



THE GEORGE INSTITUTE
for International Health



Why salt reduction matters

(为什么要减盐)

Professor Bruce Neal

Physiological need for salt

我们对盐的生理需求

- > A typical daily diet without added salt contains about 1.0g of salt (0.4g of sodium)

一般不添加食盐的日常饮食含盐量约为1克（0.4克钠）

- > 6000 years ago the Chinese discovered the preservative properties of salt

6000年以前，中国人发现食盐能使食物保鲜的特性

- > For most countries average salt consumption is now 5-10 times higher than the 1g/day we were designed for

我们的身体每人每天吃1克食盐就够了，但大部分国家的人均食盐消耗量是这个数值的5-10倍。

Changing impact on health

食盐对健康的影响在改变

- > **Salt had overall net benefit to health for several millennia**

几千年来，食盐对我们的健康一直是相对有益的

BUT

- > **With advent of refrigeration beneficial effects of salt are now outweighed by harms**

随着冷藏技术的出现，食盐对我们健康的损害已经超出于它在保存食物上给我们带来的益处了。

- > **Humans are addicted to salt**

人们对食盐上瘾了

- > **Salt is causing an enormous burden of preventable disease**

食盐造成了可预防性疾病的沉重负担

Very low salt communities

低食盐群体

South American Indian

南美洲的印第安人

- > Eats almost no salt or saturated fat, lots of fruit and vegetables, takes a lot of exercise and has a very stressful life

几乎不吃盐和饱和脂肪酸，吃很多水果和蔬菜，经常做运动，生活压力非常大。

- > Has almost no rise in BP with age

血压基本不随着年龄的增长而升高

- > Average adult BP 96/61 mmHg

成人平均血压96/61 mmHg

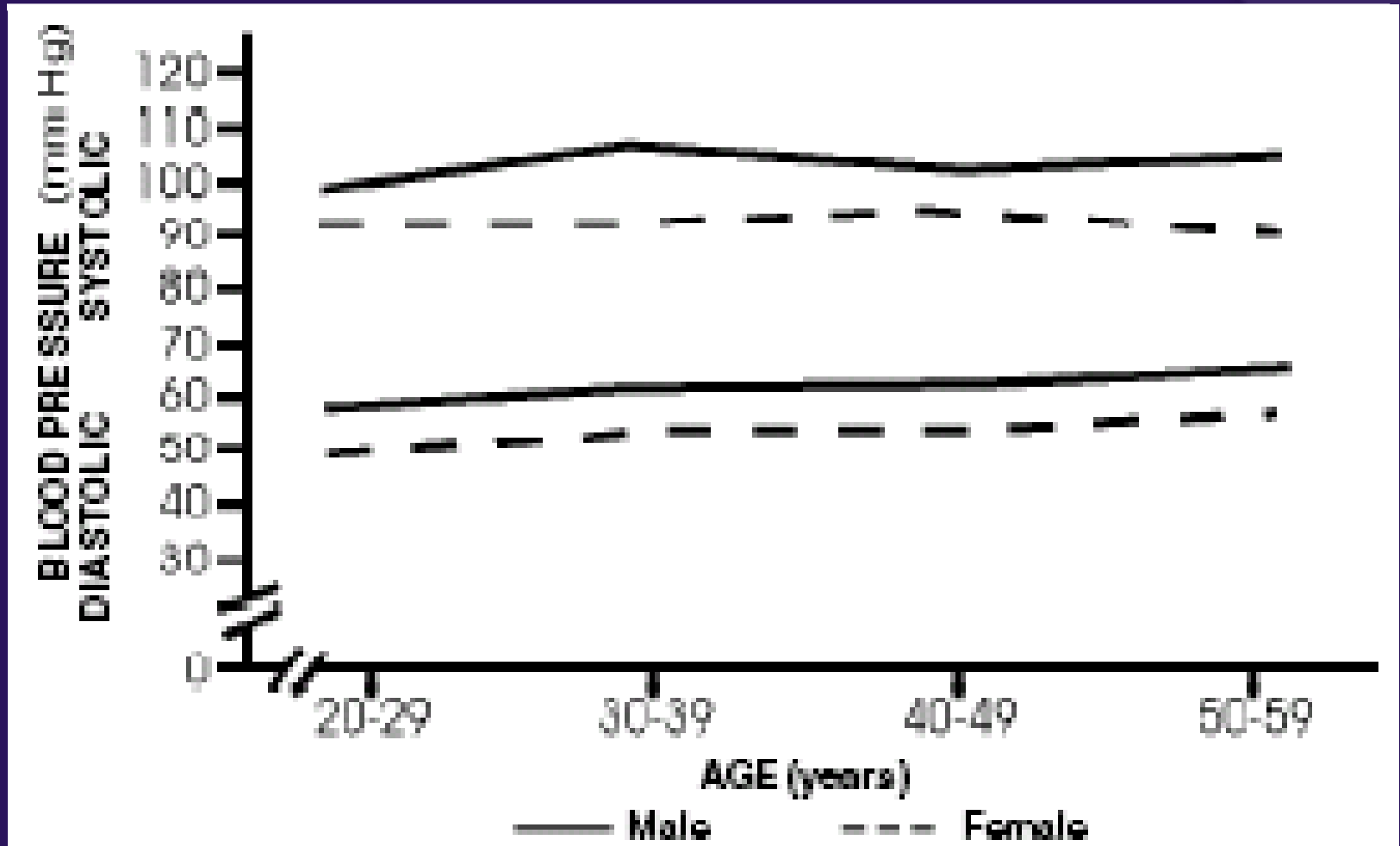
- > No vascular disease

没有血管疾病



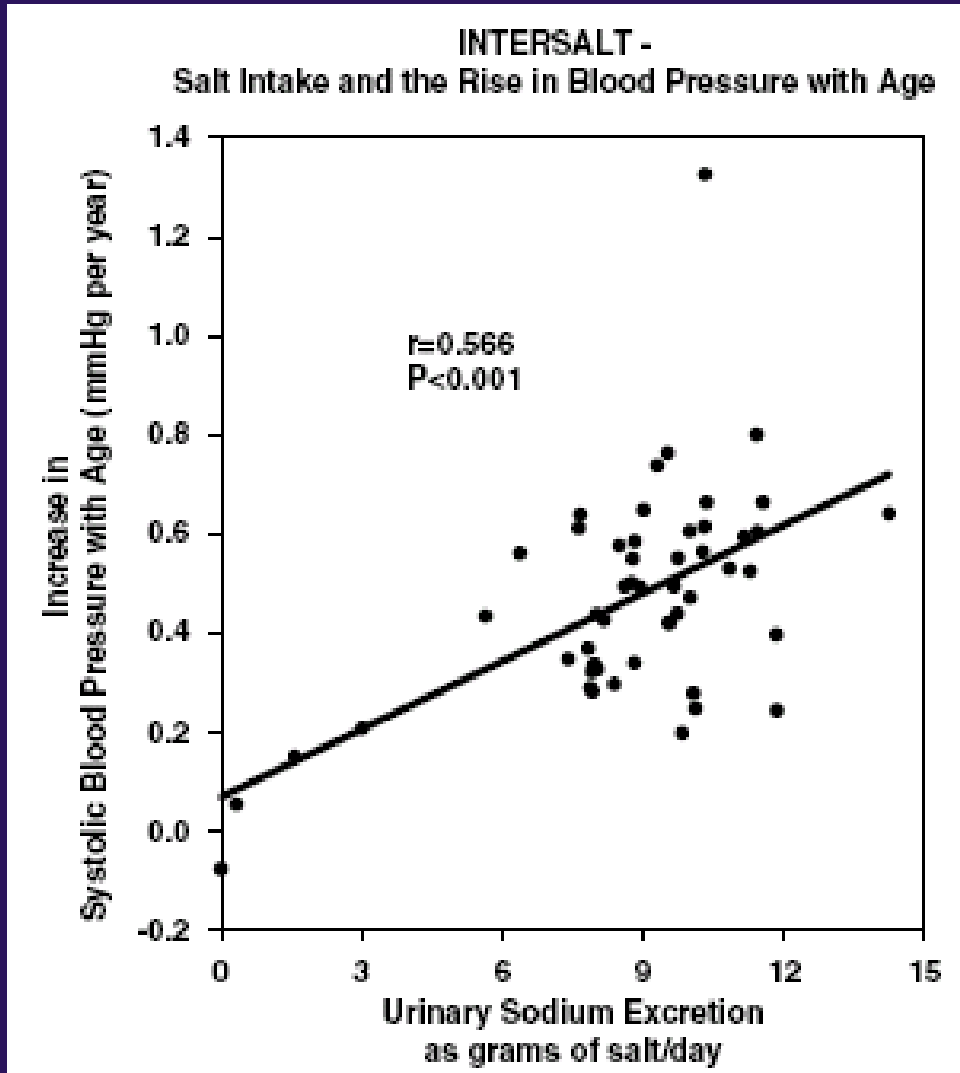
Yanomomo BP levels

雅诺马马人的 的血压水平



INTERSALT

食盐量与血压随年龄上升的关系



INTERSALT, 1988, BMJ

Long-term effects of salt

食盐的长期效应

- > **INTERSALT study done in adults suggests that chronic overexposure to salt causes a progressive rise in blood pressure with age**
在成年人中进行的**INTERSALT**研究表明，长期的吃盐过多会导致血压随着年龄的增长而升高
- > **Each additional 6g salt/day resulted in an approximate 0.5mmHg per year higher SBP**
每天食盐摄入量每增加**6g**，会导致收缩压每年升高**0.5mmHg**

The effects start in children

食盐的长期效应始于儿童期

- > **UK National Diet and Nutrition Survey of young people examined a nationally representative sample of children aged 4-18 years**

英国国家膳食营养调查对4—18岁的儿童进行了全国有代表性的抽样。

- > **In cross-sectional analyses each additional gram of salt consumed per day was associated with a 0.4 mmHg higher systolic blood pressure**

横断面分析显示，每天食盐的摄入量每增加1g，收缩压升高0.4 mmHg

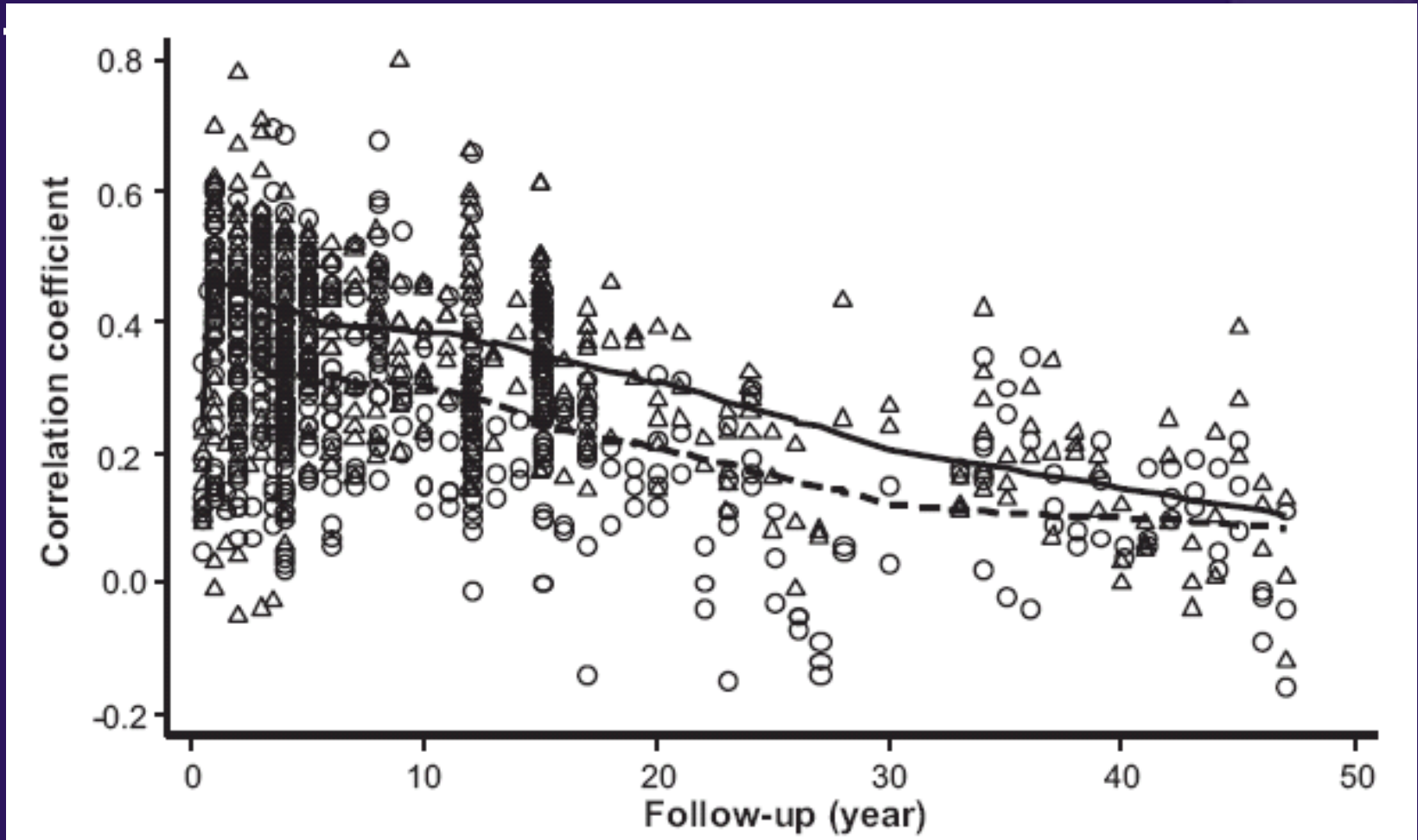
- > **Robust to multivariable adjustment, stronger with increasing age and clearly apparent at 'normal' blood pressure levels**

多变量校正以后，以上结果仍然成立。随着年龄的增长，这种变化更显著。即便在血压尚属‘正常’的范围内，这种结论也很显著。

He F et al, 2007, J Human Hypertens

Tracking

追踪随访



Excess salt and disease

过量的食盐摄入和疾病的关系

- > **Multiple cohort studies have demonstrated a positive association between salt consumption and vascular disease**

多个队列研究已经证明，食盐摄入和血管疾病之间呈正相关。

- > **Effect believed to be driven primarily by effects on blood pressure**

这种关联被认为主要来自其对血压水平的影响

- > **Some blood pressure independent effects – gastric cancer**

其它与血压无关的作用—胃癌

Short-term effects of salt reduction 减少食盐摄入的短期效果

In babies (n=476) (在婴儿中, n=476)

- > Double-blind, randomised controlled trial
双盲, 随机对照试验
- > 30% reduction in salt intake (食盐摄入量减少30%)
- > SBP reduction 2.1 mmHg ($p < 0.01$) at 6 months
6个月内, 收缩压降低了2.1 mmHg ($p < 0.01$)

In children (10 studies, 966 individuals)

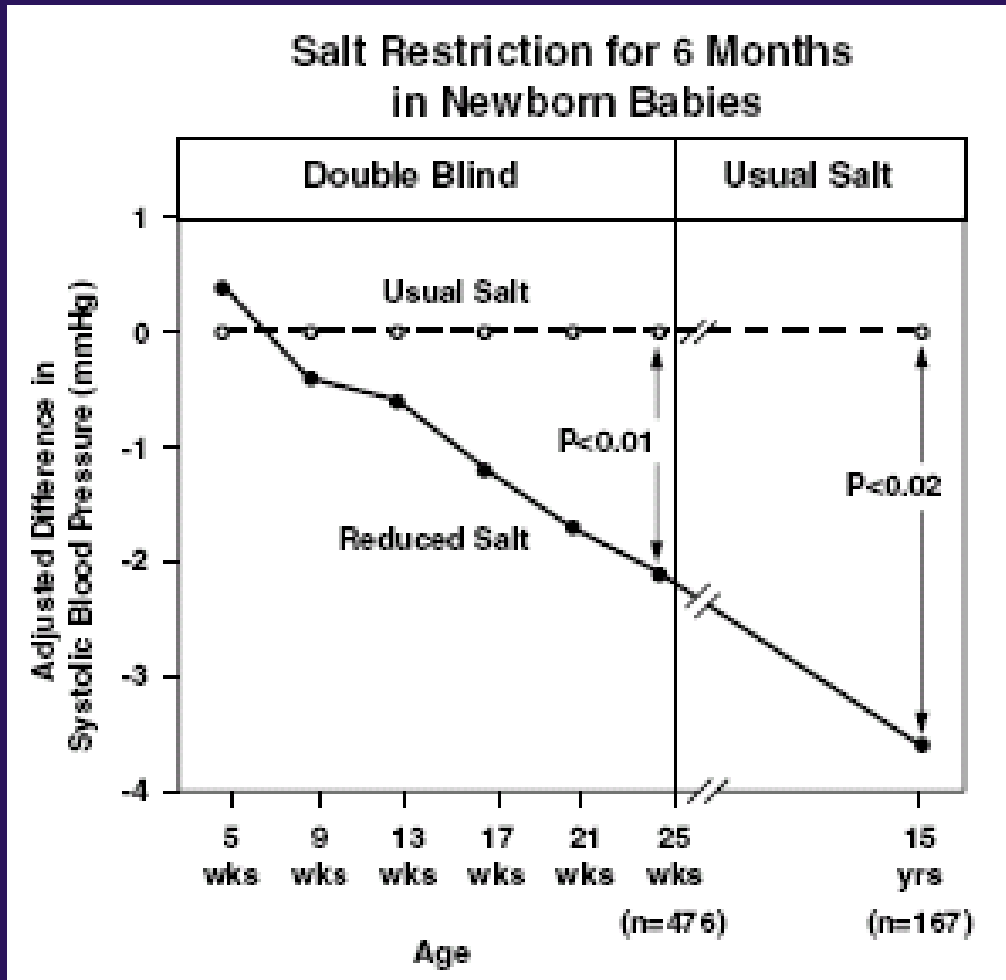
在儿童中 (10个研究, 966个儿童)

- > Meta-analysis of randomised trials
随机试验的Meta分析
- > 42% reduction in salt intake (食盐摄入量减少42%)
- > SBP reduction 1.2mmHg ($p < 0.001$) at 2 weeks
2周内, 收缩压降低了1.2mmHg ($p < 0.001$)

Hoffman A et al, 1983, JAMA
He F et al, 2006, Hypertension

Long-term effects

长期效果



新生儿中限制食盐摄入达6个月

Hoffman A et al,
1983, JAMA

Geleijnse J, 1997,
Hypertens

He F et al, 2006, J
Hum Hypertens

Effects of salt reduction in adults

减少食盐摄入在成年人中的效果

- > **Systematic overview of 28 trials**
28个临床试验的系统综述
- > **Mean urinary sodium reduction of 76 mmols/24hrs** (24小时尿钠平均降低76 mmols)
- > **Blood pressure reductions** (血压降低)
 - > **5.0/2.7 mmHg hypertensives**
高血压患者下降了5.0/2.7 mmHg
 - > **2.0/1.0 mmHg normotensives**
血压正常的人下降了2.0/1.0 mmHg
 - > **all $p < 0.001$** (所有的 $p < 0.001$)

Projected effects of salt reduction

减少食盐摄入的预期效果

- > **Reducing salt intake by 3g/day would immediately lower population**
每天的人均食盐摄入量减少**3克**将会立即降低人们的以下危险：
 - > **Stroke risk by 15%** （中风的风险下降**15%**）
 - > **CHD risk by 9%** （冠心病风险下降**9%**）
- > **Effects would get progressively larger over time**
随着时间的变化，这种效果会越来越明显
- > **Benefits would be greatest for children (although they would have to wait longest to see them)**
在儿童中的效果最为显著（尽管他们要等很久才能观察到这种效果）。
- > **No side effects**
没有副作用

He F et al, 2003, Hypertension
Neal B, 2006, WHO Geneva

Universal effects

普遍的效果

Almost every child and adult

几乎每一个儿童和成人

- > **Eats far more salt than they are designed to**
都会吃很多的盐，比他们身体应承受的量要多得多
- > **Has a blood pressure above the optimum**
血压高于最适宜的血压水平
- > **Acquires an elevated cardiovascular risk**
患心血管疾病的危险升高

Universal effects

普遍的效果

Almost every child and adult (几乎每一个儿童和成人)

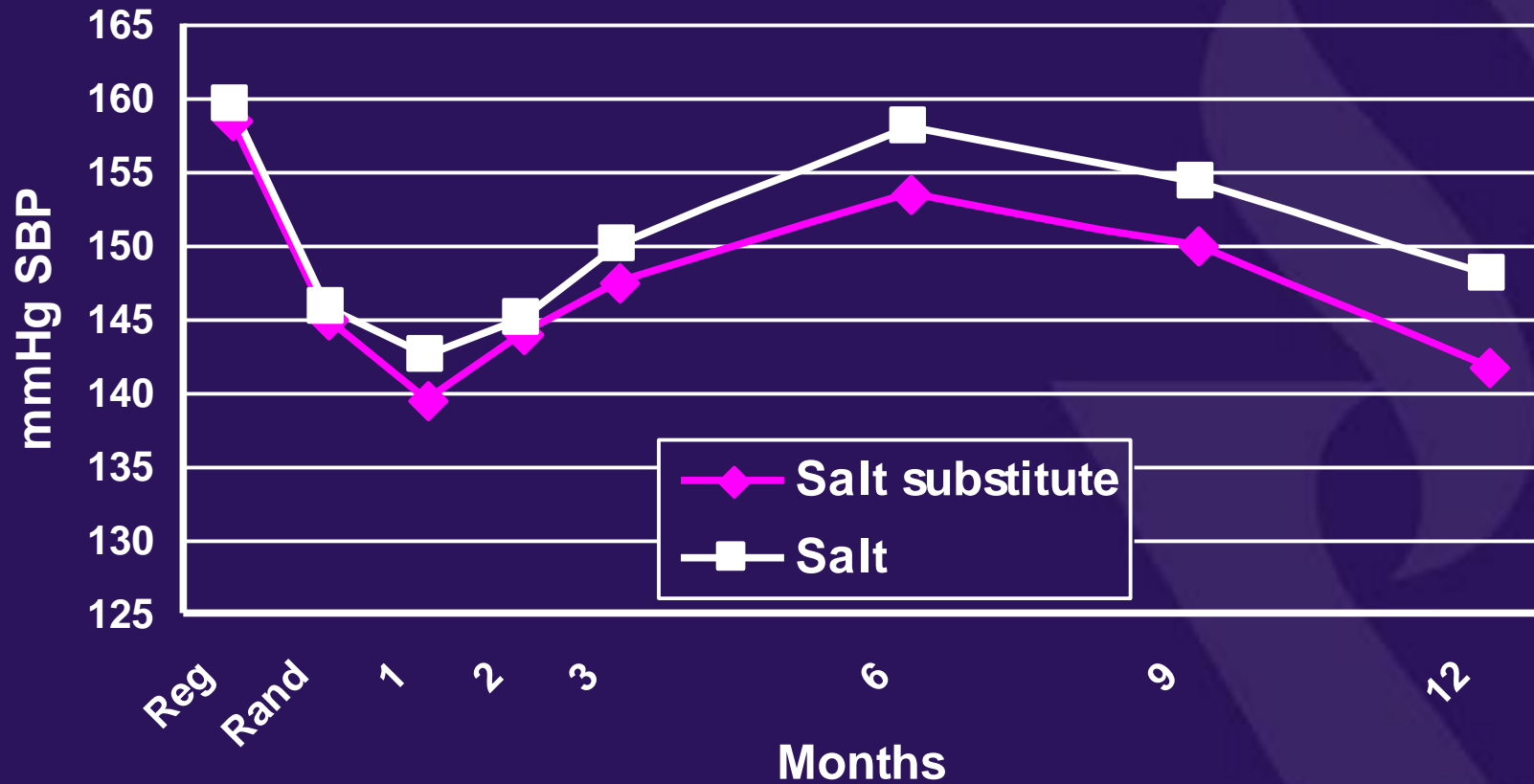
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都会吃比他们想象的要多得多的盐
- > Has a blood pressure above the optimum
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患心血管疾病的危险升高

Almost every child and adult (几乎每一个儿童和成人)

- > Could eat less salt (可以少吃一点盐)
- > Could have a lower blood pressure level (血压可以低一些)
- > Could have a reduced cardiovascular risk
可以降低患心血管疾病的危险

Effects of salt substitute on BP

代用盐对血压的影响



Effects of salt reduction on CVD

减盐对心血管疾病的影响

> TOHP I

> n=744

> Achieved Na reduction 44mmol/24hrs

(24小时尿钠下降44mmol/24hrs)

> TOHP II

> n=2382

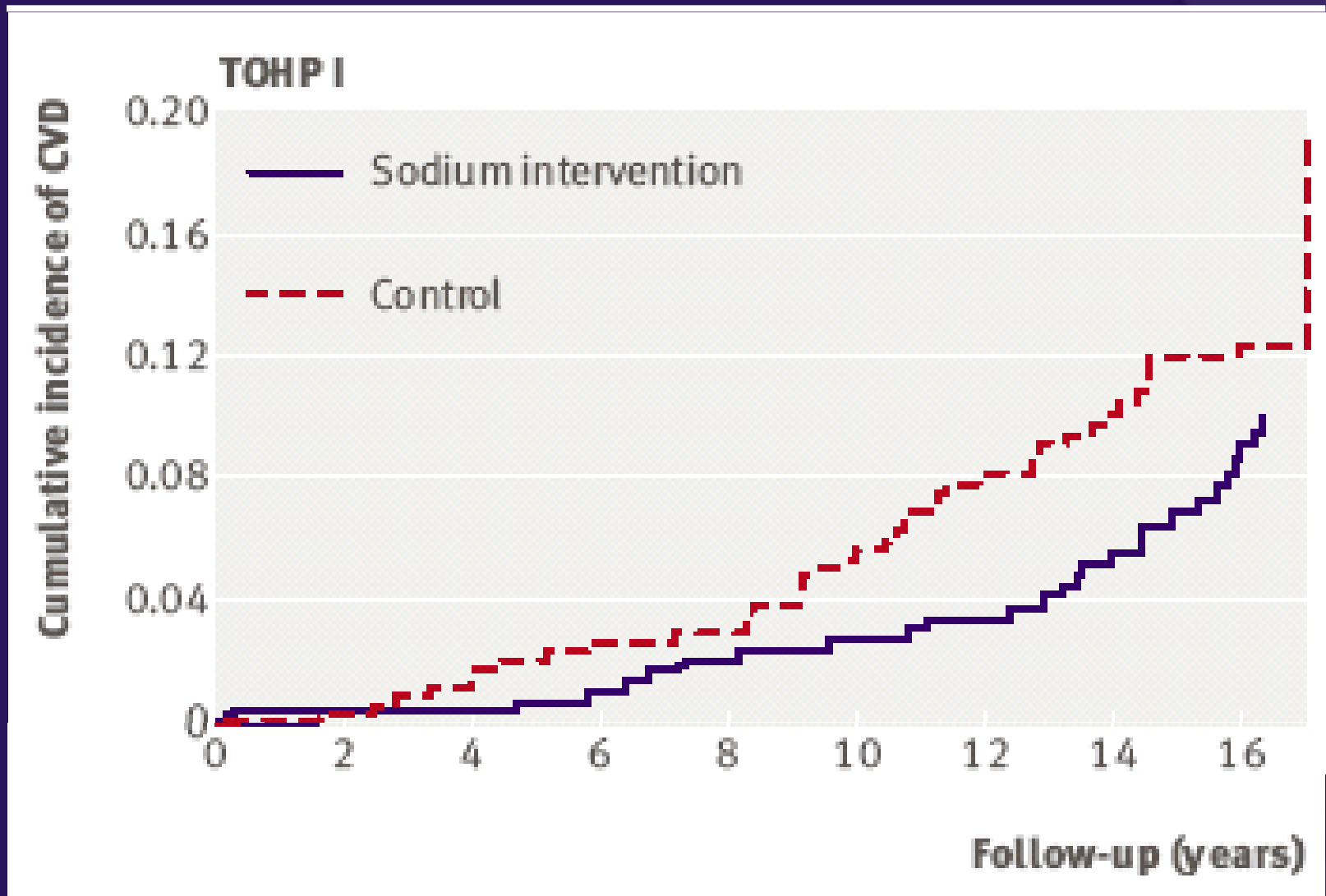
> Achieved Na reduction 33mmol/24hrs

(24小时尿钠下降33mmol/24hrs)

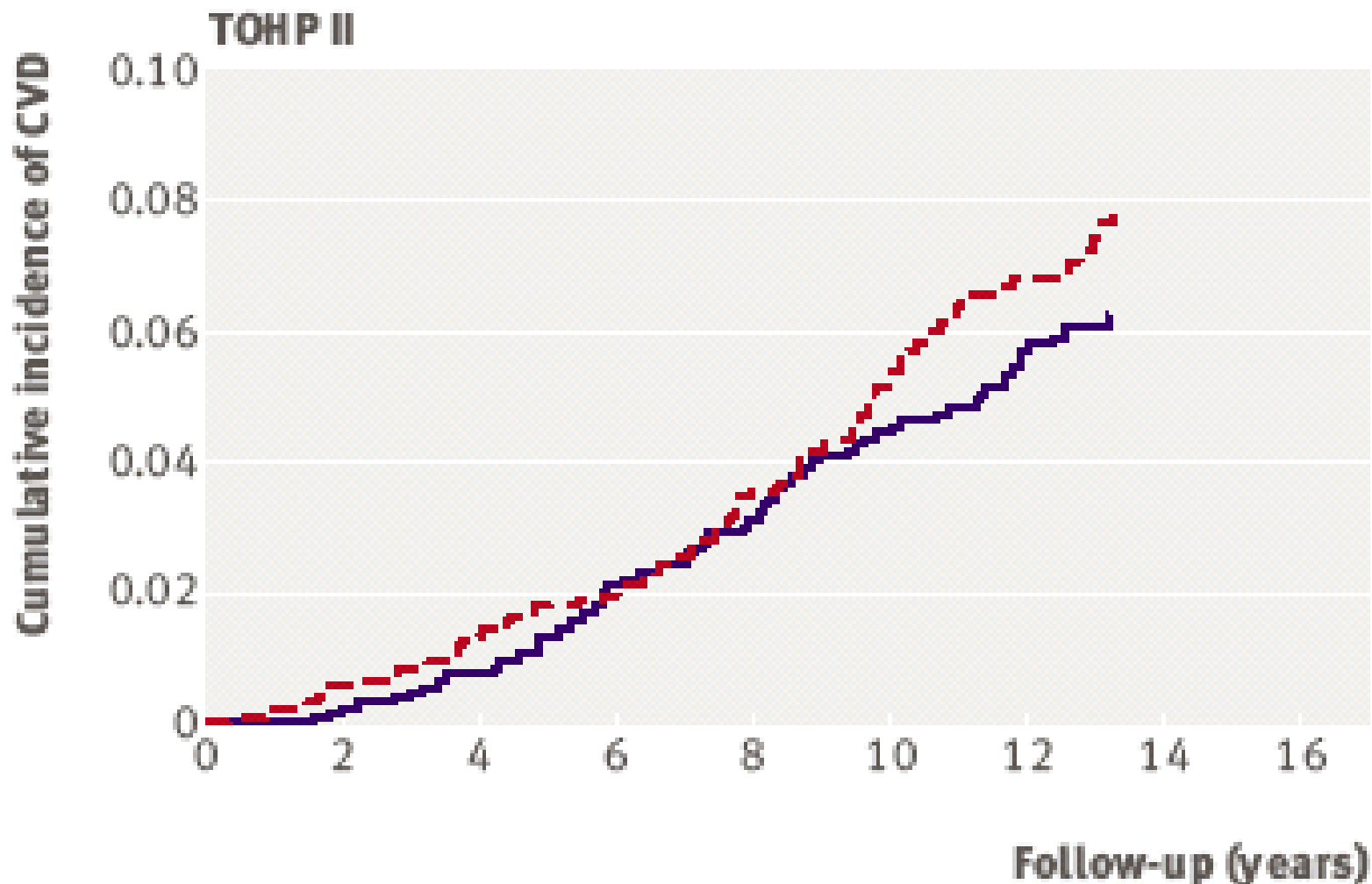
> Followed up 10-15 years after completion of original trial (77%) for cardiovascular events

在原临床试验结束后，对77%的研究对象随访10--15年，跟踪心血管疾病事件。

TOHP I



TOHP II



Overall TOHP I and II result

TOHP I 和 II 的总体结果

> **Cardiovascular risk was 25% lower in the intervention group**

心血管疾病风险在干预组中降低了**25%**

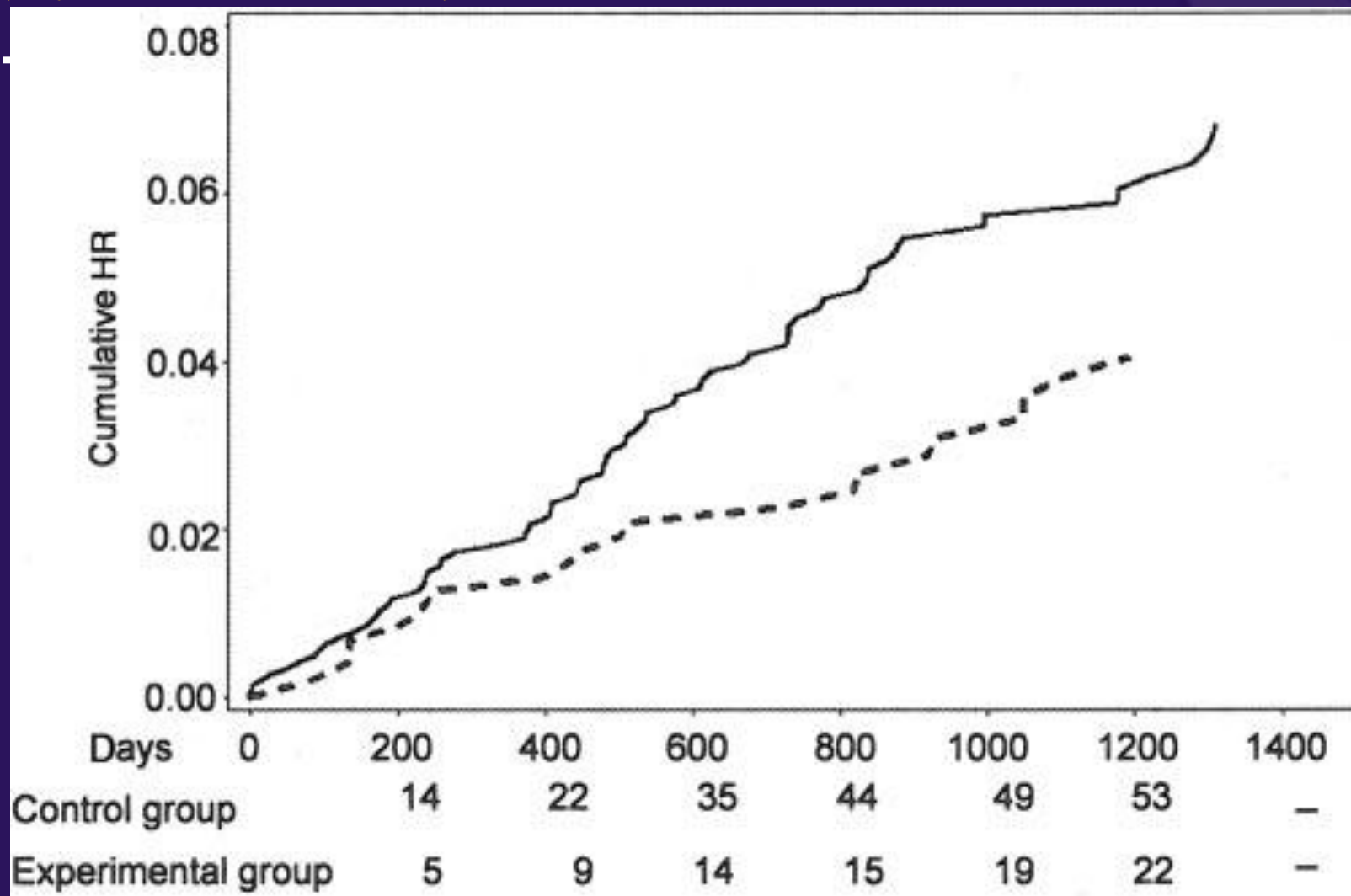
> **relative risk 0.75, (0.57 to 0.99)**

相对危险度为**0.75, (0.57 to 0.99)**

> **p=0.04**

Effects of salt substitute on CVD

代用盐对心血管疾病的影响



Costs of clinical hypertension programs (高血压的临床治疗费用)

Murray et al 2003	Europe A (West) Pop: 431 million	37 billion/year (international dollars)
Murray et al 2003	WPR A (Japan, BD, Singapore, Australia, NZ) Pop:158 million	13 billion/year (international dollars)
Gandjour A, Stock S, 2007	Germany Pop: 82 million	A\$4 billion/year
Neal 2009	Australia Pop: 21 million	A\$1 billion/year

Costs of population-based salt reduction (用于人群的减盐花费)

Selmer 2000	Norway Pop: 5 million	A\$28 million/year (inc \$15mil/year welfare losses)
Neal 2007	Australia Pop: 21 million	A\$10-20 million/year
Murray et al 2003	Europe Region Pop: 431 million	500 million international dollars
Murray et al 2003	WPR A (Japan, BD, Singapore, Australia, NZ) Pop:158 million	274 million international dollars
Asaria et al 2007	23 countries	\$0.04 to \$0.32 US dollars per person

Effects in the US population

对美国人群的影响

- > **3g population-wide reduction in salt consumption would produce up to:**
 - 人们的食盐摄入减少3克将会产生以下效果:
 - > 120,000 less cases of CHD (冠心病将减少120,000)
 - > 66,000 less strokes (中风将减少66,000)
 - > 92,000 less deaths (死亡人数将减少92,000)
- > **Cost-saving (even if only 1g achieved over 10 years)**
节约费用 (即使十年中只减少1克)
- > **Much more cost effective than drugs for hypertension** (成本效益远高于使用高血压药物)
- > **Similar benefits as might be accrued from halving smoking** (效果可与吸烟量减半相提并论)

Conclusion

结论

- > **Almost everyone eats too much salt**
几乎每个人都吃盐太多
- > **Very clear evidence that salt causes much serious premature disease**
明确的证据证实：食盐导致很多严重的疾病提早发生
- > **The science clearly shows that salt reduction will produce important health benefits**
科学研究显示：减少食盐摄入会带来重大的健康效益
- > **The population health gains will be large**
人群将获得巨大的健康收益
- > **The overall cost will be low**（总成本将会降低）
- > **The cost-effectiveness will be very favorable**
成本效益将会非常令人满意



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为什么要减盐

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