Cardiosvascular Disease Prevention through Dietary Salt Reduction

First PAHO Expert Group Meeting

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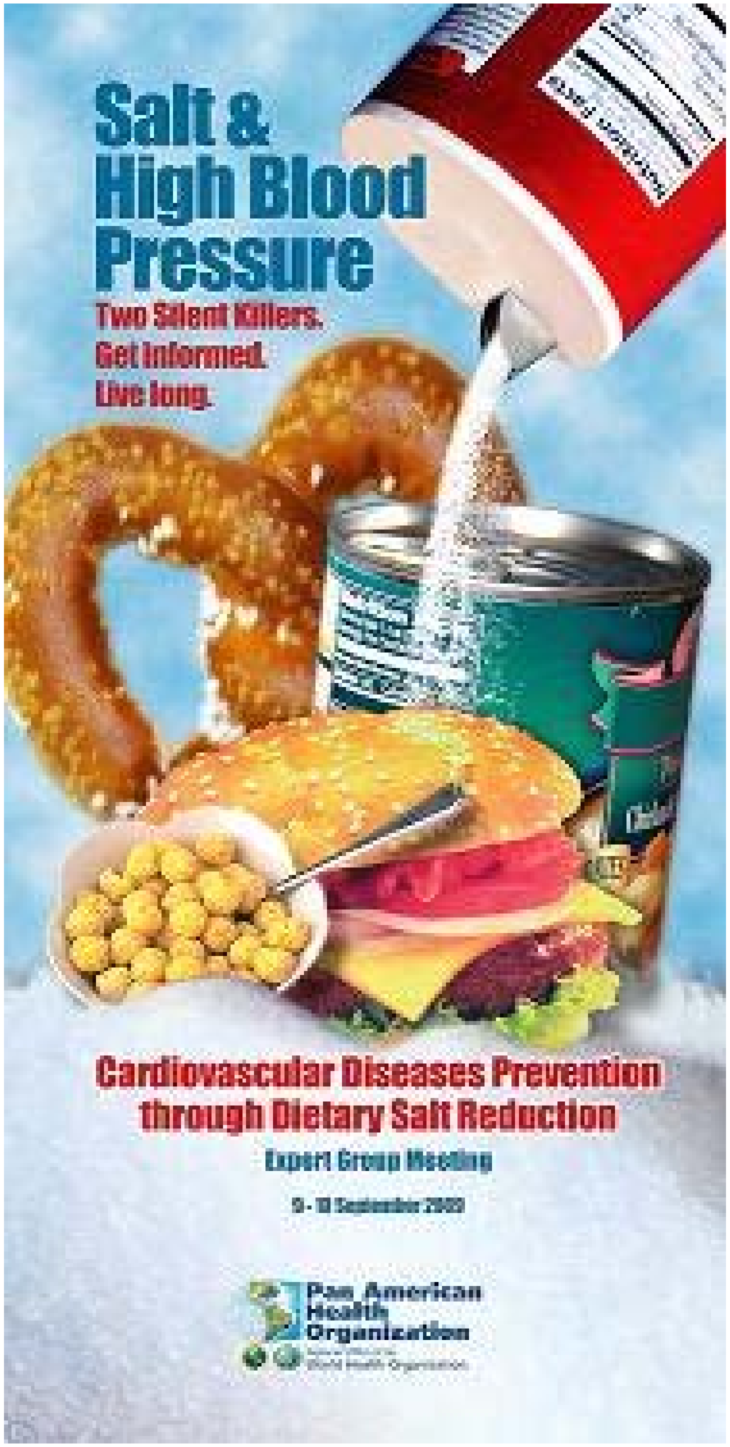
Pan American Health Organization

Regional Office of the World Health Organization



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C.S.R.I.

Monitoring and surveillance of salt intake in populations

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Definitions

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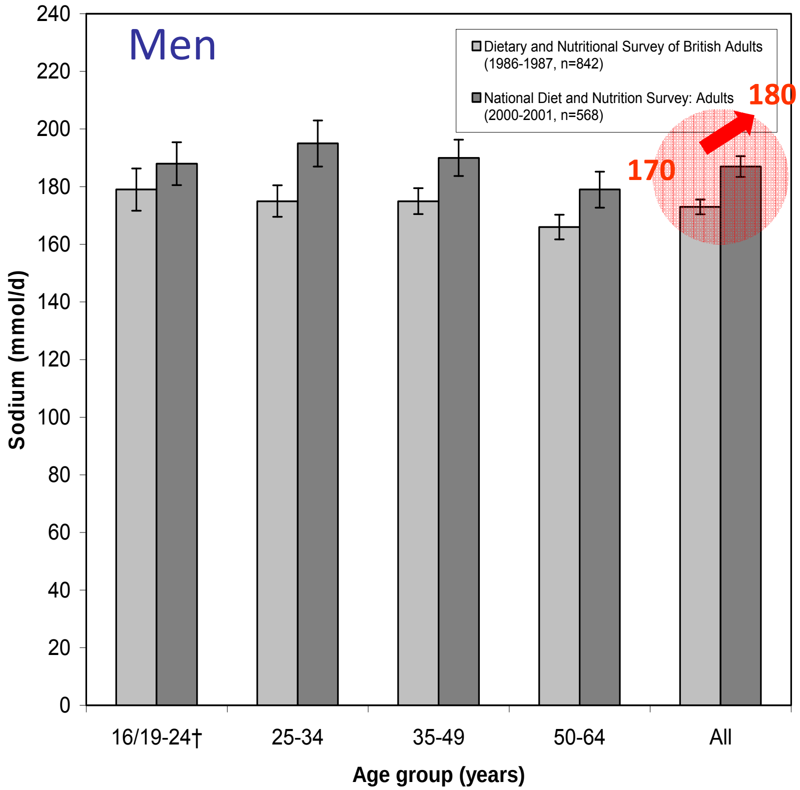
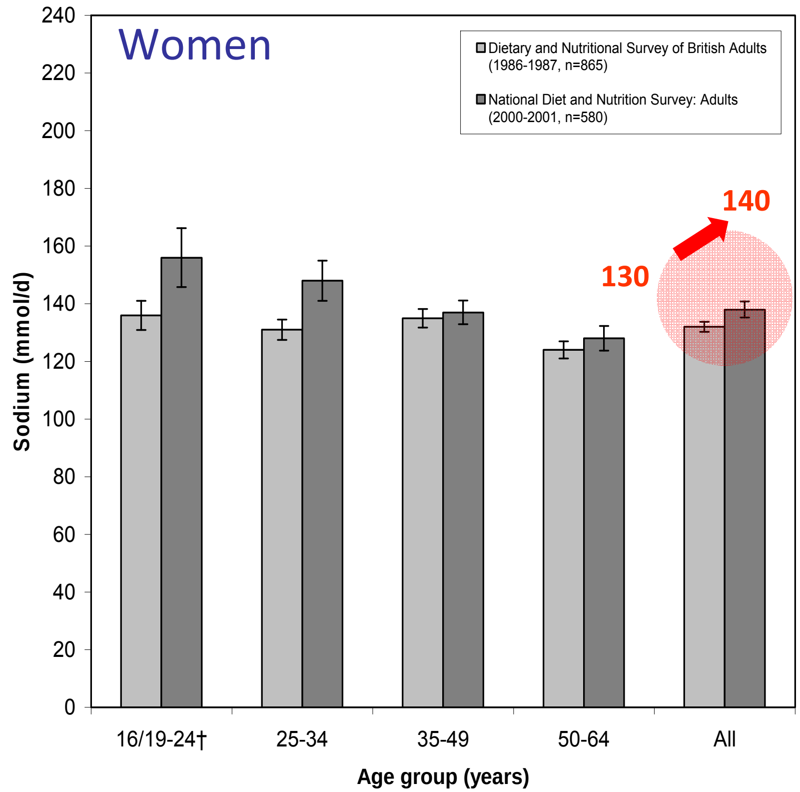
- Presentation refers to sodium intake as either mass or mmol of sodium, or mass of sodium chloride (salt) (1g sodium chloride = 17.1 mmol of sodium or 393.4 mg of sodium) – 1 mmol = 23 mg of sodium
- For the purpose of this presentation the word **salt** is used to refer to **sodium** and **sodium chloride intake** (and vice versa)
- The term **limitation of dietary salt intake** implies the reduction of total sodium intake from all dietary sources including, for example, additives such as monosodium glutamate and preservatives.

British Adult Surveys

1986-1987 & 2000-2001





Salt intake has increased in the last 20 years
(10 to 11g ♂ and 7.5 to 8.5g ♀)

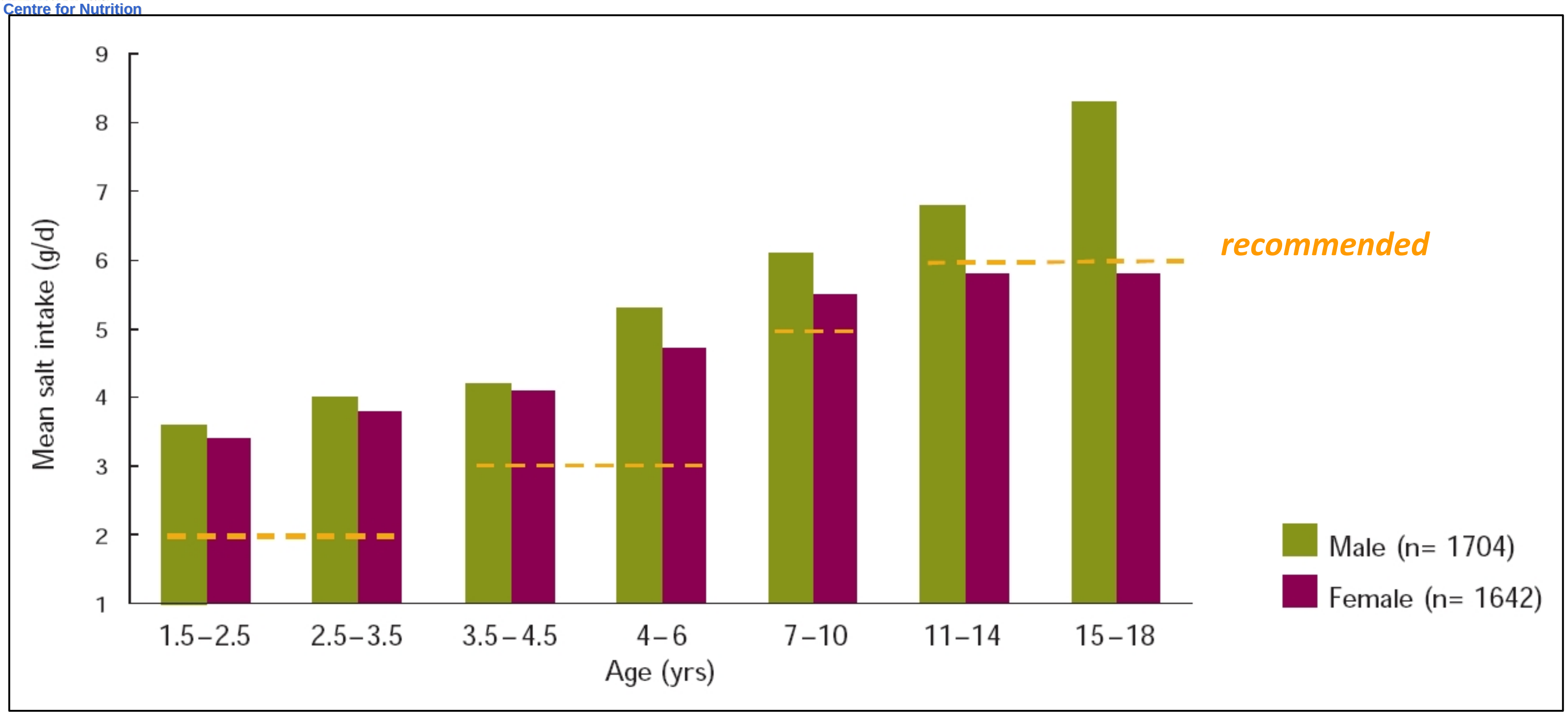
Bars: standard error *Sodium: 1 mmol = 23 mg*

* mean, standard error and n are weighted to compensate for the differential probabilities of selection and non-response

† lower cut-off was 16 years in the first survey, and 19 years in the second

Source: Henderson et al. 2003, p136

Salt intake in UK children



- Methodological problems – severe
- Data limited or absent in many countries
- Higher salt intake in boys
- Higher salt intake at older ages

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Sources of sodium in the diet

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Source	Proportion	Estimated amount†
Processed and restaurant food	77%	~131
Naturally occurring	12%	~20
Added by consumer (discretionary)		
while eating	6%	~10
in home cooking	5%	~9

† calculated on an estimated intake of 170 mmol Na per day (~10 g salt per day) and expressed as mmol/day

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European Salt Action Network

Membership (Ljubljana, March 2008)

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Implementation framework at National level

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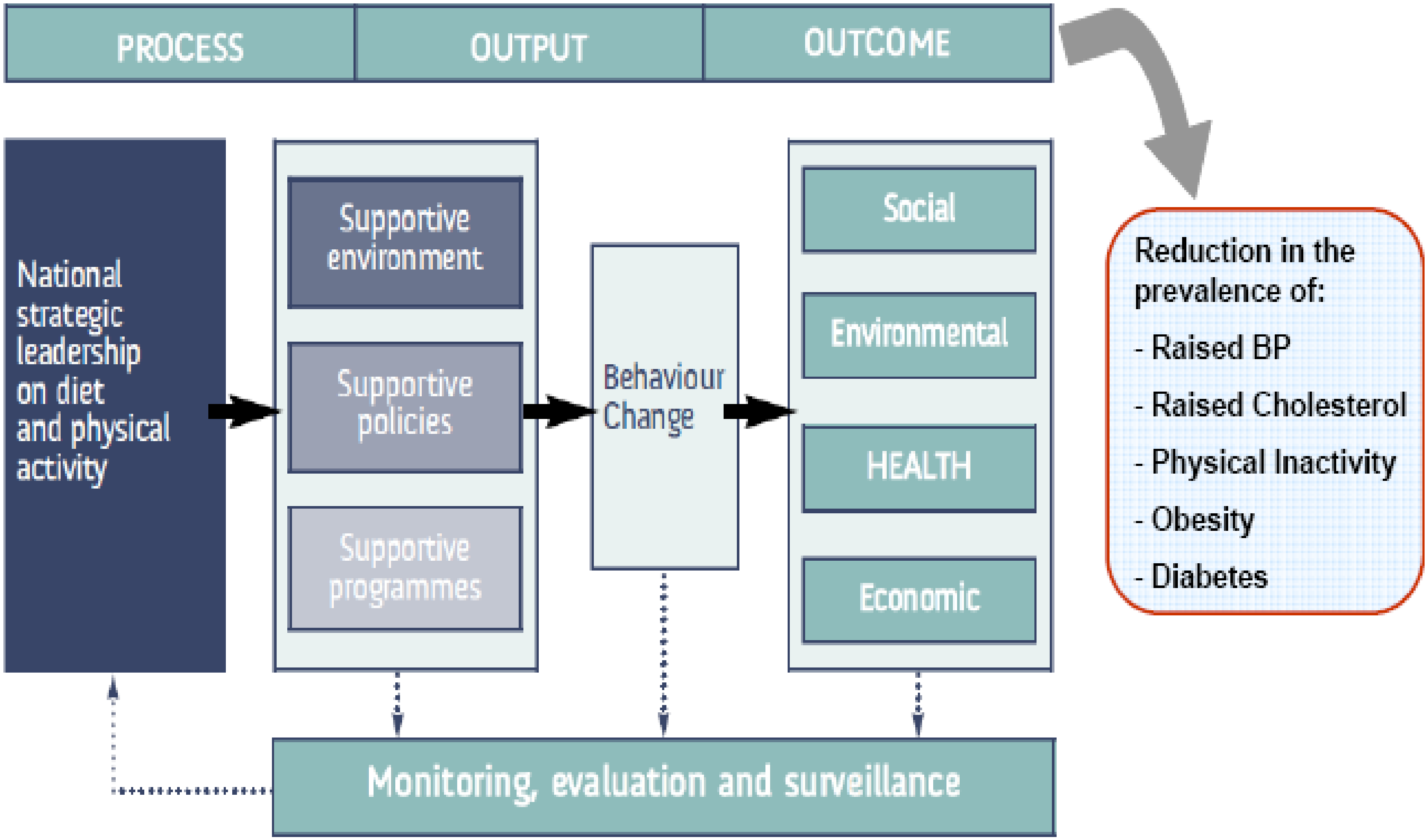

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European Salt Action Network

Monitoring and evaluation

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ESAN will target three main areas:

- Population salt intake progress towards recommended national or WHO targets
  - **Urinary sodium excretion** ('gold standard' to estimate salt intake)
  - Dietary surveys
  - Market surveys
  - Calculated sodium content of foods
- Reformulation progress towards benchmarks
  - Definition of benchmarks and food categories
    - **Bread, meat products, cheeses, ready meals**, soups, breakfast cereals, fish products, crisps & savoury snacks, sauces condiments & Spices, potatoes products, *catering meals, restaurant meals*
    - Minimum of 16% over 4 years or *'best of class'* principle
  - Monitoring of salt content of foods
    - Construction of foods databank of salt content
- Effectiveness of actions to raise public awareness
  - Measuring awareness of consumers (Consumers' Attitude Surveys)

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Methods to estimate salt intake

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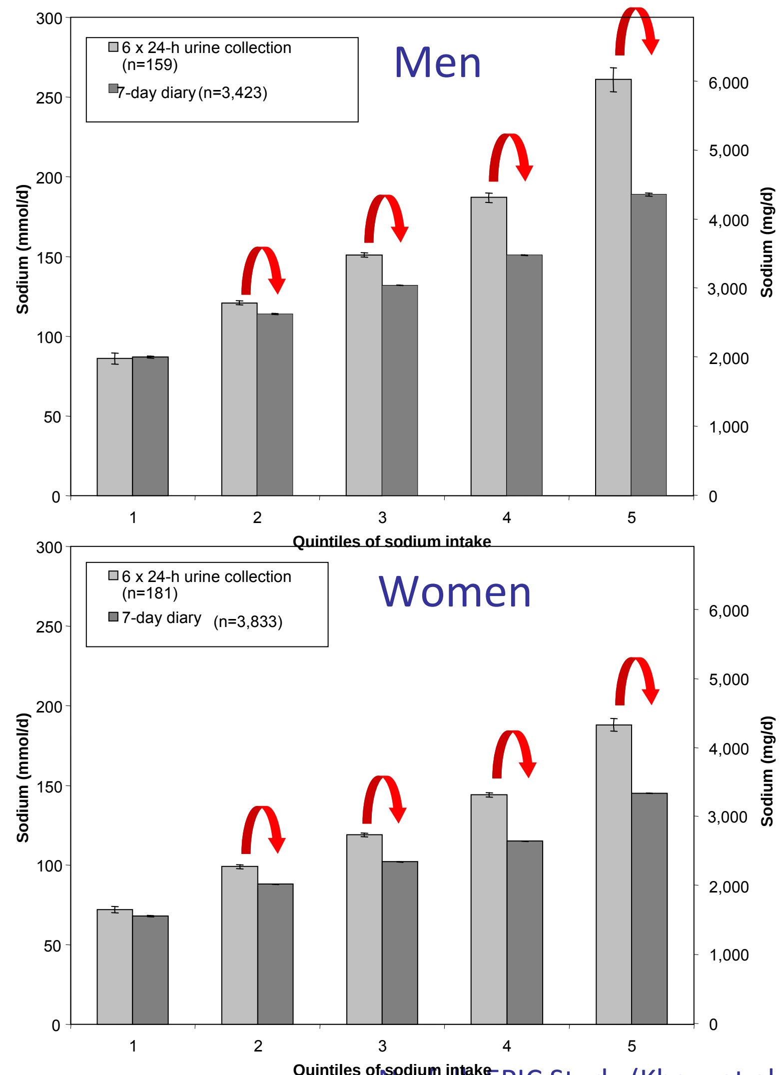
- Duplicate diets
- Dietary surveys
  - Food frequency
  - 7-day weighed records
  - Food diary
  - 24 hour recall
- Urinary collection
  - Spot (casual)
  - Overnight
  - **Timed**
  - **24 hour**

- Dietary surveys underestimate total salt intake

- The higher the intake, the greater the error



Norfolk-EPIC Study (Khaw et al. 2004)

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24 hour urine collections

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- Considered “gold standard” method to measure sodium intake
- Will capture >90% of sodium ingested (present in NaCl and other Na salts)
- High participant burden
- Problems of completeness – supervise beginning and end of collection
- PABA method to check completeness not established for large-scale population surveys
- Urinary creatinine can be used
- Also ‘ideal’ for monitoring total iodine intake

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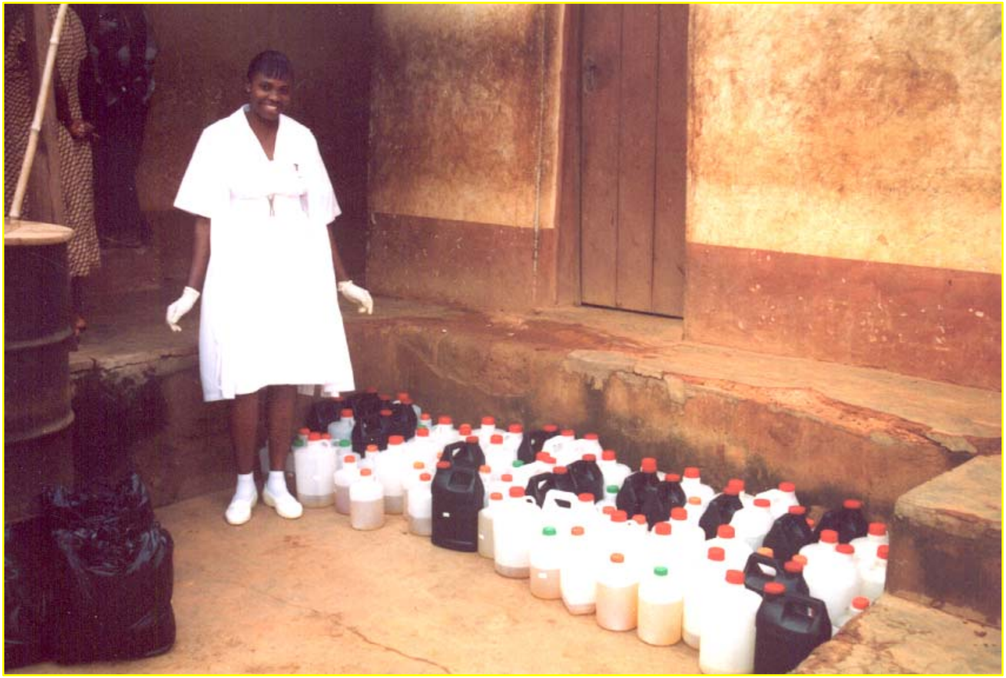
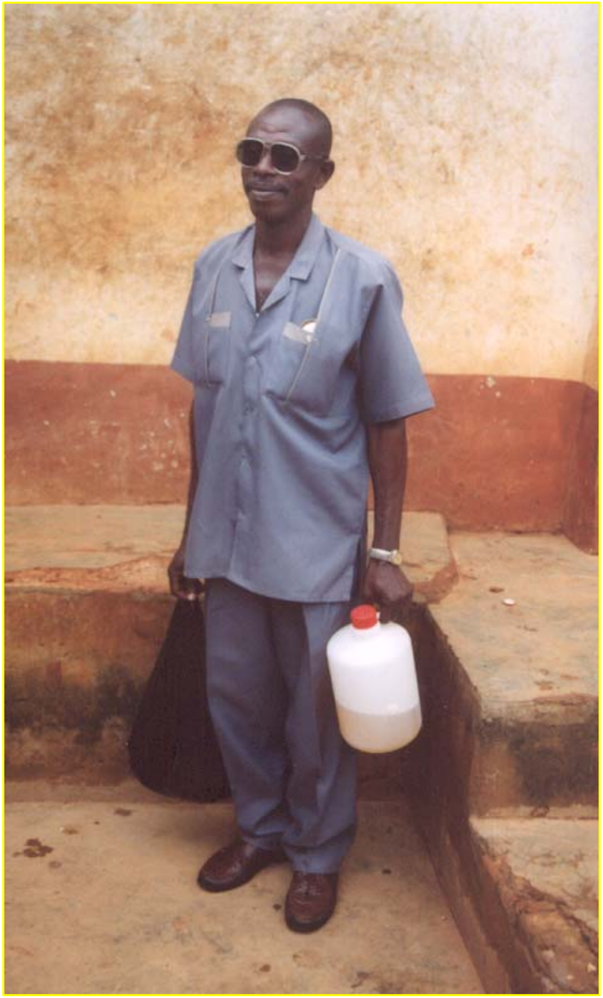
Feasibility - Experience on 24h urine collections

Study	Country	n	Sex	Age (yrs)	Average UNa (mmol/24h)	Yield (%)
Clinic-based studies						
St George's (1989) St George's (1995)	UK UK	20 47	♂ ♀ ♂ ♀	42-72 60-78	162 127	100 100
Population-based studies						
Marano '83 (1983)	Italy	78 45	♂ ♀	11	156 133	100
Olivetti Study (1976)	Italy	188	♂	25-56	177	78
W.H.S.S. (1992)	UK	692 882	♂ (W/B/SA) ♀ (W/B/SA)	40-59	186 / 188 / 174 140 / 158 / 143	66
IMMIDIET (2003)	UK Belgium Italy	526 538 540	♂ ♀ ♂ ♀ ♂ ♀	30-60	143 162 192	100 ~40 ~60
Kumasi (2002)	Ghana	1,013	♂ ♀(rural & S-urban)	45-75	101	98

24h urine collections in Ashanti, Ghana





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Practicalities

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- Field worker trained centrally
  - Participant attends screening (or field worker visits participant)
  - Participant voids bladder then
  - Field worker takes the time (START)
  - Duly labelled plastic bottle handed out
  - Participant instructed to collect ALL urine passed throughout day and night
  - Participant asked to return following morning (or field worker re-visits participant)
  - Participant voids bladder then
  - Field worker takes the time (FINISH)
  - Field worker enquires about lost or missed aliquots
  - Bottle collected and sent to the lab

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Sources of Salt in Ashanti

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		Rural N=481	Semi-urban N=532	Odds Ratio (95% CI)
	Koobi	60%	42%	2.03 (1.38 to 2.99) ***
	Kako	26%	29%	0.87 (0.40 to 1.96)
	Salted pig's feet	16%	32%	0.40 (0.15 to 1.02)
	Salted beef	9%	23%	0.34 (0.13 to 0.86)*
	Cubes	52%	56%	0.85 (0.47 to 1.56)
	Added in cooking	99%	97%	1.83 (0.90 to 3.72)
	Added at table	59%	45%	1.75 (1.18 to 2.61)**

Kerry SM et al. Ethn Dis 2005;15:33-9

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“Timed” urines

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- Less participant burden than 24 hour collections
- More variable at individual level but may give good estimate of group mean
- Desirable alternative for monitoring program effects over time (validation necessary)
- Need baseline 24 hour urine assays to compare between populations or time points
- Role of urinary creatinine
- Should learn from monitoring program for iodisation
- Could be used for ‘effective’ monitoring of iodine (ideally in adult populations)

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Practicalities

C.S.R.I.

- Field worker trained centrally
  - On the morning of screening participant instructed
    - to void the bladder in the morning at home
    - to record the time (START)
    - to drink one glass of water
    - to refrain from passing urine until screening
  - At screening
    - to void bladder completely
    - to record the time (FINISH)
  - Collection time (FINISH – START) in min (usually 4-5h ± 1-2h)
  - Extrapolated to 24h (validation studies vs 24h needed)

Spot urines

- Less participant burden than 24 hour collections
- Highly variable at individual level but may give estimate of group mean
- Less desirable for monitoring program effects over time
- Highly dependent on hydration, volume, residual bladder volume
- Currently used for monitoring iodine (mainly children and women of childbearing age)

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Overnight collections

- Less participant burden than 24 hour collections
- May give biased estimates of sodium excretion
  - (greater % excretion overnight in hypertensive individuals…)
- Undesirable for monitoring program effects over time

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Measurement of sodium intake

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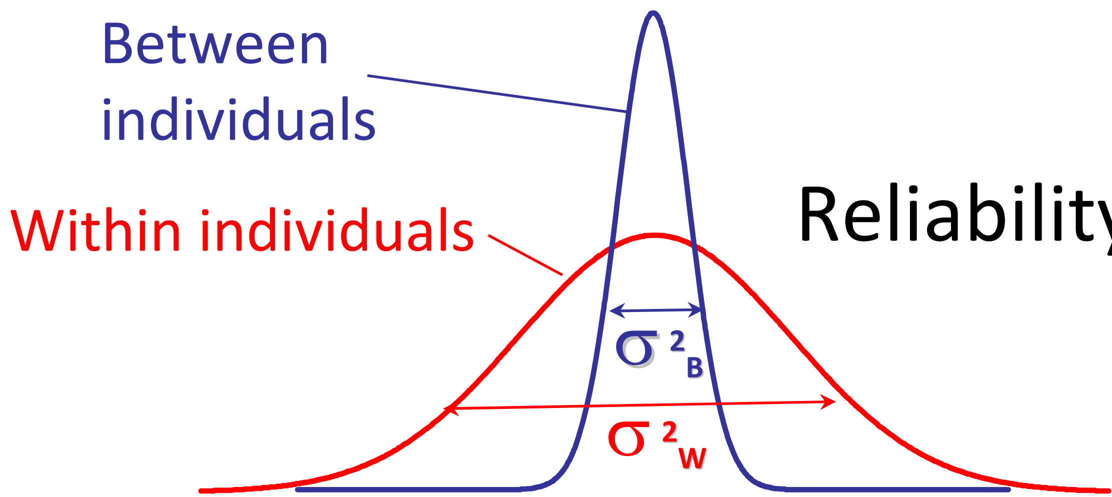
Sodium intake highly variable within-individuals from day to day

Misclassification of individual intake and increase in variance of group (mean unbiased)



$$\text{Reliability} = \frac{\sigma^2_B}{\sigma^2_B + \sigma^2_W}$$

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Sample size

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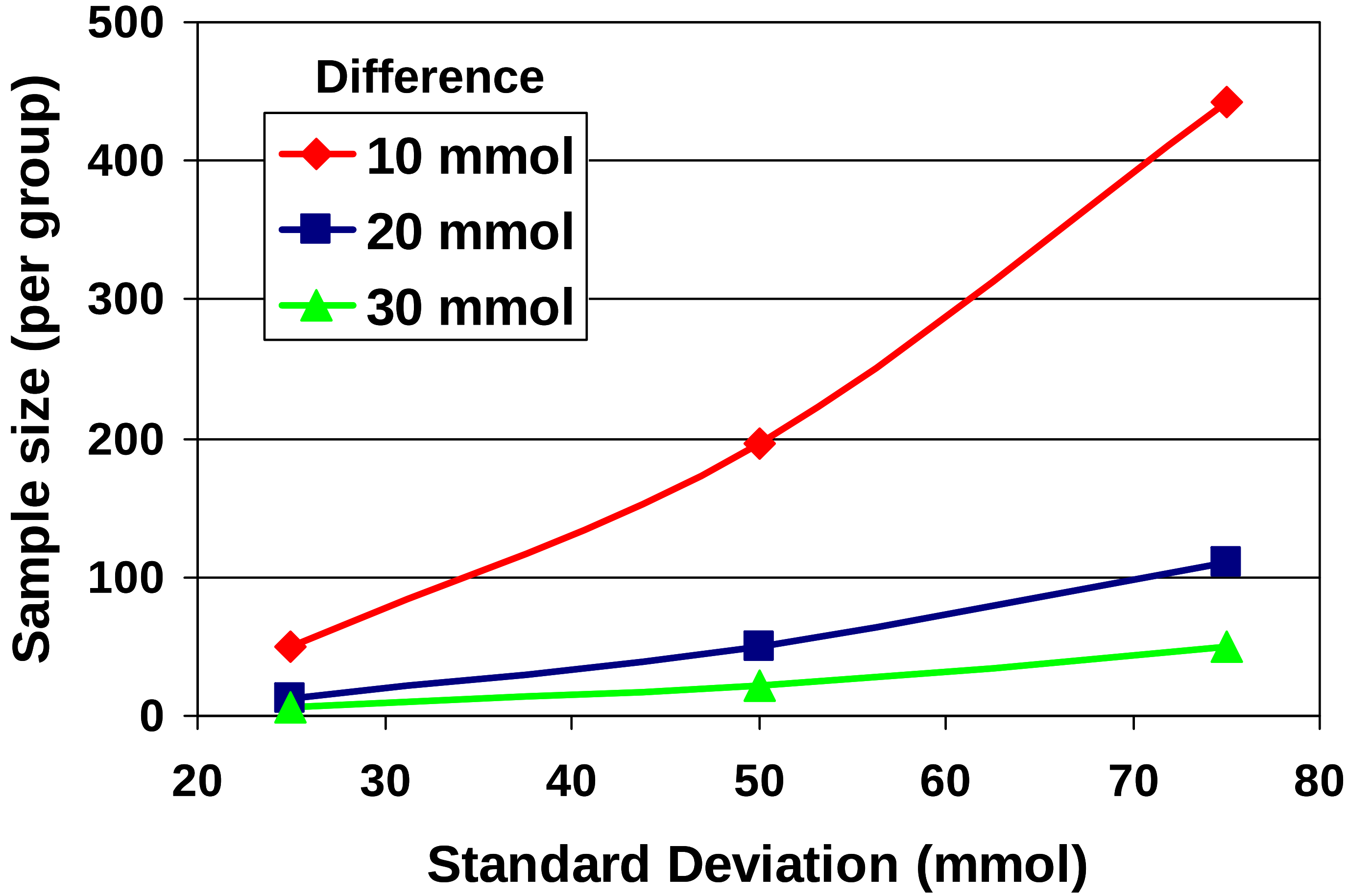
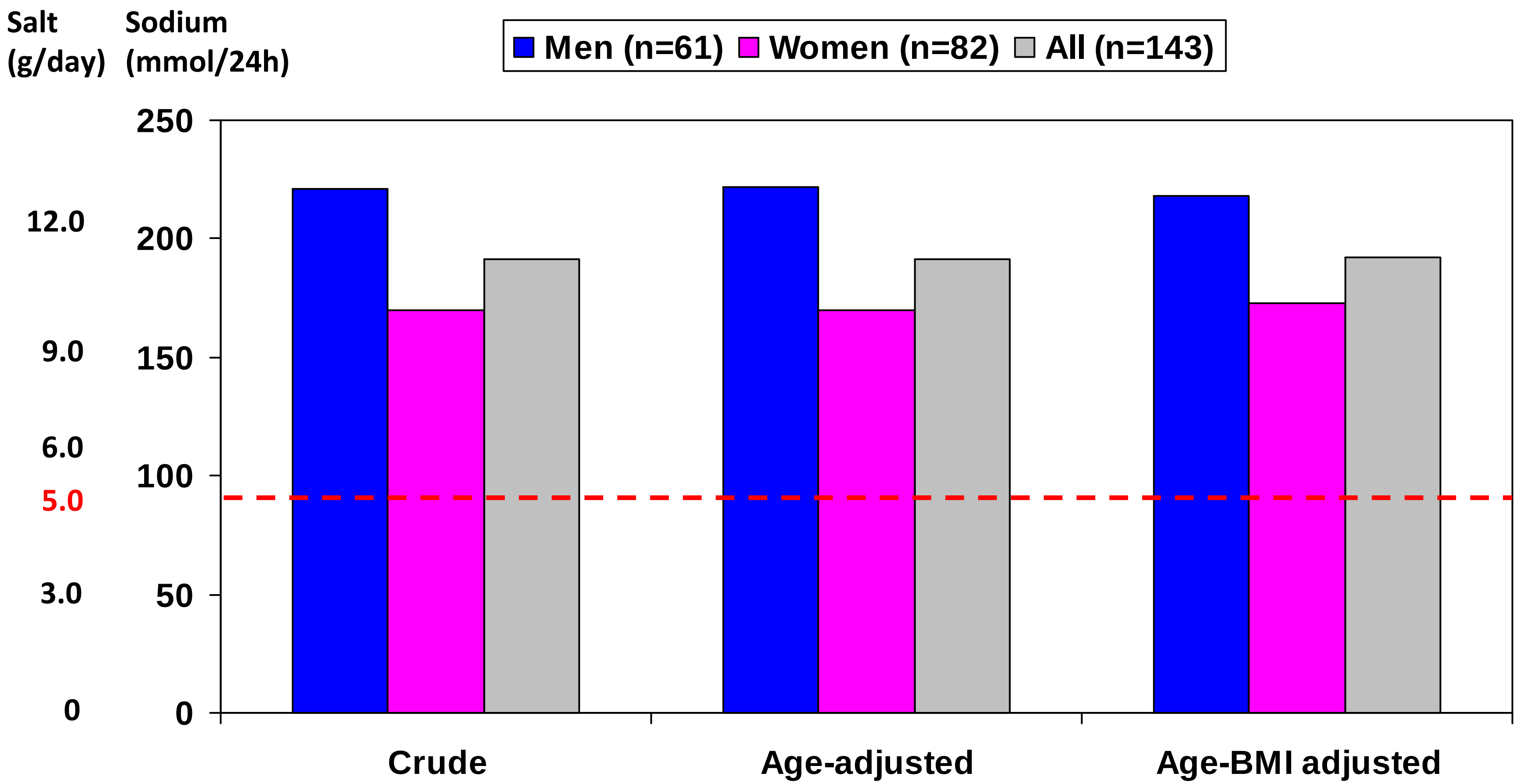
- <u>Random</u> sample of ~100 people (<u>minimum</u>) to give estimate of 24 hour urinary sodium excretion with 95%CI around the mean of $\pm$12 mmol/day
- Sample of ~200 to give separate estimates for men and women (multiples for age groups)
- To consider attrition rate
- Modest reduction in 95%CI with 2x24 hour urine collections per person
- Much larger samples may be required for more precise estimates

Example

(α=0.05; β=0.80)



Urinary sodium excretion in Slovenia (2007)



SD ~ 70-80 mmol/24h)

Ribič CH et al. Public Health Nutrition 2009 (in press)

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Urinary sodium excretion in Slovenia (2007)

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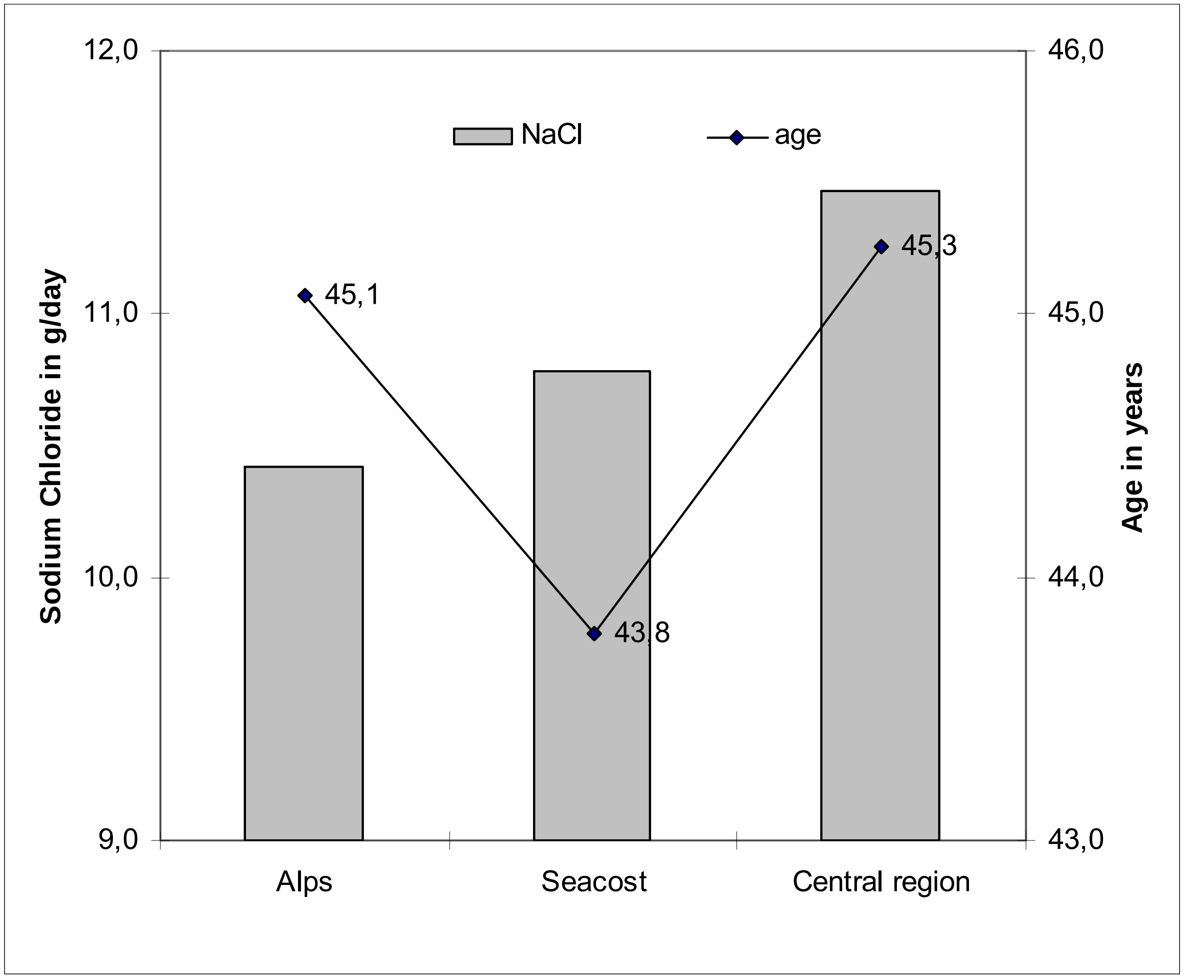

Ribič CH et al. Public Health Nutrition 2009 (in press)

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Relationship between 24h urinary iodine and 24h urinary sodium in 12 villages in Ashanti.

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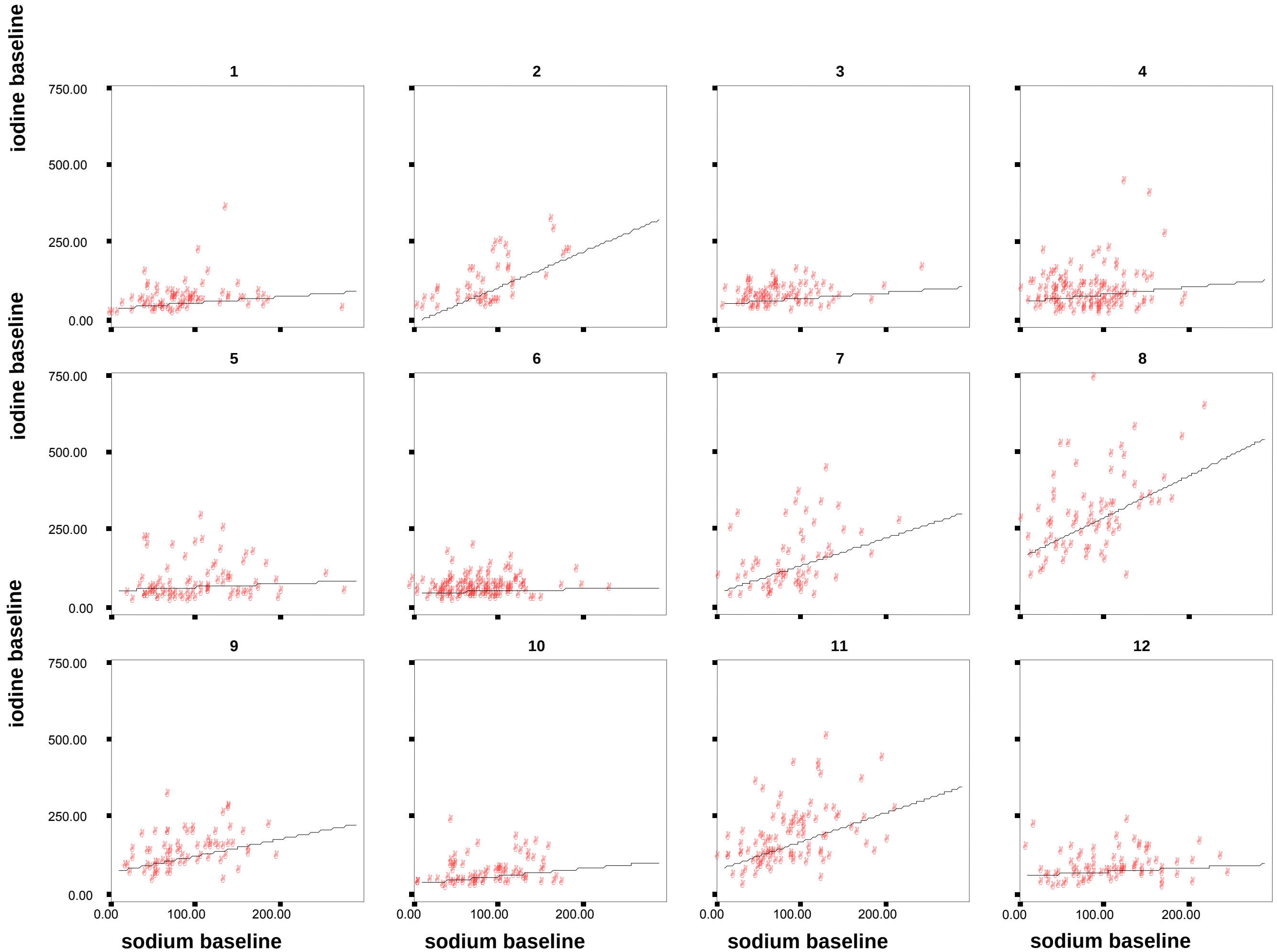

Cappuccio FP et al. (unpublished)

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Prevalence of Iodine Deficiency at baseline (left) and 6 months (right) by locality and gender

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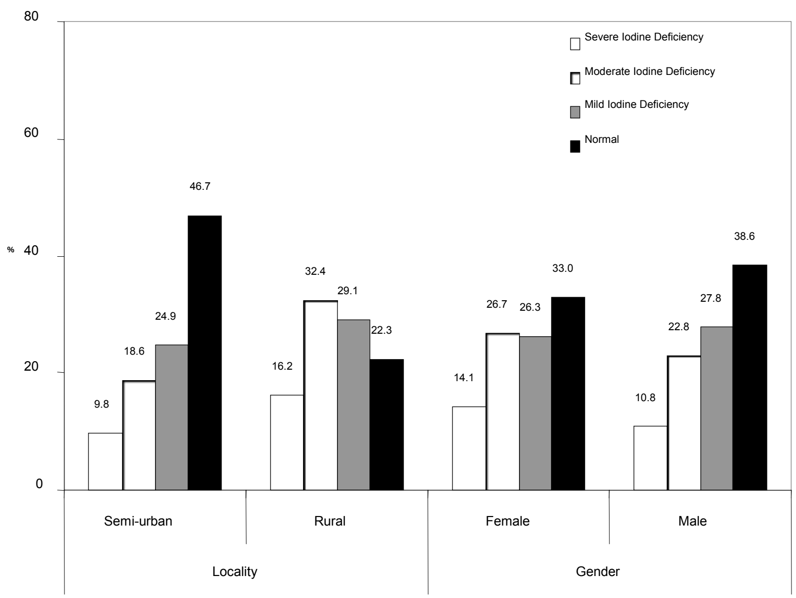

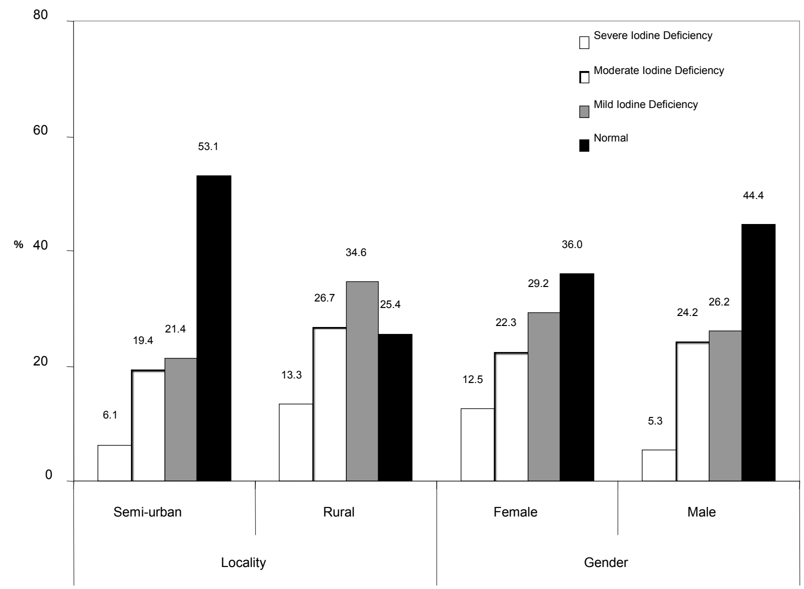

Normal (Iodine sufficient): 24 hr urinary iodine concentration ≥ 100μg/L
Mild Iodine Deficient: 50μg/L ≤ 24 hr urinary iodine concentration < 100μg/L
Moderate Iodine Deficient: 20μg/L ≤ 24 hr urinary iodine concentration < 50μg/L
Severe Iodine Deficient: 24 hr urinary iodine concentration < 20μg/L

Cappuccio FP et al. (unpublished)

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Summary

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- **Measurement**
  - Dietary approaches (underestimate intake)
  - Urinary approaches ('gold standard'): gets >90% of ingested sodium in absolute amount
- **Different issues to evaluate group means and individual means**
  - 'Timed' urines may be effective for estimating population changes (*absolute* - knowing baseline amount - or *proportional*)
  - 24 hour urines need to get at individuals' levels – but may not be good estimate of 'usual' level as it varies from day-to-day
- **Feasibility and Costs**
  - Highly *feasible* in different contexts
  - Estimate costs in the region of **€2,500 - €3,500** per centre per year plus set up costs (assuming minimum samples of n=400 per centre per year)
- **Include minimum data-sets**
  - Age, height, weight, waist circumference, blood pressure, heart rate, hypertension status, drug therapy, (iodine measurement).