

‡ Trials that conducted multiple interventions were excluded (25, 30, 32, 38, 42).

§ Trials in which blood pressure was not the primary outcome were excluded (22–24, 26, 30, 35, 37, 39, 43, 45).

↓ SBP = 3.8 mm Hg; ↓ DBP = 2.6 mm Hg

Whelton et al. *Ann Intern Med* 2002;136:493-503

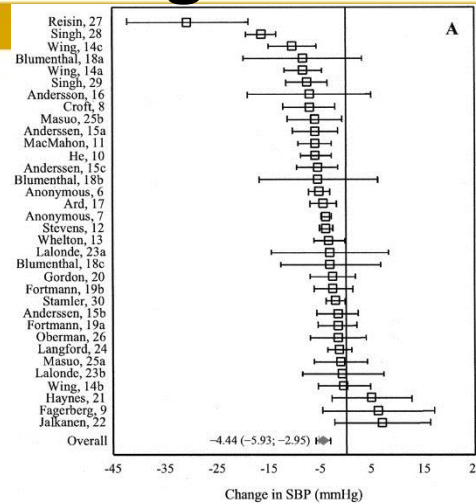
Meta-analysis (25 randomized studies): Effects of Weight Reduction on BP

n = 4874

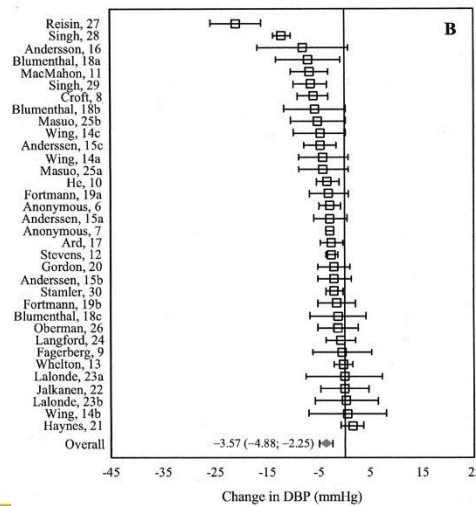
For every kg lost:

SBP ↓ 1.05 mm Hg

DBP ↓ 0.92 mm Hg



↓ SBP = 4.44 mm Hg



↓ DBP = 3.57 mm Hg

Neter et al. *Hypertension*
2003;42:878-84

Observed Effect of Lower Sodium Intake on Cardiovascular Events in TOHP Trials

- 25-30% lower risk of cardiovascular events in those who had been in the low sodium groups
- 759-1012 mg/day reduction in dietary sodium during intervention

Cook et al. *BMJ* 2007;334:885-92

Health Care Cost Savings in Canada by Reducing Dietary Sodium

Using the Cochrane review data, a reduction in average dietary sodium intake by 1800 mg/d (from 3500 mg to 1700 mg in Can) would result in:

- 1 million fewer hypertensive Canadians
- Almost double the BP treatment and control rate
- Hypertension care cost savings of \$430 to 538 million /yr

Joffres et al. *Can J Cardiol* 2007;23:437-43

Impact of Reducing BP Through Dietary Sodium in Canada

Modeling results

- Annual reduction in incidence of:
 - Myocardial infarction (5%)
 - Strokes (13%)
 - Heart Failure (17%)
- Reduction in health care costs associated with the overall predicted 8.6% reduction CVD
 - \$1.7 billion per year (1998 costs)

Penz et al. *Can J Cardiol* 2008;24:497-501

Health Behaviour Management: Summary

Intervention	Target
Reduce foods with added sodium	→ 2000 mg /day
Weight loss	BMI <25 kg/m ²
Alcohol restriction	≤ 2 drinks/day
Physical activity	30-60 minutes 4-7 days/week
Dietary patterns	DASH diet
Smoking cessation	Smoke free environment
Waist circumference	Men <102 cm Women <88 cm

Key Learnings

- ✓ High dietary sodium is an key contributor to high blood pressure. Processed foods are our main source of dietary sodium. Eating fresh vegetables and fruits and low fat milk products helps to control BP
- ✓ To decrease blood pressure, consider reducing sodium intake towards 2,000 mg (5g of salt or 87mmol of sodium) per day
- ✓ Improving more than one lifestyle has an additive effect

**The full slide set of the
CHEP Recommendations
is available at
www.hypertension.ca**