

Fatal and Nonfatal Outcomes, Incidence of Hypertension, and Blood Pressure Changes in Relation to Urinary Sodium Excretion

Katarzyna Stolarz-Skrzypek, MD, PhD

Tatiana Kuznetsova, MD, PhD

Lutgarde Thijs, MSc

Valérie Tikhonoff, MD, PhD

Jitka Seidlerová, MD, PhD

Tom Richart, MD

Yu Jin, MD

Agnieszka Olszanecka, MD, PhD

Sofia Malyutina, MD, PhD

Edoardo Casiglia, MD, PhD

Jan Filipovský, MD, PhD

Kalina Kawecka-Jaszcz, MD, PhD

Yuri Nikitin, MD, PhD

Jan A. Staessen, MD, PhD

for the European Project on Genes in Hypertension (EPOGH) Investigators



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Contexte : World Action Salt Hypertension



Intersalt study: relation sodium-BP

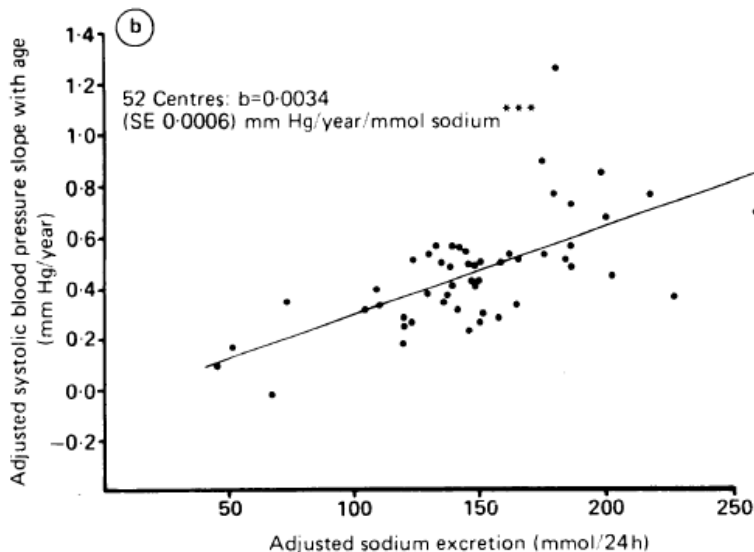
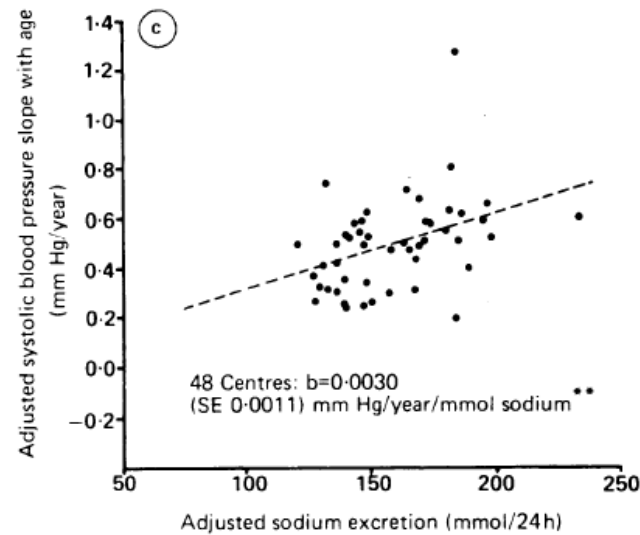
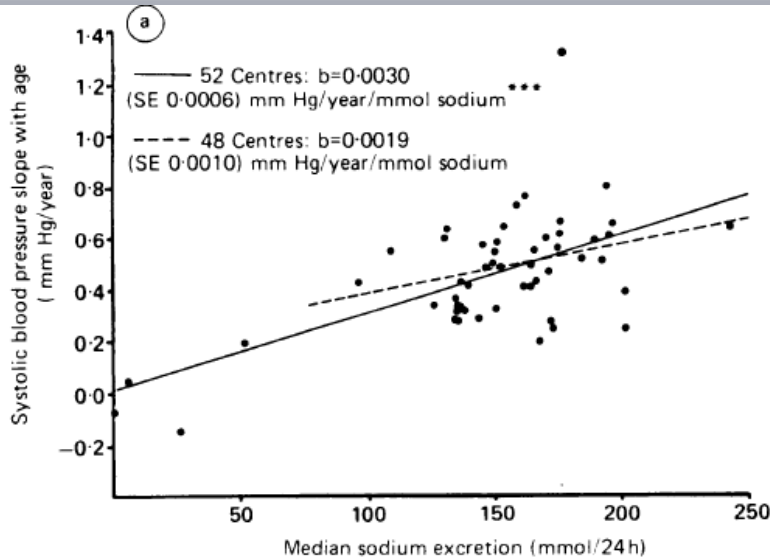
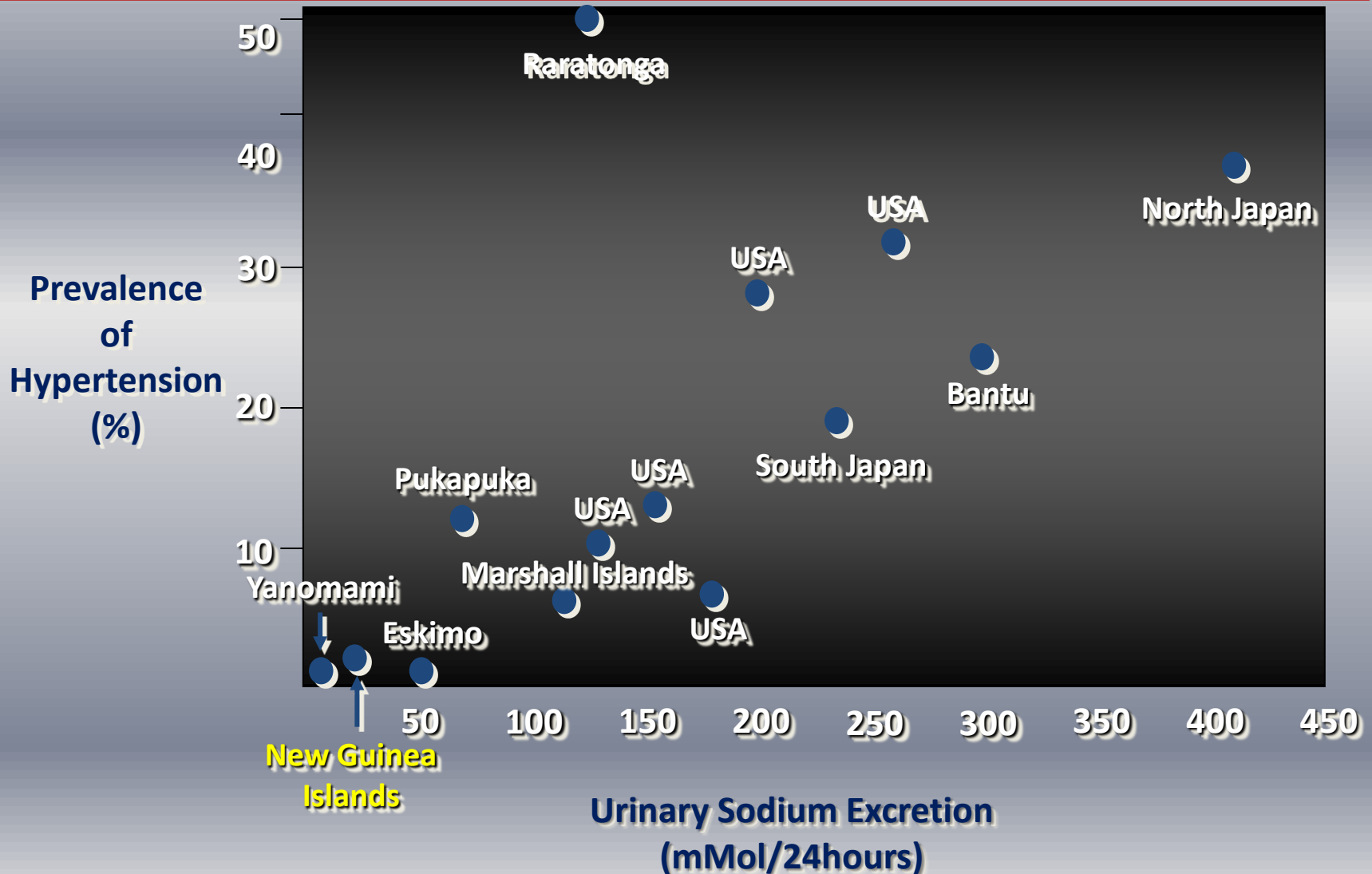
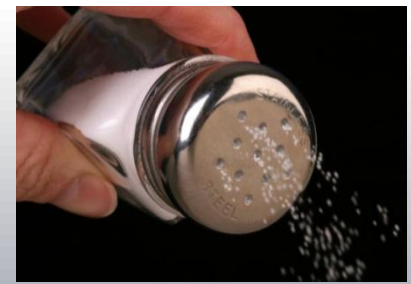


FIG 1—Cross centre plots of systolic blood pressure slope with age and median sodium excretion and fitted regression lines for 52 and 48 centres: (a) standardised for age and sex; (b) also adjusted for body mass index and alcohol intake (52 centres); (c) also adjusted for body mass index and alcohol intake (48 centres)
* $p<0.05$; ** $p<0.01$; *** $p<0.001$

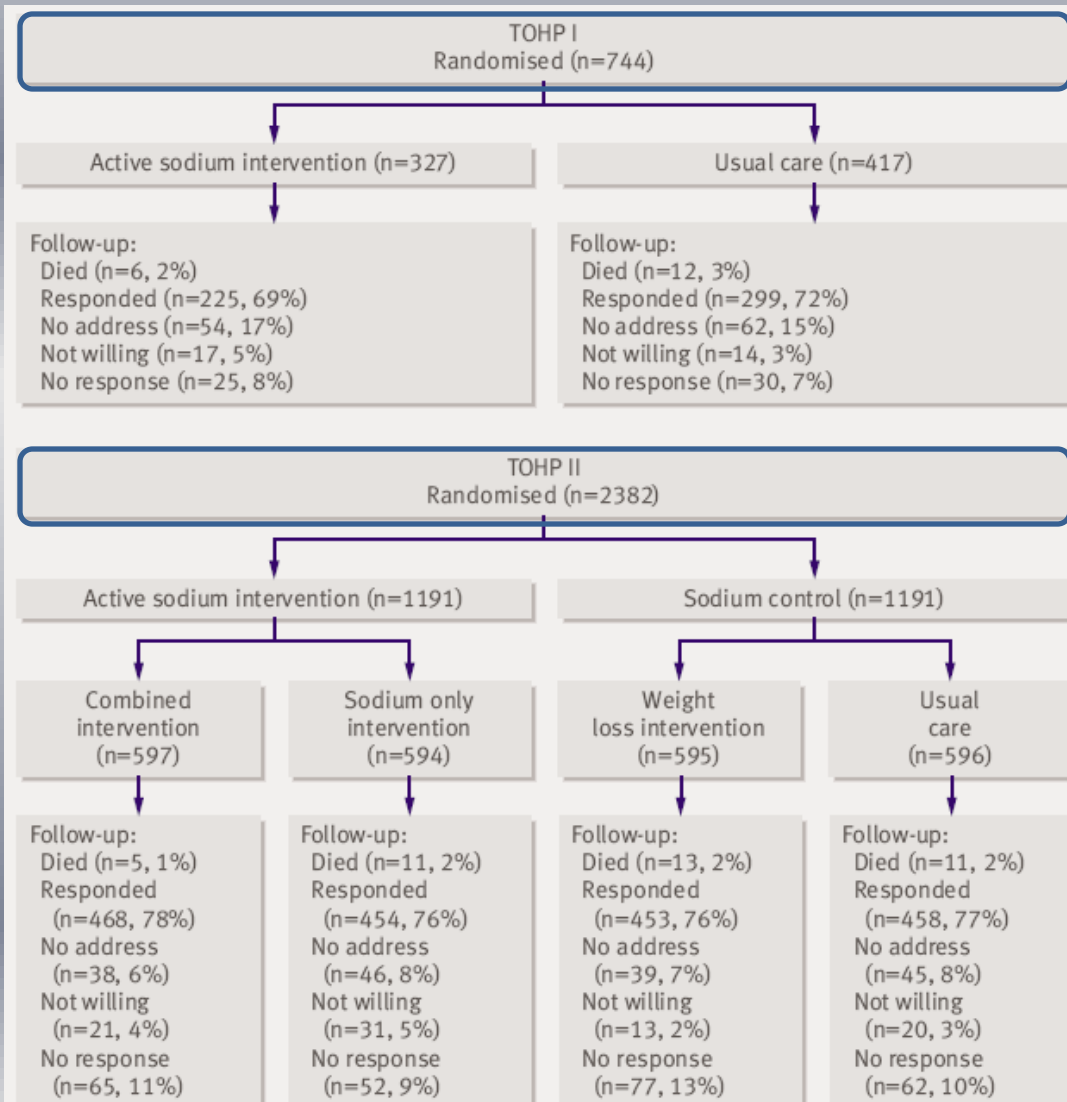
52 centers
N=10079
Age 20-59 yo

E_{Na} 0.2-242mmol/24h

Salt intake and BP



TOHP I et II: effect sodium restriction-BP



Dietary sodium reduction

TOHP I:

44mmol/24h

18 months

TOHP II:

33mmol/24h

36-48 months



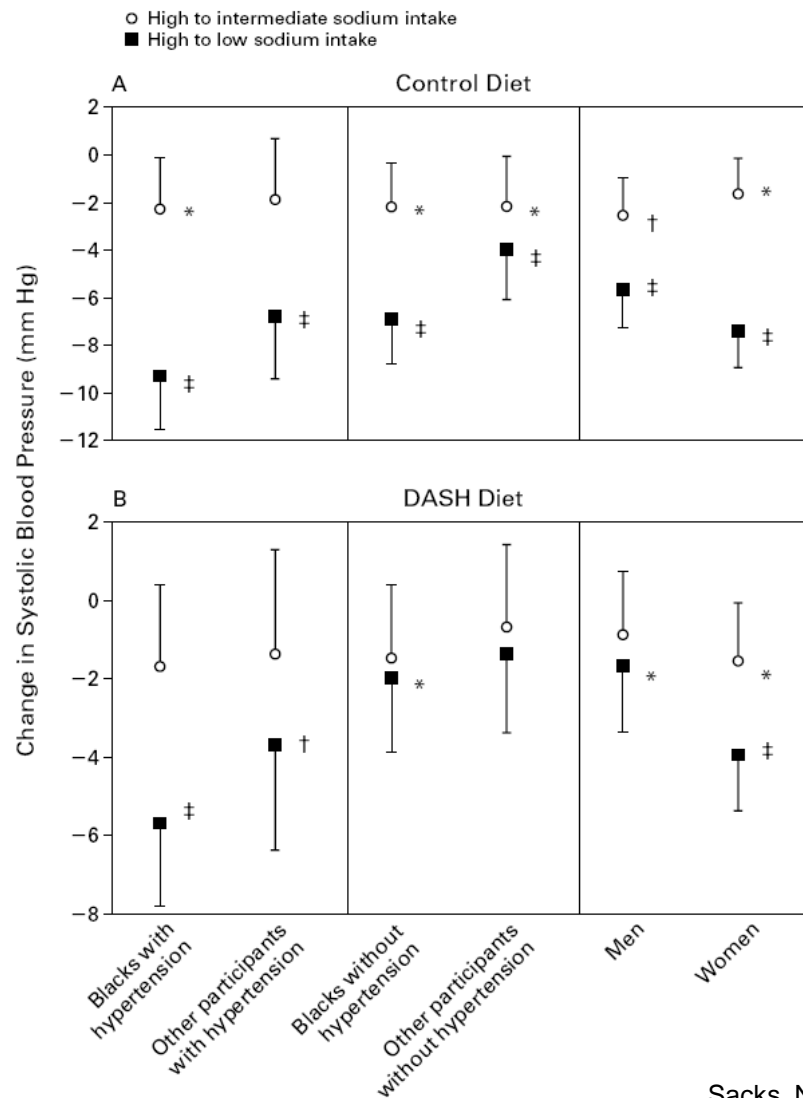
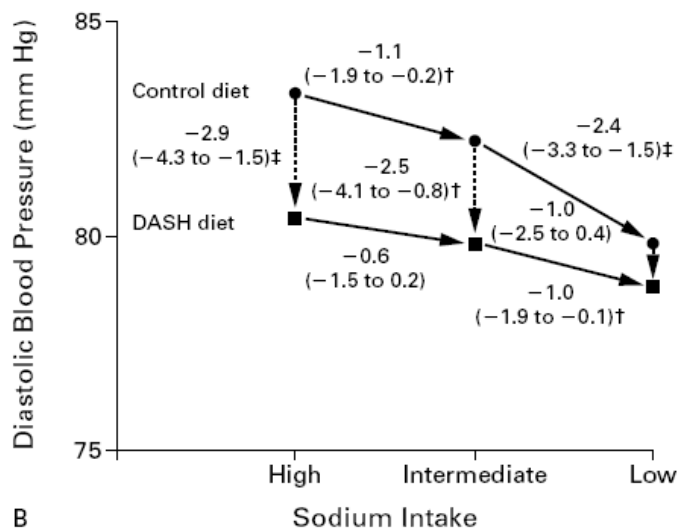
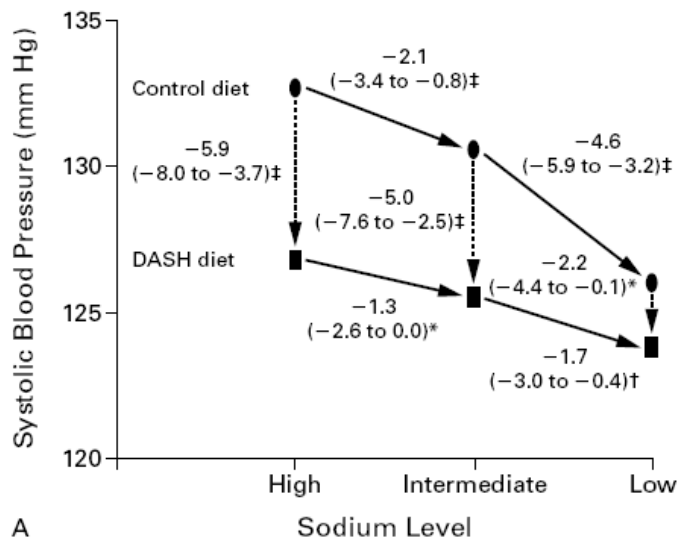
TOHP I ↓ 1.7/0.9mmHg

TOHP II ↓ 2.9/1.6mmHg (6m)

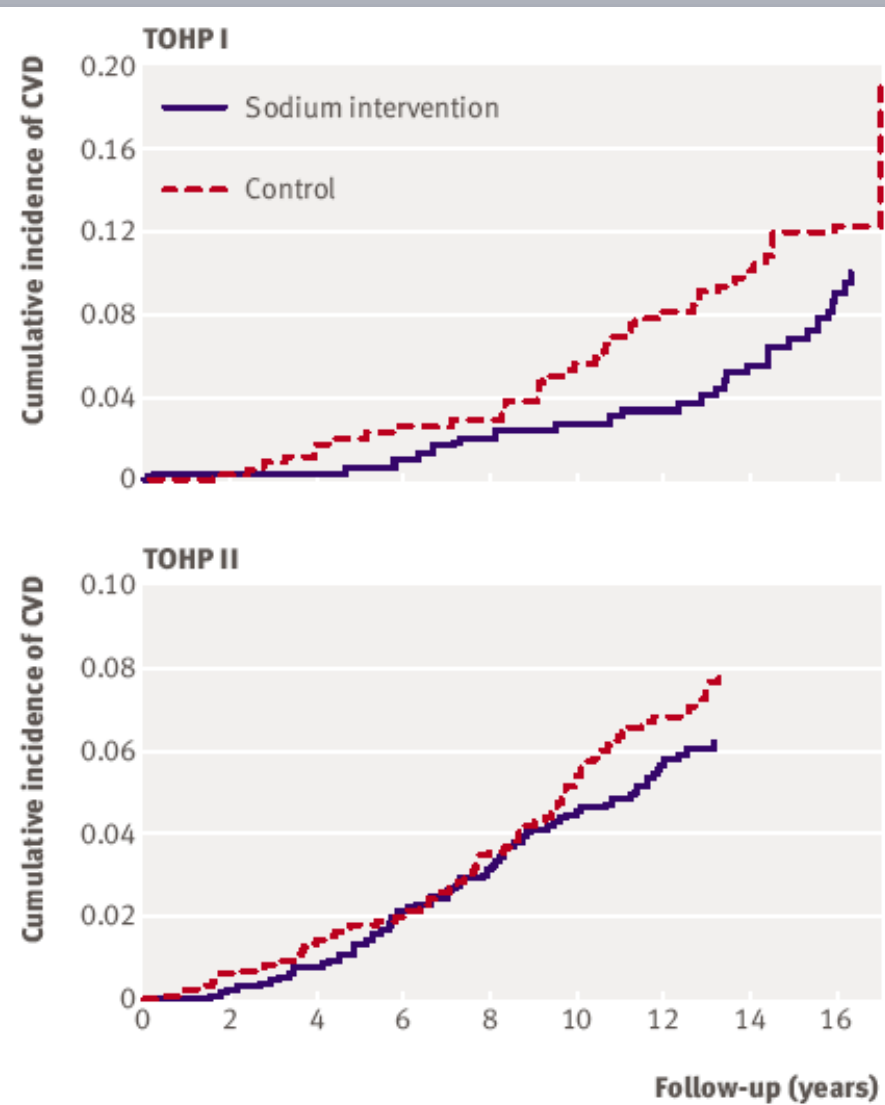
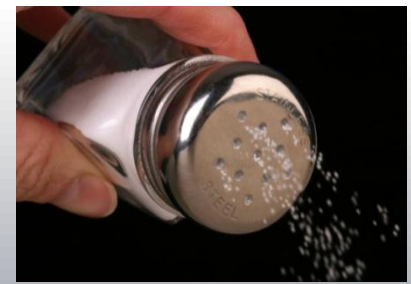
↓ 1.2/0.7mmHg (36m)

RR HTA 48m interv. = 0.78-0.82

Dietary Approach Stop Hypertension



TOHP: long term effects on CV disease



RR intervention 0.75 (0.57-0.99, $p=0.04$)
→ Risk reduction 25% adjusted

« Sodium reduction previously shown to lower blood pressure, may also reduce long term risk of cardiovascular events »

Guidelines sodium intake



- JNC 7: 100mmol/d
- ESH 2007: < 85mmol/d
- ADA: sodium restriction
- KDOQI: <100mmol/d
- WASH: max salt intake 5g/d

!!! CALL FOR SODIUM REDUCTION!!!

Fatal and Nonfatal Outcomes, Incidence of Hypertension, and Blood Pressure Changes in Relation to Urinary Sodium Excretion

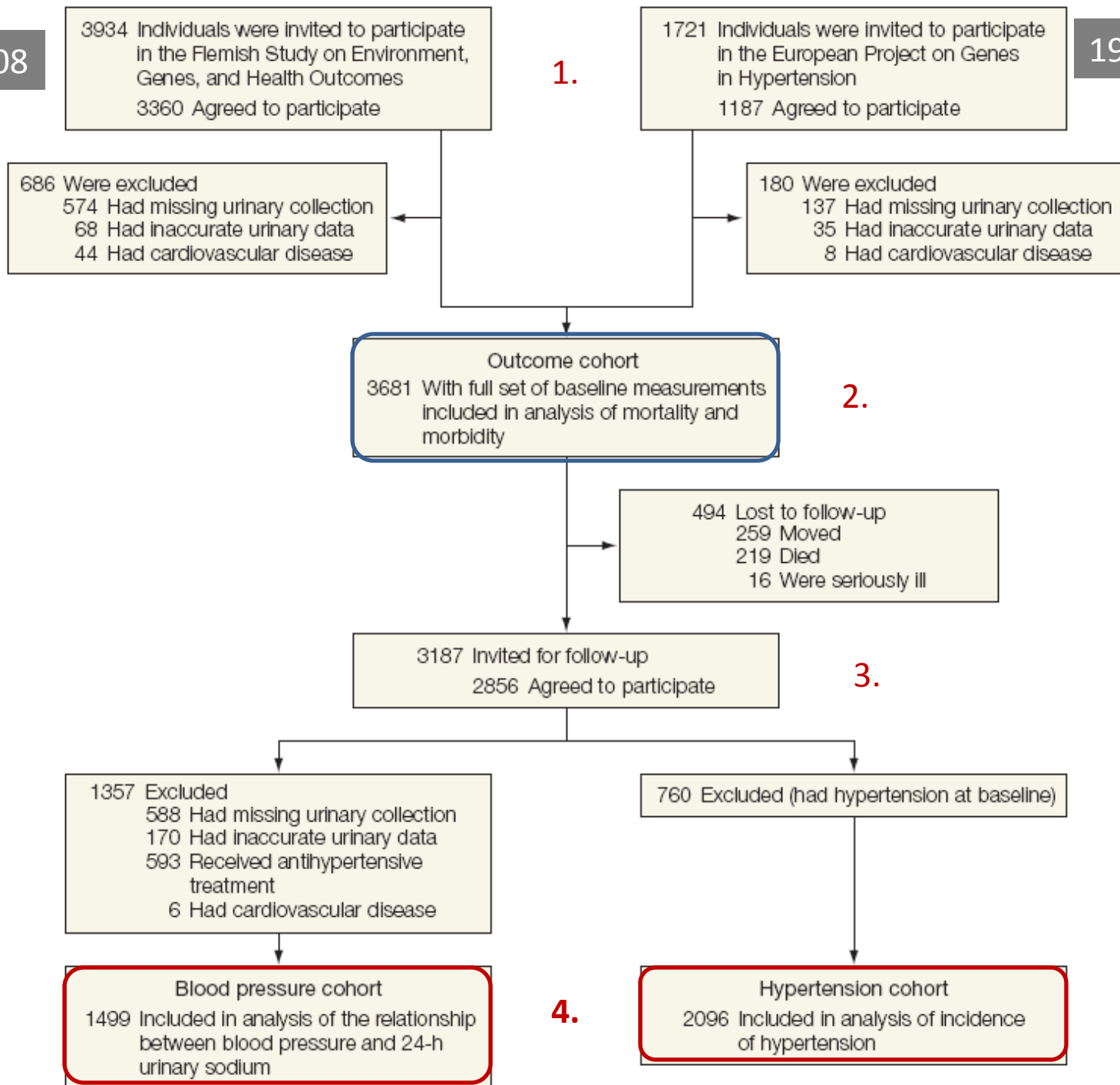
«Assumption that lower BP, to our knowledge, has not yet been confirmed in longitudinal population-based study...»

European population based study

- Incidence of mortality/morbidity + HTA
- Relation to 24h urine sodium excretion
- Association BP-24h urinary sodium excretion

1985→2008

1999→2008



Method - measures

- BP office : 5 consecutive readings
- Mercury sphygmomanometer
- Cuff size adapted to arm girth
- HTA definition: $>140/90$ mmHg or drugs

- 1x24h urine collection (2.5l container):
Na, K, creat

Innaccurate if: volume <300 ml/24h

creat <4 or > 25 mmol Women

creat <6 or >30 mmol Men

Method – outcome assessment

- Vital status : cause of death (ICD code)
- Non fatal events

Stroke (except transient)

Cardiovascular events (stroke, coronary endpoints, left ventricular failure, aortic aneurism, cor pulmonale, arterial embolism)

Censored after 1st event

Table 1. Baseline Characteristics of Study Participants by Cohort^a

Characteristics	Cohort		
	Outcome (n = 3681)	Hypertension (n = 2096)	Blood Pressure (n = 1499)
Follow-up, median (IQR), y	7.93 (6.35-17.20)	6.48 (5.13-9.19)	6.14 (5.14-7.93)
Participant characteristics, No. (%)			
FLEMENGHO	2674 (72.6)	1644 (78.4)	1109 (74.0)
EPOGH	1007 (27.4)	452 (21.6)	390 (26.0)
Women	1941 (52.7)	1133 (54.1)	786 (52.4)
Hypertension	949 (25.8)		148 (9.9)
Diabetes mellitus	152 (4.1)	40 (1.9)	29 (1.9)
Antihypertensive treatment	443 (12.0)		
Use of female sex hormones	381 (10.4)	250 (11.9)	165 (11.0)
Use of NSAIDs	502 (13.6)	283 (13.5)	185 (12.3)
Educational attainment, No. (%)			
≤Elementary school	1210 (32.9)	679 (32.4)	437 (29.1)
Secondary school	1896 (51.5)	1118 (53.3)	854 (57.0)
Higher education	575 (15.6)	299 (14.3)	208 (13.9)
Smokers, No. (%)	1044 (28.4)	653 (31.2)	455 (30.4)
Alcohol intake ≥5 g/d, No. (%)	886 (24.1)	465 (22.2)	345 (23.0)
Characteristic, mean (SD)			
Age, y	40.9 (16.3)	38.6 (14.6)	38.3 (14.2)
Blood pressure, mm Hg ^b			
Systolic	124.7 (17.1)	118.7 (10.4)	120.9 (12.8)
Diastolic	76.3 (10.6)	73.3 (8.0)	74.6 (8.9)
BMI	25.2 (4.6)	24.5 (4.0)	24.6 (4.0)
Total cholesterol, mg/dL	209 (46)	207 (46)	207 (42)
24-h urinary measurements, mean (SD)			
Duration, h:m	23:52 (00:59)	23:51 (01:02)	23:48 (01:08)
Volume, l	1.52 (0.64)	1.52 (0.65)	1.54 (0.65)
Sodium, mmol	178.0 (74.8)	174.2 (74.1)	172.7 (62.5)
Potassium, mmol	66.2 (26.3)	66.8 (25.5)	66.3 (22.4)
Sodium-to-potassium ratio	2.93 (1.56)	2.81 (1.27)	2.78 (1.12)
Creatinine, mmol	11.6 (3.9)	11.7 (3.8)	11.9 (3.7)

Results - outcome

Outcome cohort (n= 3681).

Median follow-up: 7.9y

Death: 219

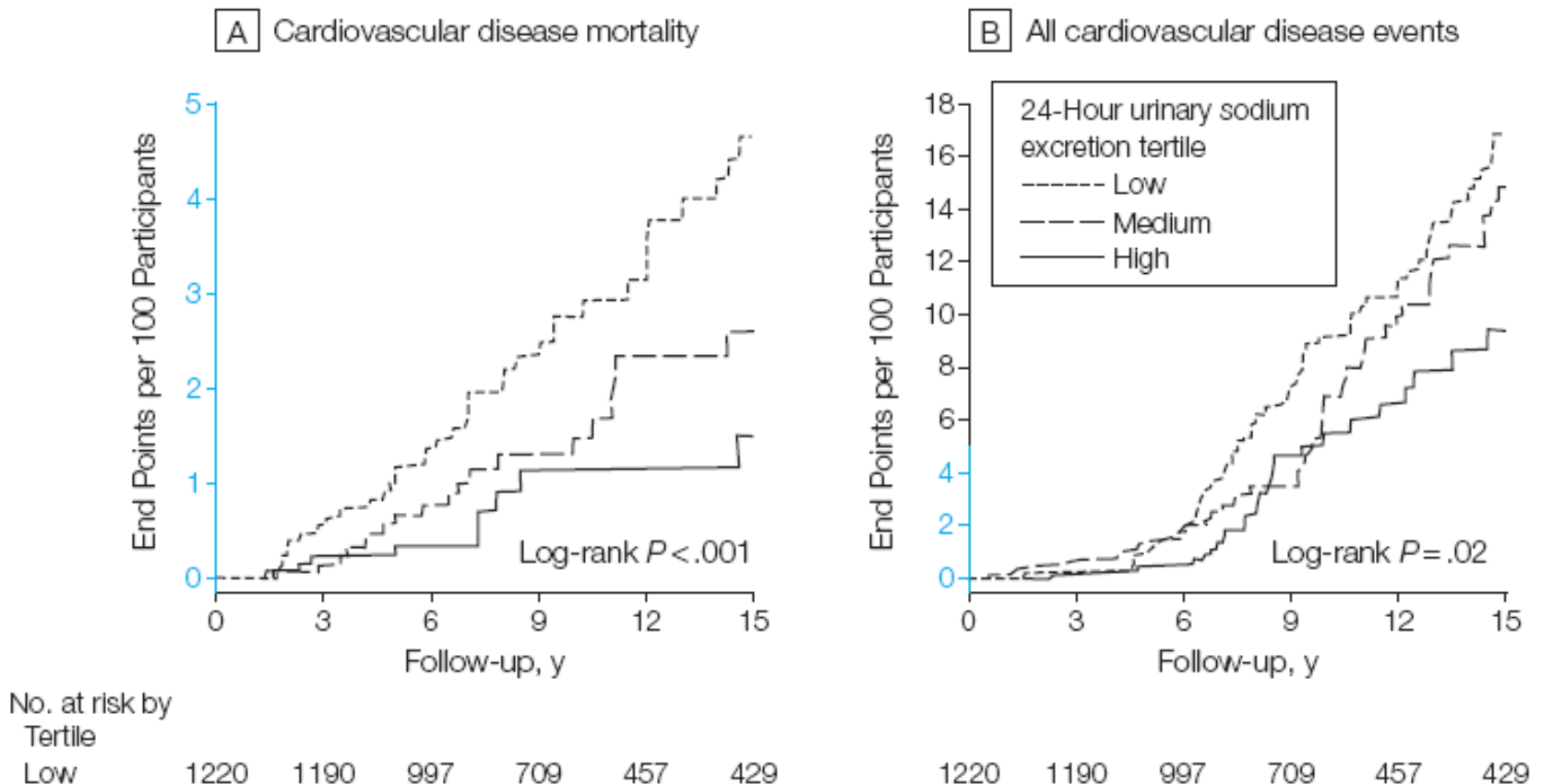
5.84 cardiovascular events-years

24-Hour Urinary Sodium Excretion Tertiles at Baseline

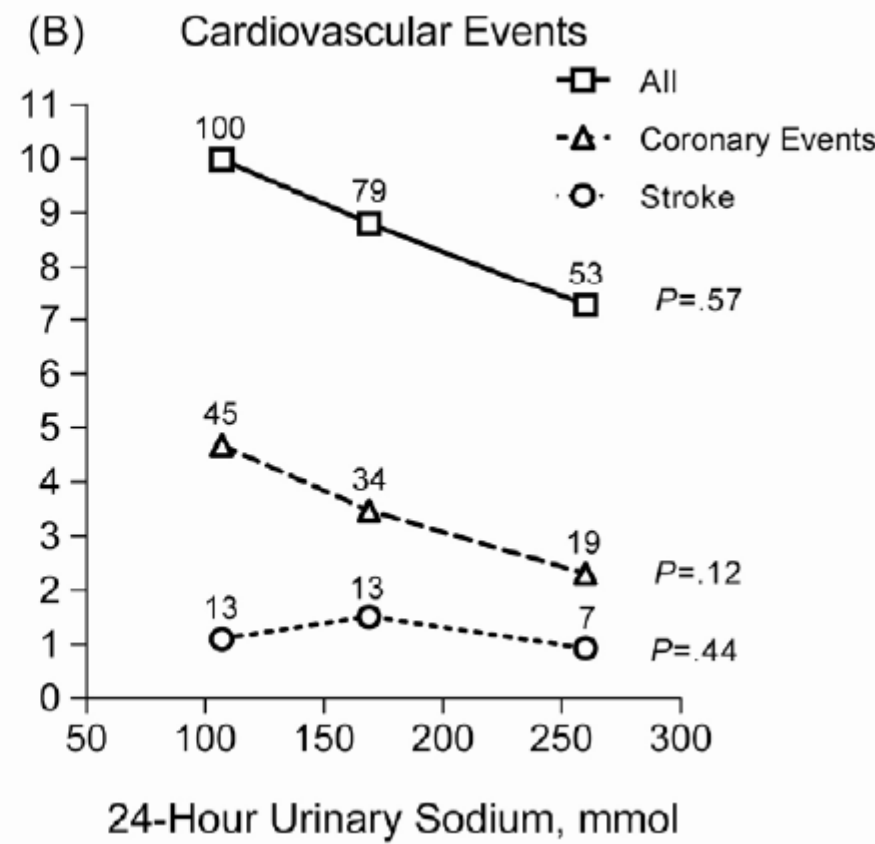
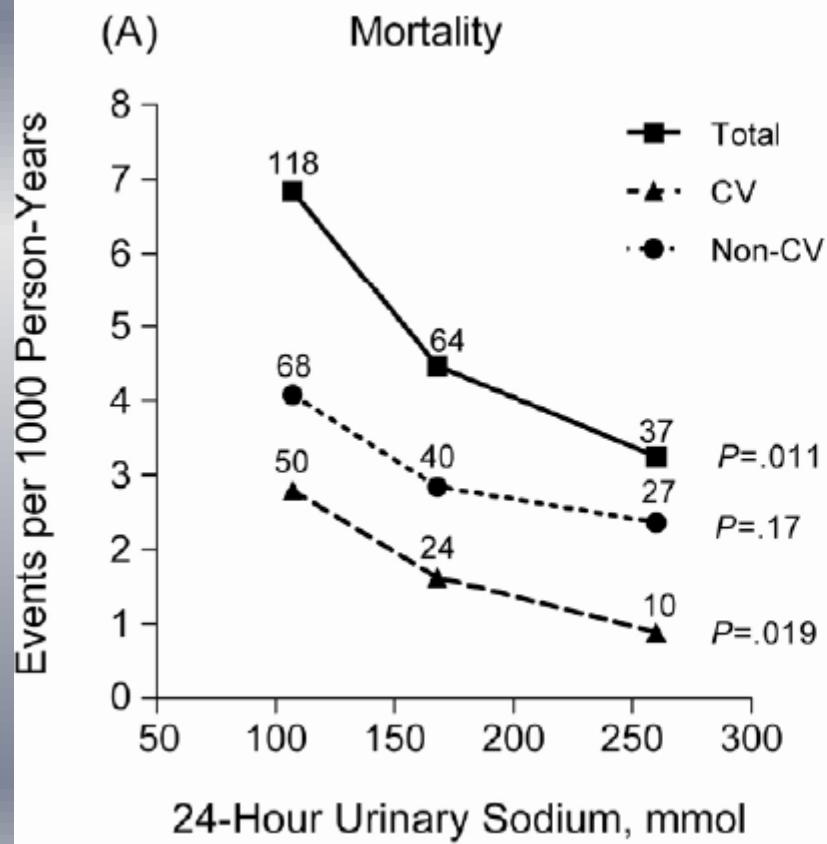
	Low (n = 1220)	Medium (n = 1250)	High (n = 1211)
No. of women	645	658	638
Range, mmol	50-126	127-177	178-400
Mean (SD), mmol	95.1 (22.0)	150.2 (15.0)	231.7 (50.9)
No. of men	575	592	573
Range, mmol	50-158	159-221	222-400
Mean (SD), mmol	120.1 (28.4)	188.8 (17.6)	290.5 (56.2)
Mean Nau defined	106	165	250
Mean volume, L	1.37 (0.64)	1.51 (0.62)	1.67 (0.65)
Mean creat u, mmol	8.4 (2.2)	9.5 (2.0)	10.6 (2.5)

Results – CV endpoints

Figure 2. Kaplan-Meier Survival Function Estimates for Cardiovascular Mortality and All Cardiovascular Events



Cardiovascular death or events decrease with increase of sodium excretion



Cardiovascular mortality increases in the lower tertile : HR 1.56

LOW

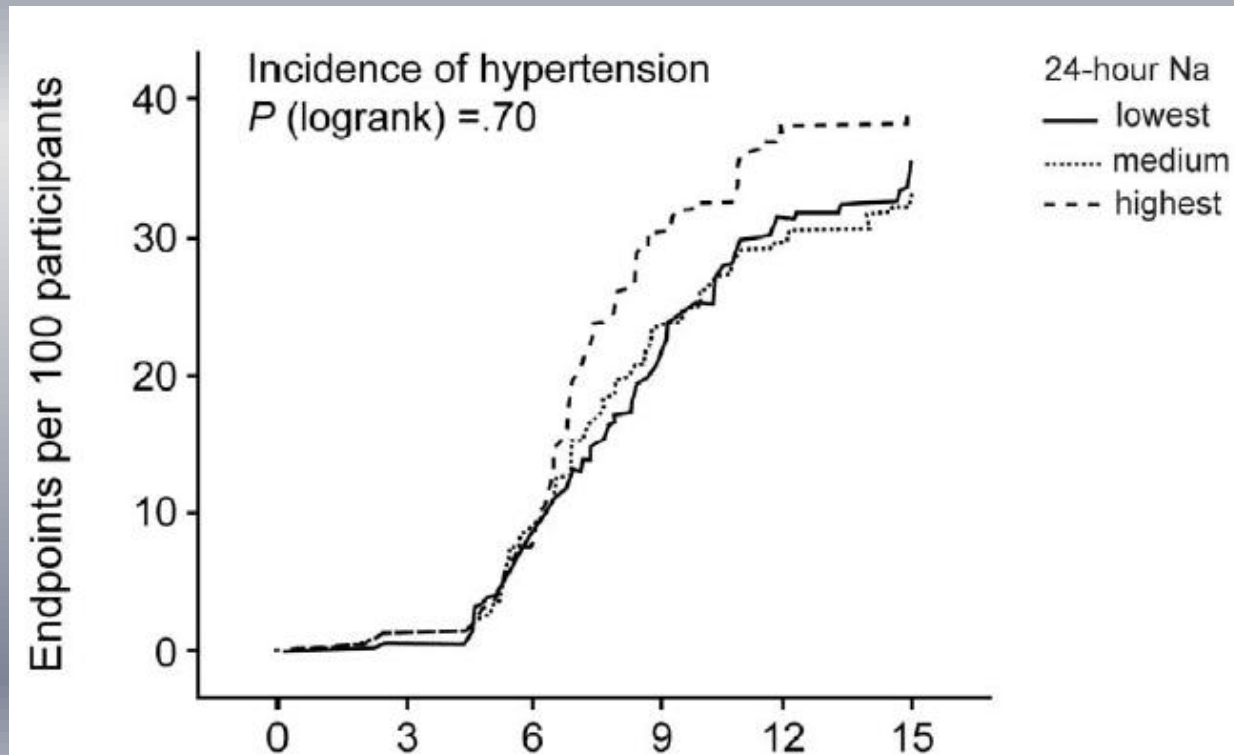
MEDIUM

HIGH

	Total No. of Events of Outcome Cohort	No. of Events	Adjusted HR (95% CI) ^a	No. of Events	Adjusted HR (95% CI) ^a	No. of Events	Adjusted HR (95% CI) ^a	<i>P</i> Value
Mortality								
All causes	219	118	1.14 (0.87-1.50)	64	0.94 (0.75-1.18)	37	1.06 (0.84-1.33)	.10
Cardiovascular	84	50	1.56 (1.02-2.36) ^b	24	1.05 (0.72-1.53)	10	0.95 (0.66-1.38)	.02
Noncardiovascular	135	68	0.98 (0.71-1.36)	40	0.90 (0.68-1.20)	27	1.11 (0.83-1.47)	.64
Fatal and nonfatal events								
All cardiovascular	232	100	1.13 (0.90-1.42)	79	1.11 (0.90-1.36)	53	0.90 (0.73-1.11)	.55
Coronary	98	45	1.42 (0.99-2.04)	34	1.17 (0.89-1.54)	19	0.86 (0.65-1.13)	.10
Stroke	33	13	1.07 (0.57-2.00)	13	1.29 (0.75-2.20)	7	0.78 (0.45-1.33)	.64

Results – incidence HTA

- Hypertension cohort (n=2096)
- Median follow-up: 6.5y
- Incident HTA: 552



Baseline 24h urinary sodium does not predict incidence of HTA

Results – Blood pressure

Blood pressure (N=1499)

Follow-up 6.1 y

Cross-sectional analysis adjusted (sex, age, BMI, alcohol, hormones, AINS, family cluster, 24h K):

100mmol increase in sodium excretion associated with:

↑ 1.14mmHg SBP baseline

↑ 1.46mmHg SBP follow-up

NOT with diastolic

Results – Blood pressure longitudinal

- Increase in SBP (0.37mmHg/y)
DBP (0.039mmHg/y)
- 15.1% developed HTA during follow-up
- 24h urinary sodium excretion stable

Study Population	Absolute		Relative	
	Estimates (95% CI) ^b	P Value	Estimates (95% CI) ^b	P Value
Change in systolic pressure				
FLEMENGHO	2.373 (1.154 to 3.392)	<.001	2.740 (1.410 to 4.069)	<.001
EPOGH	0.196 (-1.409 to 1.801)	.81	0.085 (-2.181 to 2.351)	.94
All	1.711 (0.786 to 2.637)	<.001	2.211 (1.059 to 3.364)	<.001
Change in diastolic pressure				
FLEMENGHO	0.576 (-0.246 to 1.398)	.17	1.476 (-0.113 to 3.065)	.07
EPOGH	-0.052 (-1.317 to 1.212)	.94	-0.175 (-3.064 to 2.714)	.90
All	0.379 (-0.313 to 1.070)	.28	1.107 (-0.279 to 2.492)	.12

conclusions

- SBP correlates with 24h urinary sodium excretion at baseline and follow-up
- But baseline sodium excretion doesn't predict HTA
- Inverse relation between cardiovascular events and sodium excretion





-
- 2 population study not at the same time
 - 1 cohort analysed as 3 → confusing
 - Population: âge, caucasien → extrapolation?
 - Small number of events?
 - Missing or lost to follow-up
 - 1x24h urine collection to assess salt intake?
 - Collections problems: Misclassified in low?
 - Does BP predict mortality in this cohort?
 - Reverse causality explain increase mortality?

PUGH

TAKEAWAY LUNCHES

SALT
MAY
CONTAIN
TRACES
OF
SALAD

