Reducing dietary salt
The need to act

Norm Campbell


1) The role of increased blood pressure as a determinant of adverse outcomes
2) The health risks of high dietary salt

Salt and Sodium

CONFUSING TERMINOLOGY !!!!

- 5 gm salt is 2000 mg sodium

- 2300 mg sodium is
  - ✓ about a teaspoon of salt (sodium chloride)
  - ✓ 100 mmol of sodium or salt
  - ✓ 5.8 gm (5800 mg) of salt (NaCl)

Salt and Hypertension

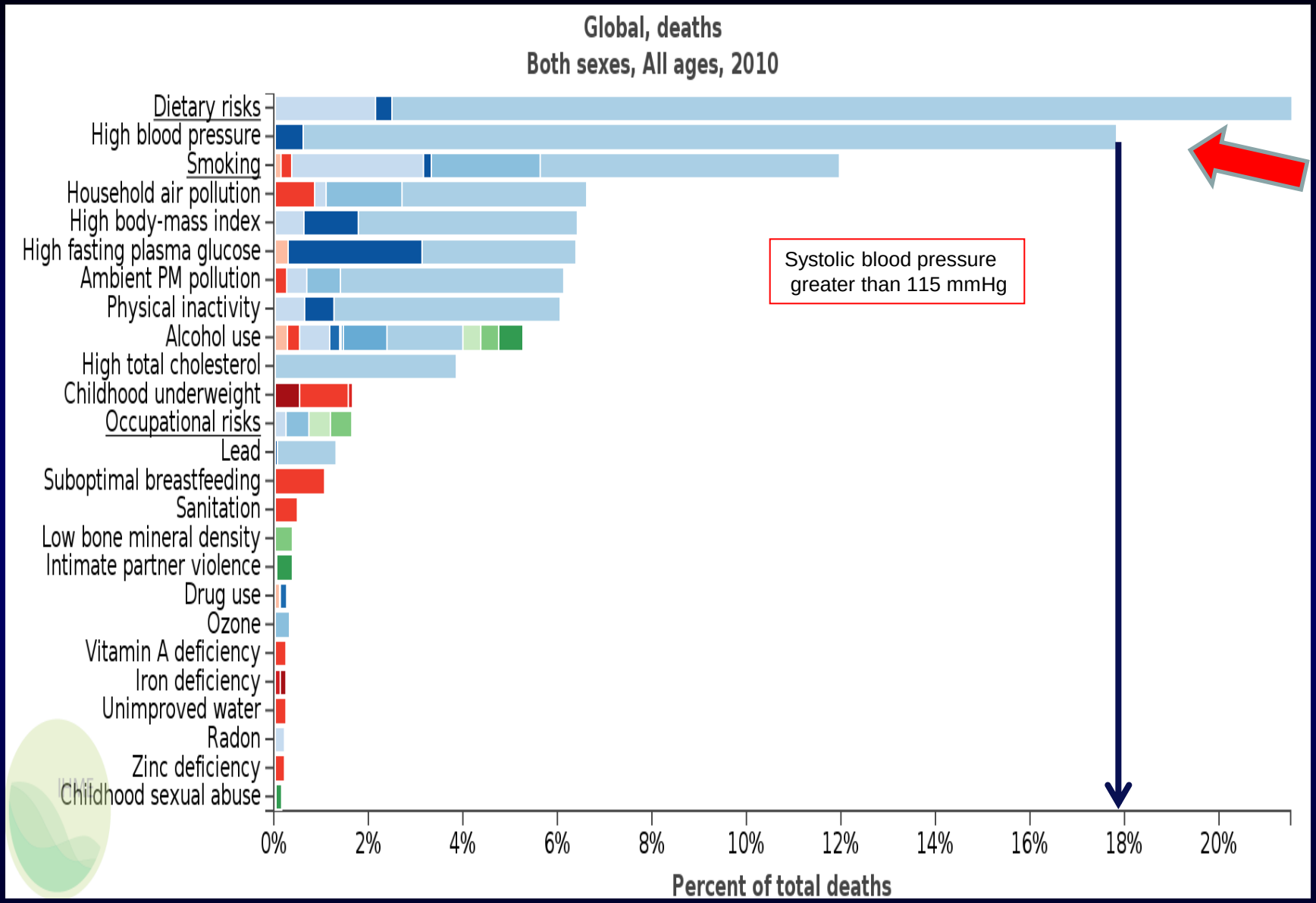


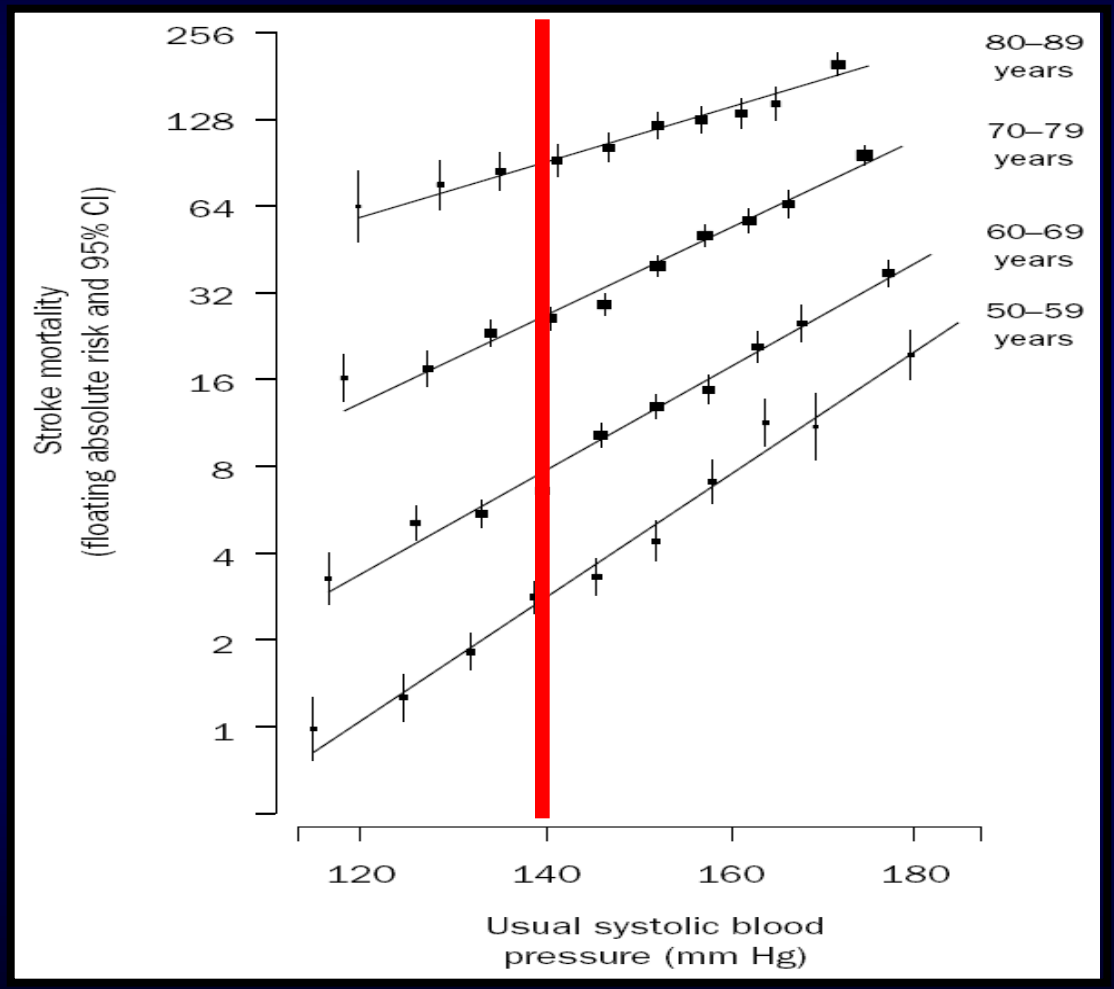
Figure obtained by cropping a downloaded figure from http://www.healthdata.org July 8 2014,

The Burden of Hypertension
Blood Pressure* As A Cardiovascular Risk

- Attributable Risk
  - Overall ½ of heart and stroke*
  - Stroke 54%*
  - Heart failure 50%
  - Heart attack 25%
  - Kidney failure 25%
  - Dementia
  - Many other vascular diseases

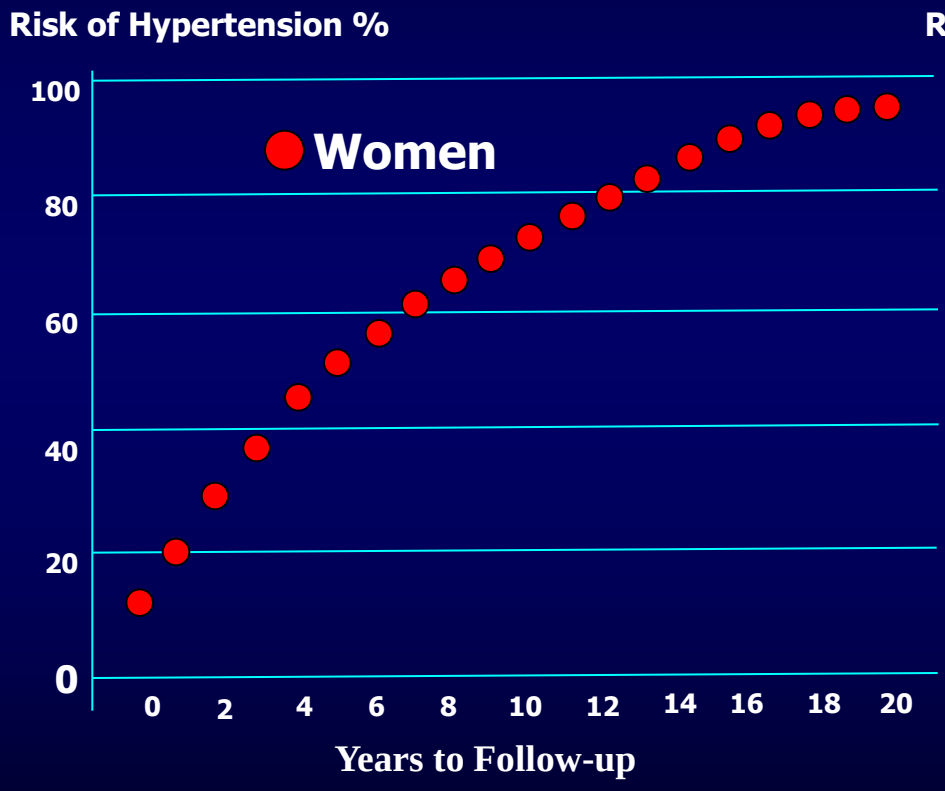
* Systolic blood pressure greater than 115 mmHg

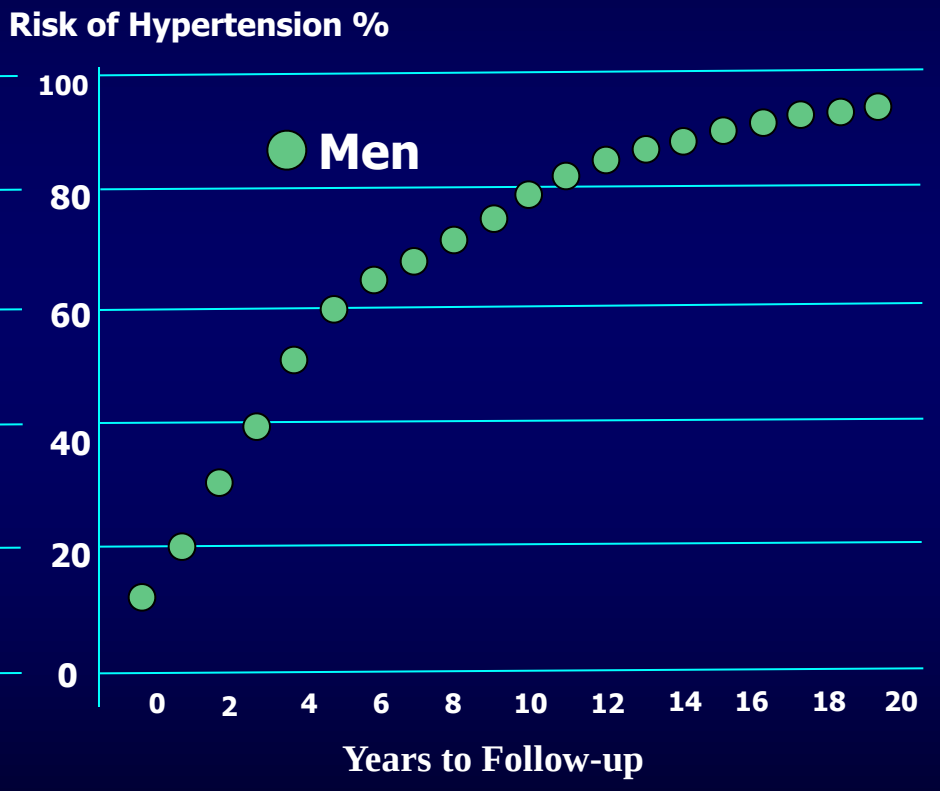
The Burden of Hypertension
Blood Pressure and Risk of Stroke Mortality



Lancet 2002;360: 1903-13

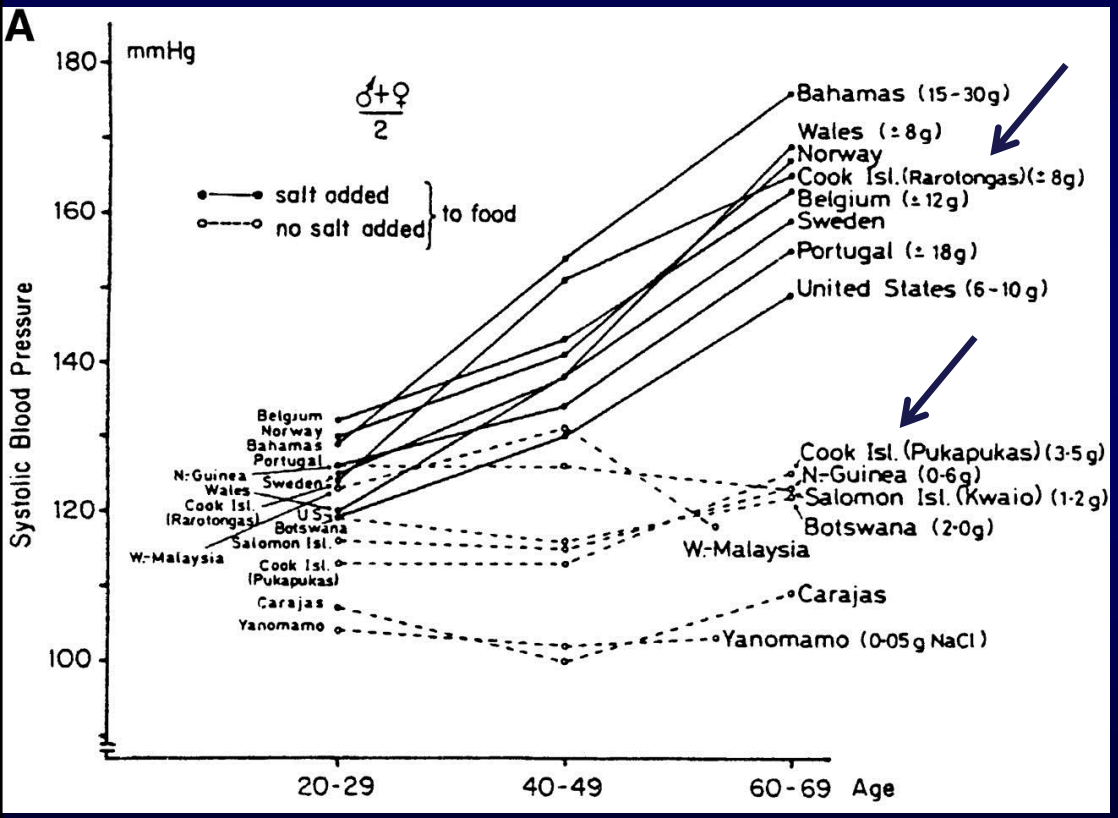
The Burden of Hypertension
Lifetime risk of Hypertension
(in Normotensive Women and Men aged 55-65 years)





JAMA 2002: Framingham data.

Societies that eat unprocessed foods, are physical active and lean do not develop hypertension



- BP is well known to rise with age in modern industrialized societies.

Meneton et al, 2005

Excess salt intake raises BP in animals

Rats
Pigs
Mice
Dogs
Rabbits
Chickens
Baboons
Chimpanzees
Green monkeys
Spider monkeys

Such studies provide us with detailed information regarding *how* salt may affect BP

-Not always reversible
-Slow as well as fast component
-Can have epigenetic impact
-May relate to hypertension with aging

Excess salt intake increases morbidity and mortality in animals

Morbidities:

- Cardiac Hypertrophy
- Vascular Hypertrophy
- Vascular Stiffening
- Renal Damage
- Hyperlipidemia
- Insulin Resistance

The increase in dietary salt and BP in animal models is not innocuous

Taking sodium out of natural food sources causes harm

Mortality:

- Hypertensive Encephalopathy
- Stroke
- Heart Failure
- Premature Death

Salt, hypertension and vascular disease in humans
A vast array of evidence involving 1000s of studies

- Migration studies
- Epidemiological studies; cross sectional and cohort; hypertension and in healthy populations vascular disease
- Clinical trials; hypertension and a lack of certainty about vascular disease
- Modeling studies

- Weekly systematic review of the literature; Sodium science at Hypertensiontalk.com
- June 2013-May 2014: 5534 studies

Attributable Risk of Lifestyle to Hypertension

Risk factor	Approximate attributable risk for hypertension
Increased salt in diet	32%
Decreased potassium in diet	17%
Overweight	32%
Sedentary lifestyle	17%
Excess alcohol	3%

Committee on Public Health Priorities to Reduce and Control Hypertension in the U.S.Population, Institute of Medicine. A Population-Based Policy and Systems Change Approach to Prevent and Control Hypertension. National Academy of Sciences , 1-187. 2011. National Academies Press.

Salt: Meta-analyses

Key features: random allocation; >2.3 g/day reduction in salt; assessed intake by 24 hr urine; >4 weeks duration; isolated intervention; 37 RCT in adults; 10 controlled trials in children not all that met inclusion criteria

Adults

Reduction of BP 3.14 (5.98 – 0.3) / 1.7 (3.1-0.33) mmHg;

Baseline salt intake 7g – 11g

Treatment salt intake 3.25g – 7.2g

Greater reduction in people with hypertension

Greater reduction with salt to less than 5g/day vs >5g/day

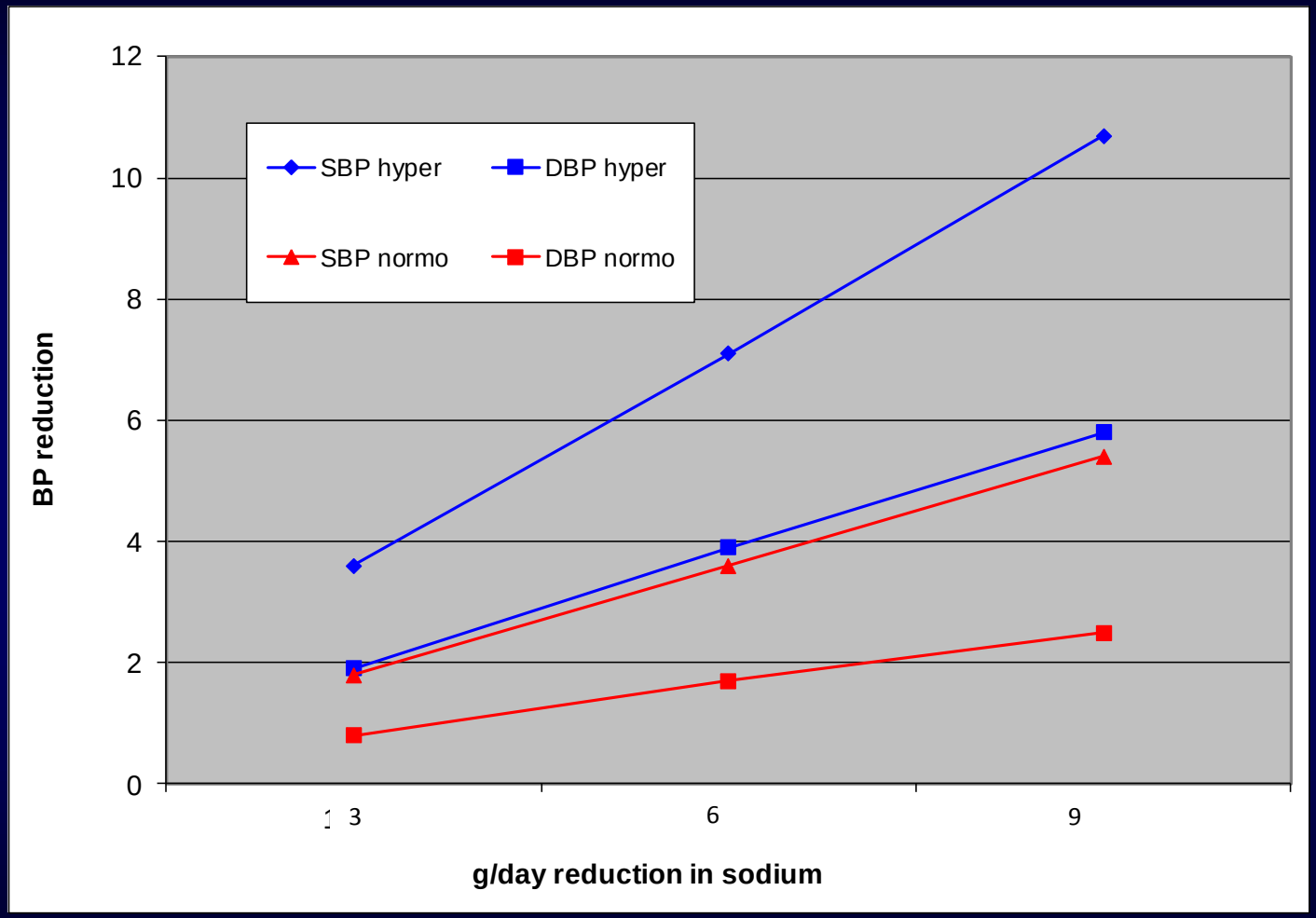
No adverse effect on cholestrol, LDL cholestrol, HDL cholestrol or tryglycerides, urinary or plasma adrenaline or noradrenaline

Children

Systolic Blood pressure decrease of 0.84/.87 mmHg

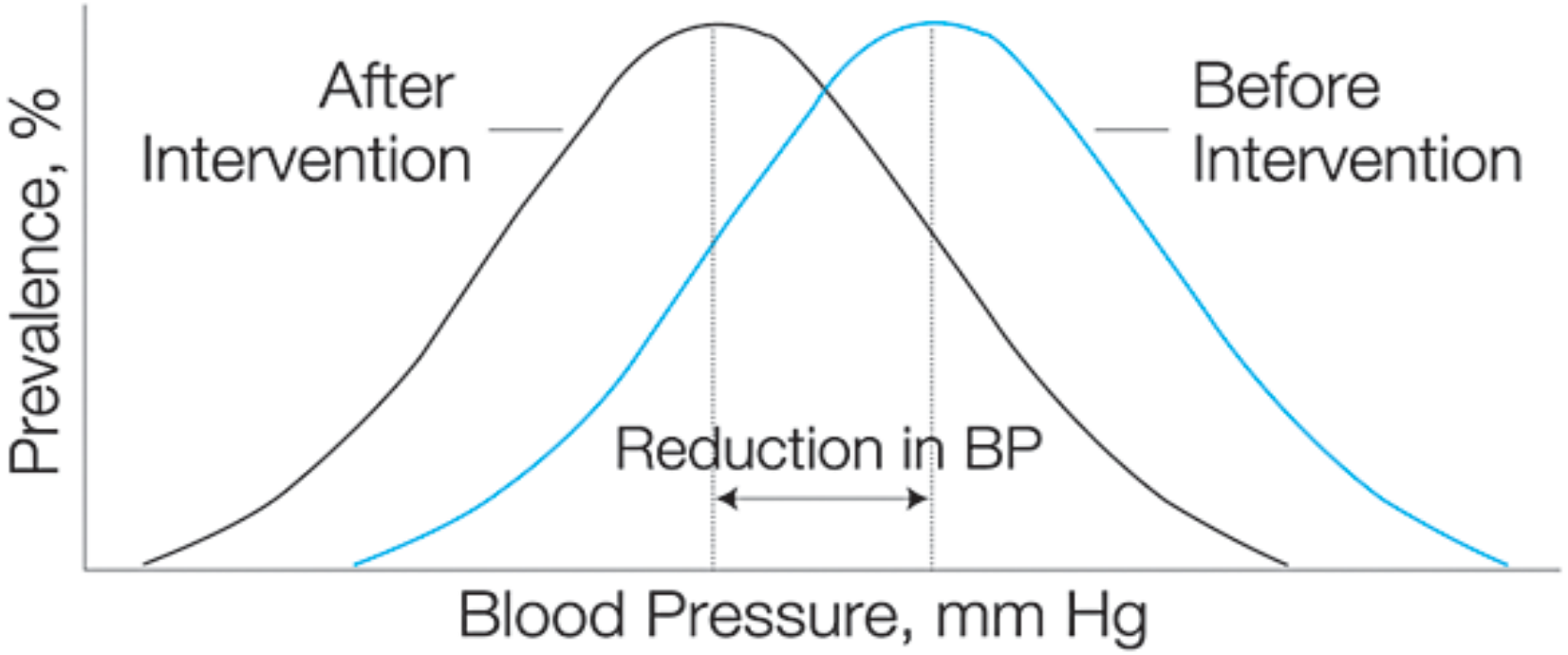
Aburto NJ et al. BMJ (2013)

Meta analysis on different levels of reduction in dietary salt on blood pressure



Hypertension 2003;42:1093-1099

Effect of 'small' reductions in systolic blood pressure on cardiovascular and total death



Reduction in BP, mm Hg	% Reduction in Mortality		
	Stroke	CHD	Total
2	−6	−4	−3
3	−8	−5	−4
5	−14	−9	−7

From Whelton, P. K. et al. JAMA 2002;288:1882-1888

Salt: Meta-analyses

- Cohort studies of CVD in non acutely ill populations; 1+ years duration

7-10 studies depending on outcome in question

- All cause mortality RR 1.06 (.94-1.2)
- Stroke RR 1.24 (1.08-1.43)
- Fatal stroke 1.63 (1.27-2.1)
- Cardiovascular disease 1.12 (0.93-1.34)
- Coronary heart disease (1.04 (0.86-1.24)
- Fatal heart disease (1.32 (1.13-1.53)

Salt intake as low as 3 gm/day

Aburto NJ et al. BMJ (2013)

Estimated effects on hypertension, CVD and related costs if dietary salt reduced

- 30% reduction in prevalence of hypertension by reducing salt to recommended levels- about 300 million people with hypertension related to excess salt intake
- 3.4 million deaths/year globally to reduce to under 2.5g /day, 1.65 million under 5.0g /day
- 8.5 million deaths averted worldwide over 10 years by reducing salt intake 15%
- Slightly more cost effective than efforts to reduce tobacco use in low to middle income countries.
- In the USA cost savings of 10-30 billion dollars/yr and reduced CVD events by up to 260,000/yr, deaths up to 90,000/yr from reducing salt by 3 g/day

Salt and other health issues

- Obesity and related diseases (e.g. diabetes)
- Asthma
- Kidney stones
- Osteoporosis
- Gastric Cancer (promoter)
- Renal Cancer
- Meniere’s disease

How much salt is unhealthy?

- Difficult to answer accurately as BP increases as dietary salt increases
- Small amounts are in hunter gather population diets (< 2.5 g/day)
- Physiological balance maintained in homeostatic settings at levels of around 0.25 g/day
- Rapid or extensive reductions in dietary salt are associated with increases in lipid and glucose values
- In those not yet acclimatized, physical activity in hot dry climates increases salt losses in sweat and the amount of dietary salt required
- In disease states there may be different sodium requirements (postural hypotension, short gut syndrome, salt losing nephropathy, some genetic variants of sodium transporters, high dose diuretic or hypotensive therapy use)

Salt intake recommendations

- WHO: less than 5 g salt (sodium <2000 mg)/day
- A large number of independent scientific and public health organizations and governmental organizations review the evidence base on dietary salt and invariably recommend between less than 6 g salt and less than 5 g salt day (AHA 3.75 g/day)

Salt intakes around the world

- With few exceptions the average consumption of populations is over 5.8 g/day after age 5 and many over 10 g/day
- In developed economies the vast majority of salt is added in food processing (~80%)
- In undeveloped economies most salt is added at home in cooking and at table
- In transition economies, salt at home and in food processing is an issue.

Int J Epi 2009;38:791-813

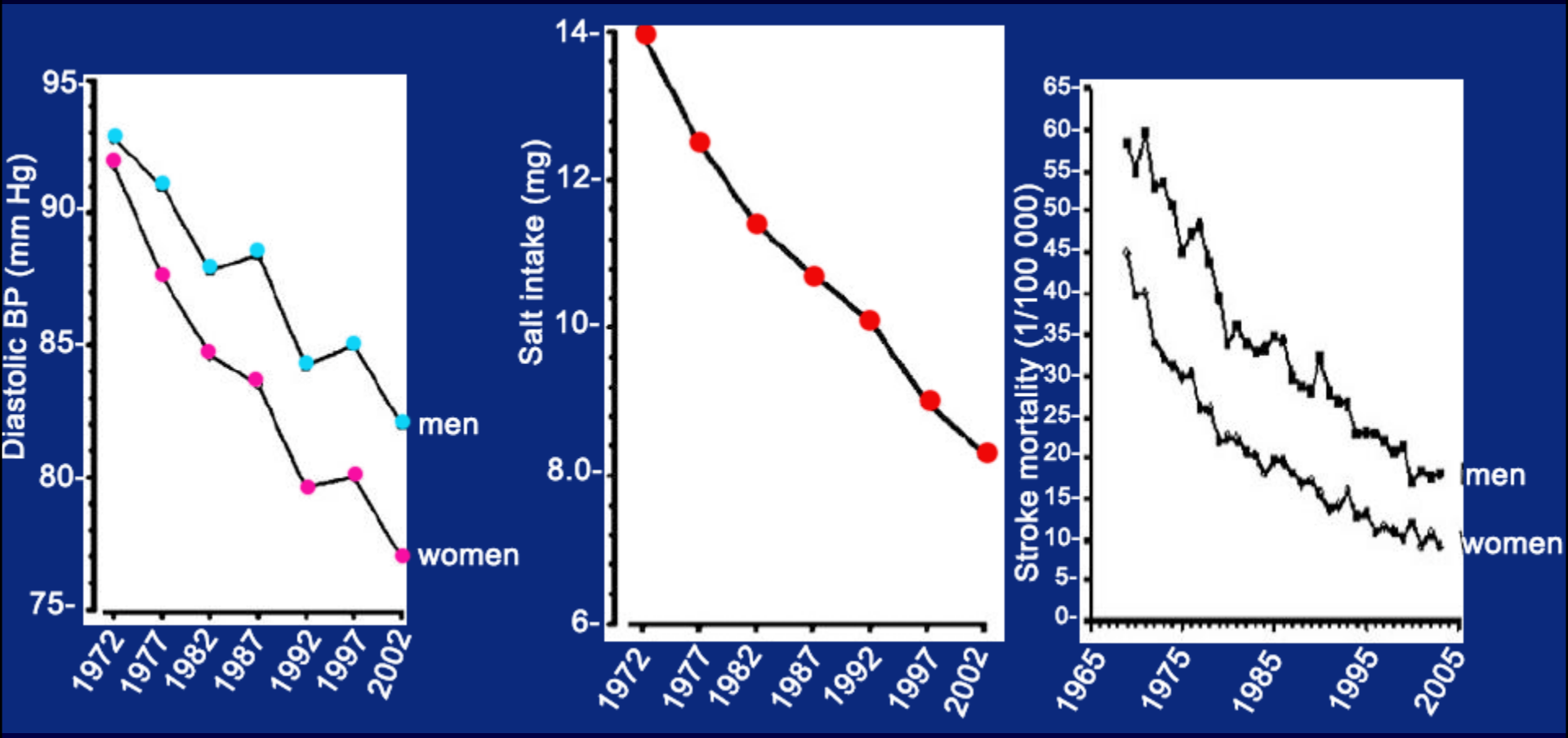
Generating controversy

- Incomplete database (especially lack of RCT with substantive endpoints)
  - The 1998 Wingspread Statement on the Precautionary Principle: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."
- Commercial interference
- Low quality research

  - International effort underway to develop recommendations for research standards

  - Even minimal quality standards like those of WHO review remove nearly all the controversial studies
- Incomplete or out of context reviews of evidence.

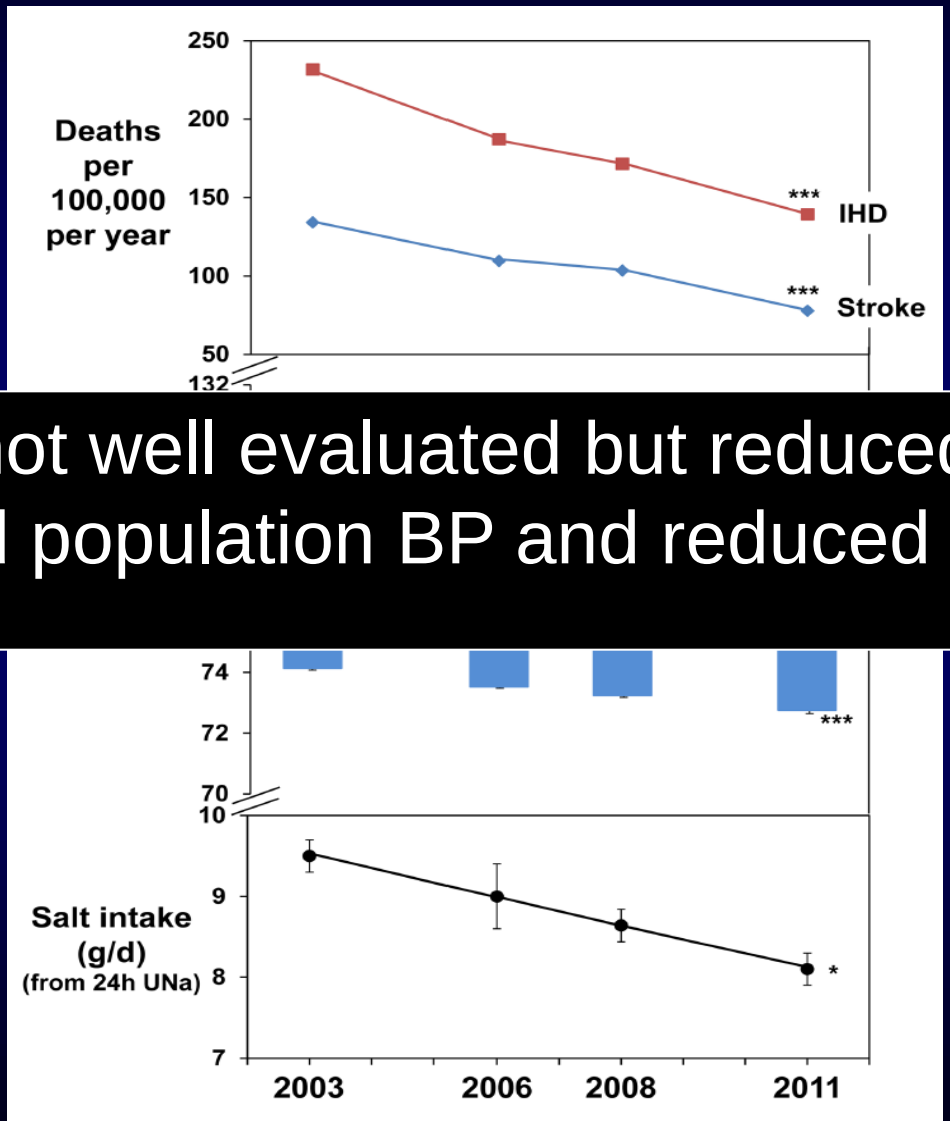
Changes in DBP, salt intake and stroke deaths in Finland



DBP **Salt** **Stroke**

Karppanen H et al Progress, Cardiovascular Disease 2006;49:59-75

Changes in CVD, blood pressure and salt consumption in the England 2003-2011



Japan not well evaluated but reduced salt intake, reduced population BP and reduced stroke

He FJ, Pombo-Rodrigues S, MacGregor GA. *BMJ Open* 2014;**4**:e004549. doi:10.1136/bmjopen-2013-004549

Discussion

- Salt intakes around the world are much higher than physiological levels that humans evolved on
- The high intakes are linked to major causes of death and disability throughout the world
- Reducing dietary salt is estimated to be one of the most effective and cost effective interventions to improve health.