

# Monitoring of Sodium Intake in the Canadian Population

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# Objectives

- What methods can be used to monitor sodium intake?
- What are the challenges associated with the monitoring of sodium intake?
- How is the monitoring done in other countries?  
What issues were faced?
- How can we best monitor sodium intake in Canada?  
What are the components of a successful strategy?

# Objectives – in 20 minutes

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What are the components of a successful strategy?

# CONFLICT OF INTEREST

None relevant to this presentation and topic

# Sodium vs Salt

One teaspoon of salt is equivalent to 2,400 mg of sodium

Salt (sodium chloride) is but one source of sodium, albeit the main one in our diet

Monosodium glutamate

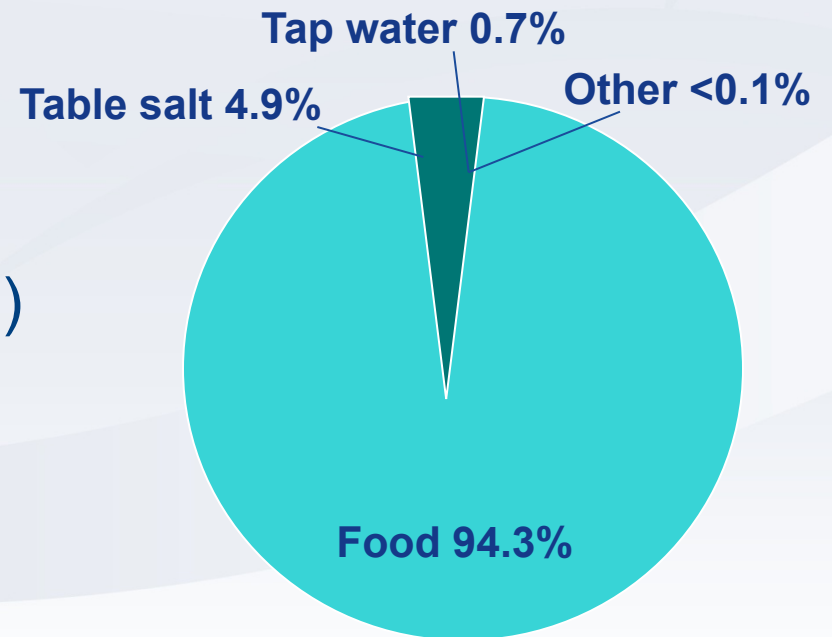
Sodium nitrite

Sodium bicarbonate (baking soda)

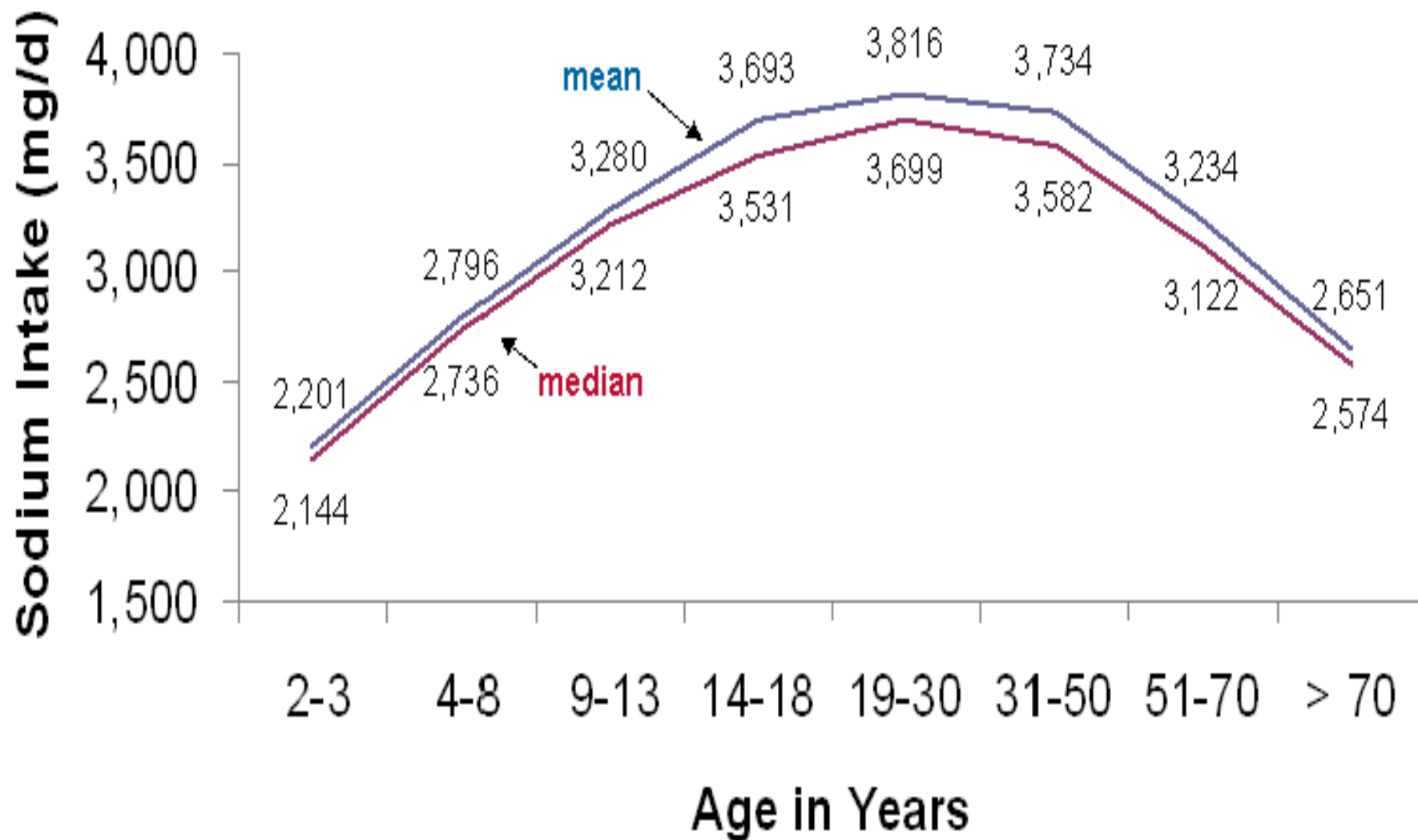
Sodium benzoate

Sodium perborate

Sodium lauryl sulfate

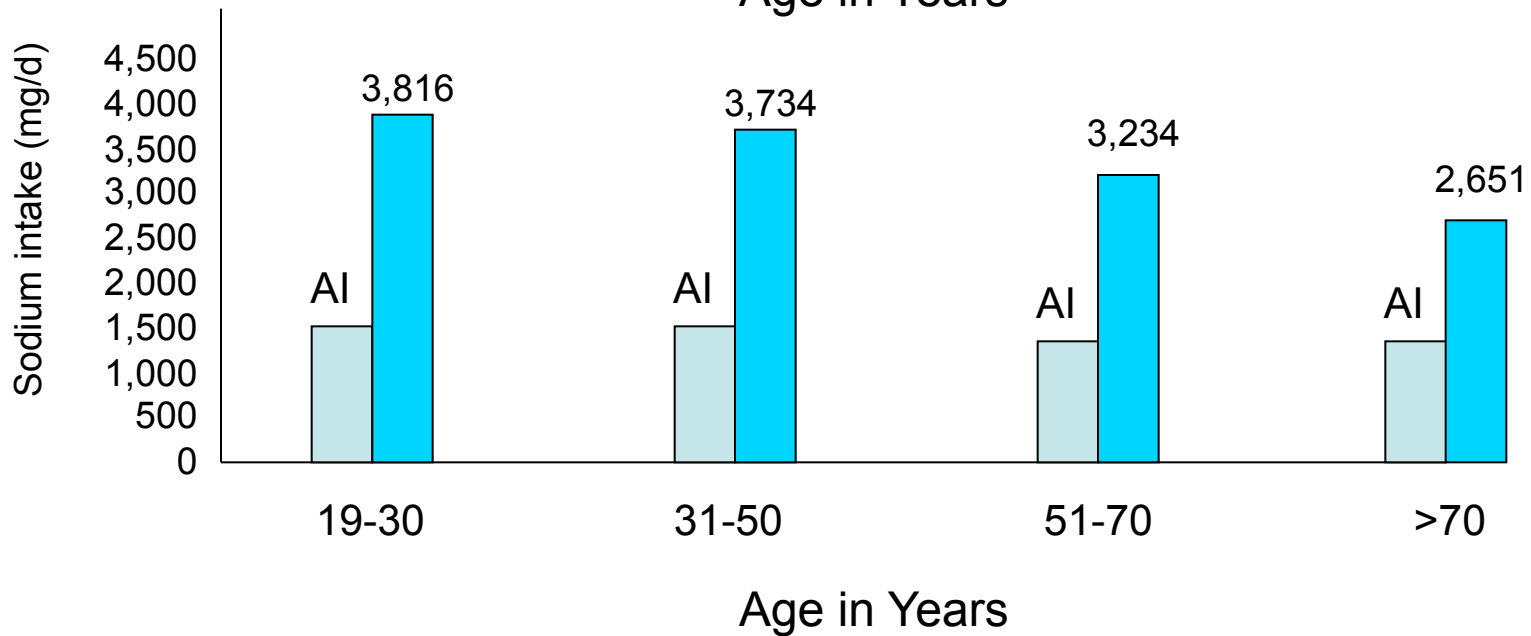
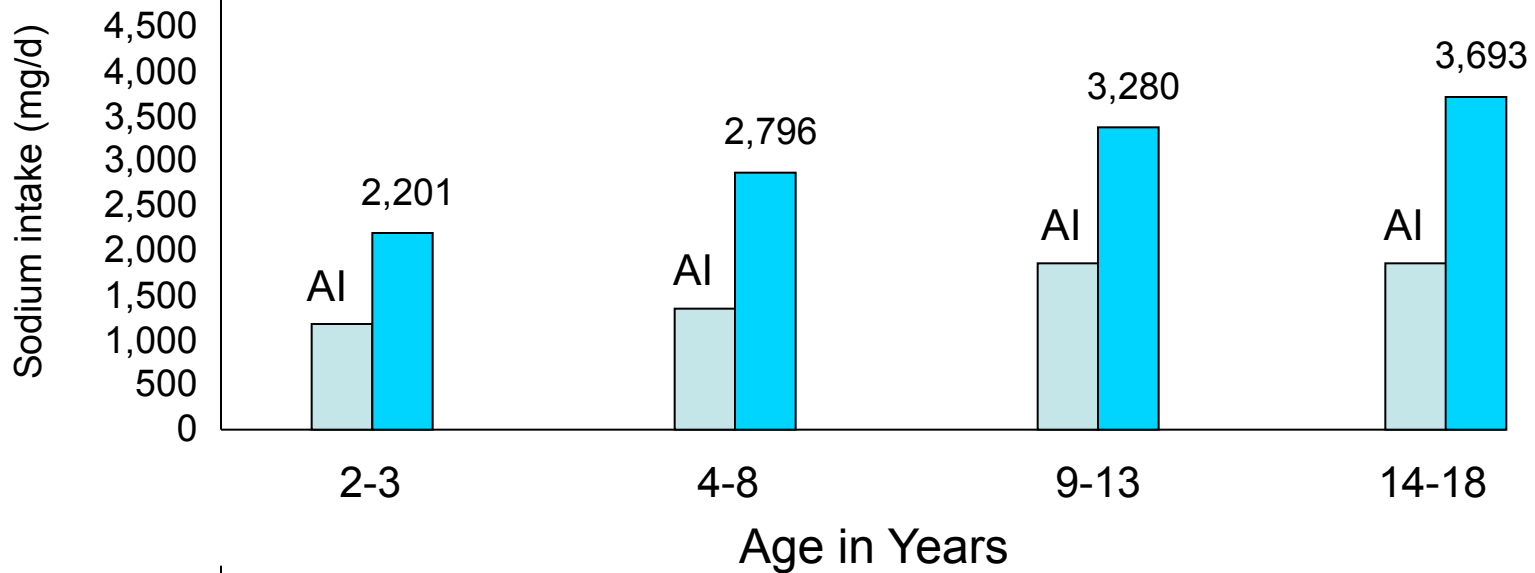


## Usual Daily Mean and Median Sodium Intake From Foods



Source: NHANES 2003-04

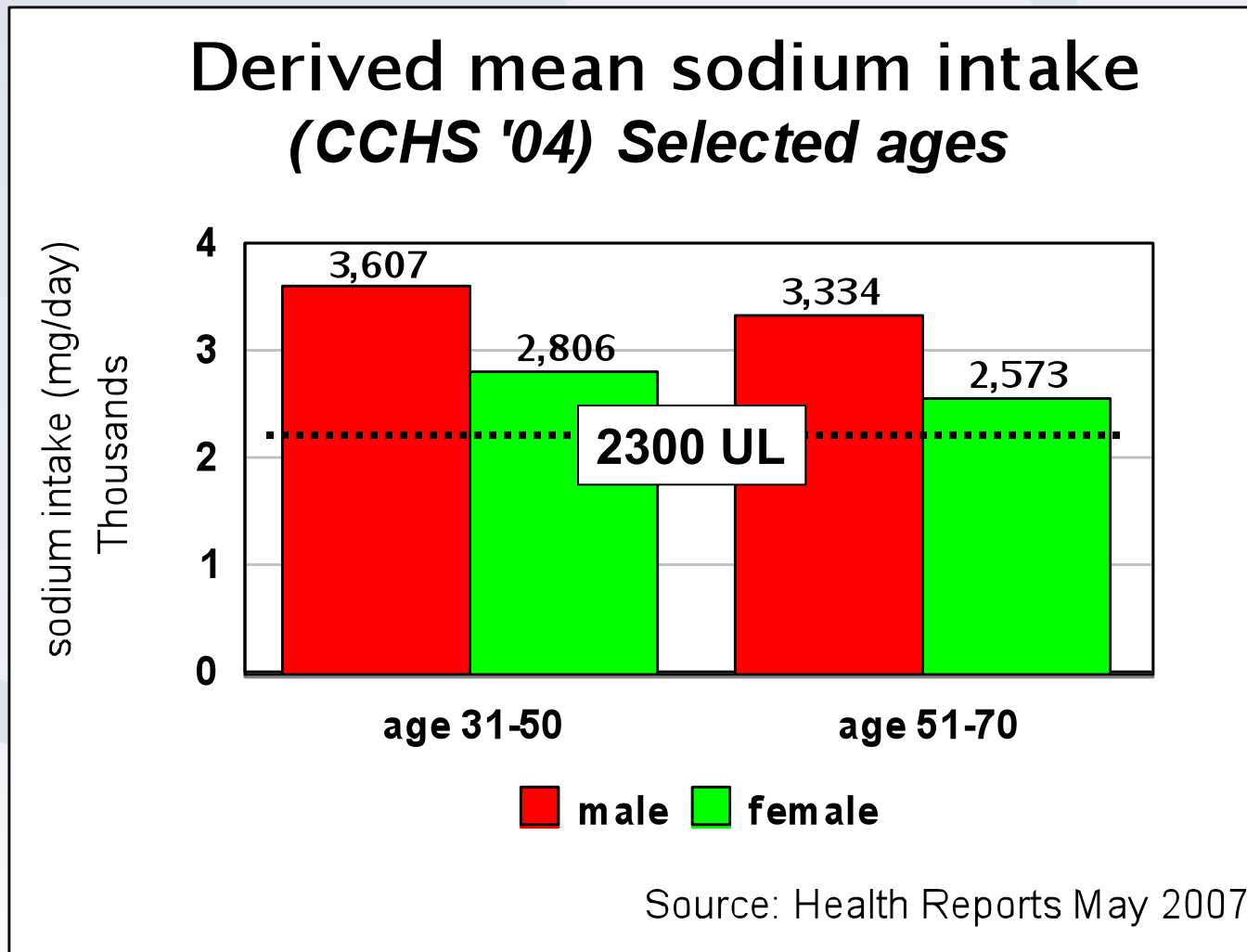
## Usual mean sodium intake from foods vs Adequate Intake



Source: NHANES 2003-2006

# Sodium intake: Canada

(CCHS'04 self-reported food intake, ages 51-70)



# How to Determine Sodium Intake

Measure dietary consumption

and /or

Measure urinary output



**Salt**



**Intake**

**=**

**Output**

# How to Monitor Sodium Intake

- single-day food frequency record
- multiple-day food frequency records
- 24-hour dietary recall

# How to Monitor Sodium Intake

- Food frequency questionnaire is the most cost-effective tool for large population studies to assess usual intake, particularly with high day-to-day variability.
- Results improve with the use of multiple recalls.
- Should be used only in educated and compliant populations.

but,

- most of the salt consumed is hidden in prepared foods, so individuals do not know how much salt they consume.
- food/caloric intake is generally underestimated, (10% in CCHS '04, obese by 20%).

# How to Monitor Sodium Intake

Multiple 24-h dietary recalls can provide excellent detail, allowing for diverse dietary practices,

but

they are costly and require multiple contact with participants.

# Validity of Estimates Based on Intake Data

Need excretion measures to validate intake values.

Presently one approach alone is insufficient.

# How to Monitor Sodium Output

- spot urine samples
- 24-hour urine samples

$$\text{Predicted 24 h Na excretion} = \frac{\text{Spot urine [Na] (mEq/L)}}{\text{Spot urine [creatinine] (mEq/L)}} \times 24 \text{ h creatinine excretion (mg)}$$

# Estimation of 24-Hour Sodium Excretion from Spot Urine Samples

Samuel J. Mann, MD, Linda M. Gerber PhD  
J Clin Hypertens 2010;12:174-180

1. Compared predicted 24 hour sodium excretion from spot urines samples for sodium taken at random, am and pm with 24 hour urinary sodium, adjusted for urine concentration by measuring 24 hour creatinine in 81 subjects.
2. Spot urine derived sodium taken pm correlated best with 24 hour sodium ( $r=0.86$ ,  $p<.001$ ).  
Random and am samples showed no correlation.

# 24h Urinary Sodium Excretion

- As electrolyte excretion rates reflect the diet of an individual, unless the diet is very stable over time, variation in Na excretion from spot samples taken at different times of day within the same individual can be large, often larger than the variation among a group of individuals in western populations.
- Therefore a 24-hour measurement is the best method to assess sodium intake.

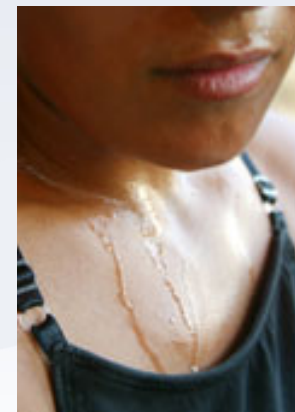
# 24h Urinary Sodium Excretion

- However even a 24 hour collection is but one window in time.
- Therefore, more than one collection should be undertaken and participants should avoid any activity that may provoke a lot of sweating in the day (or two) before the collection.

# Not all the output is in the urine.



[sodium in the urine] = intake - loss  
via non-renal routes, ie sweat



and,  
time correlates of sodium intake and  
excretion can vary.



Therefore

24-hour urine collection to determine intake is  
best carried out in usual **steady-state conditions**.

# Sodium Intake Measured Elsewhere

Country	Year	Dietary Intake	Urinary Excretion
USA <sup>1</sup>		1998 24-hr	no
FINLAND	2002	48-hr recall	24-hr
PORTUGAL	2006	?	24-hr
INTERSALT <sup>2</sup>	1996	?	24-hr
TASMANIA <sup>3</sup>	1995	?	24-hr
SHS	2006	?	24-hr & Spot

1. NHANES

2. 32 country study

3. Australian Hobart Salt Study

# Scottish Health Survey - subset

- 564 useable samples
- 19% men and 23% women excluded 2<sup>o</sup> incomplete samples
- Na, K and Cr were measured
- 3 Spots: Day 1 evg, Day 2 first urine, Day 3 after 24h finished

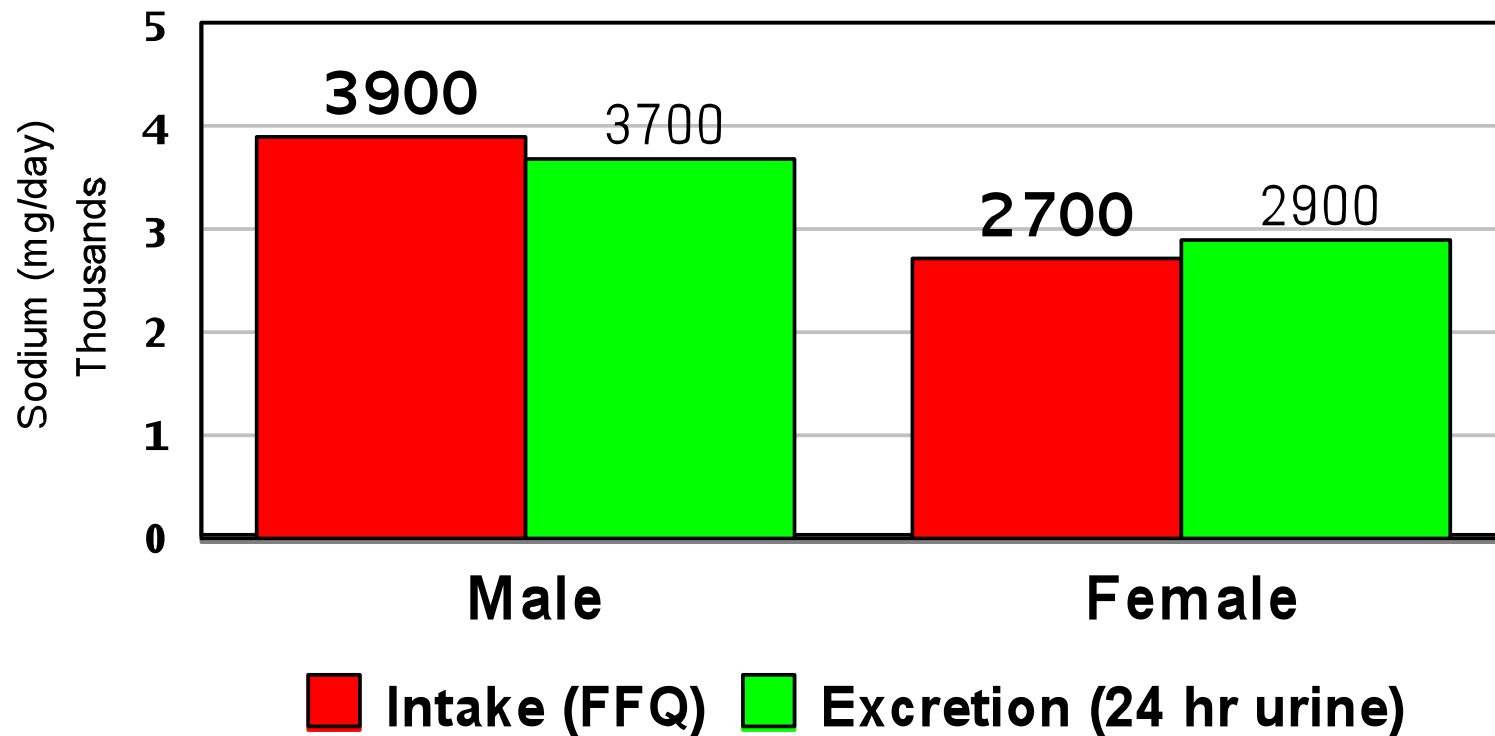
Na/Cr and K/Cr showed statistically significant ( $p < 0.005$ ) correlations between Spots and 24 hr urine measures.

Correlations were not strong ( $r = 0.29$  to  $0.59$ ), slightly stronger for women

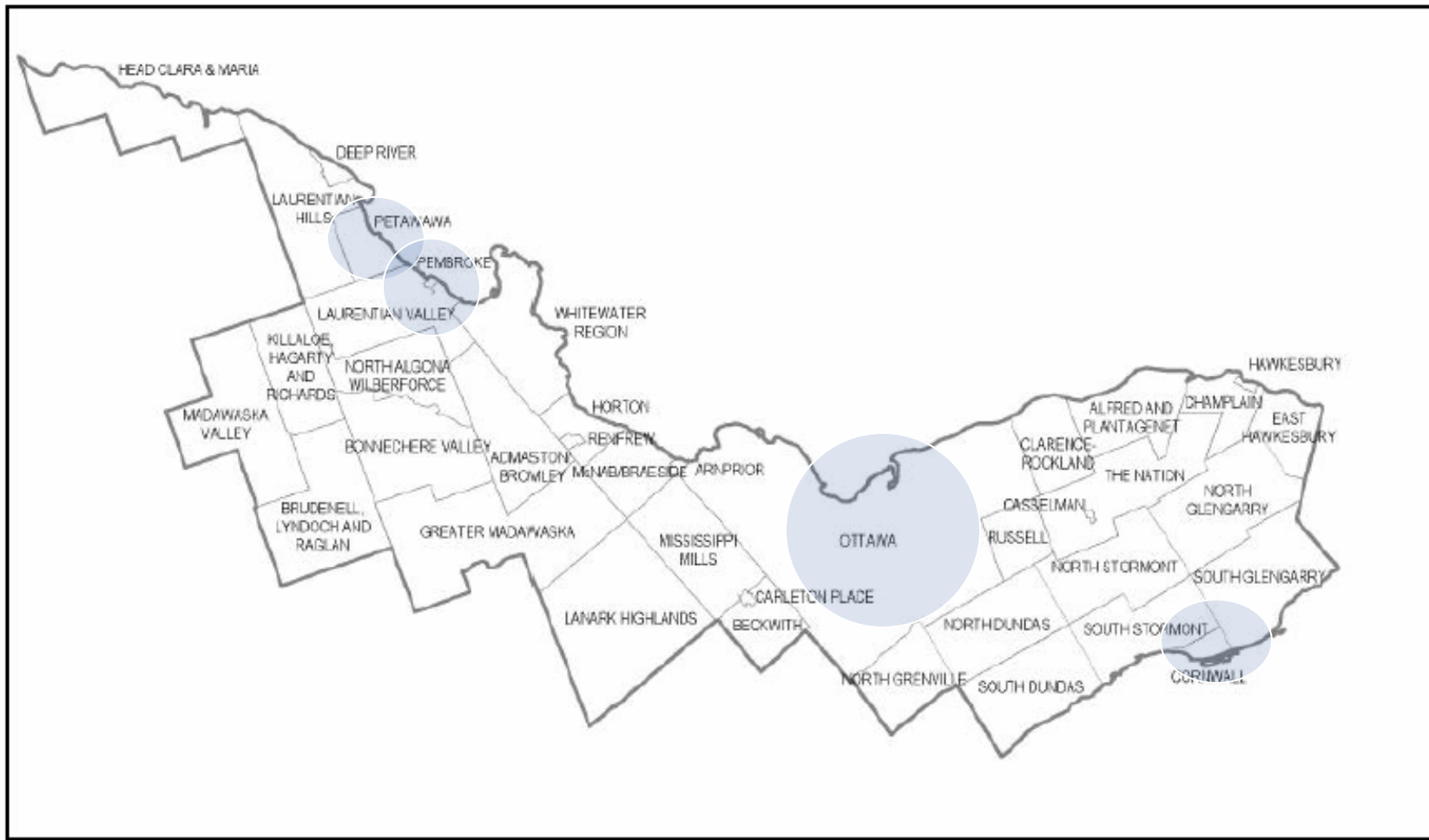
Conclusion: Spot urine sampling may be good enough for tracking and differentiating between subgroups

# Sodium intake vs. excretion

Finland 2002 (Reinivuo ECJN'06)



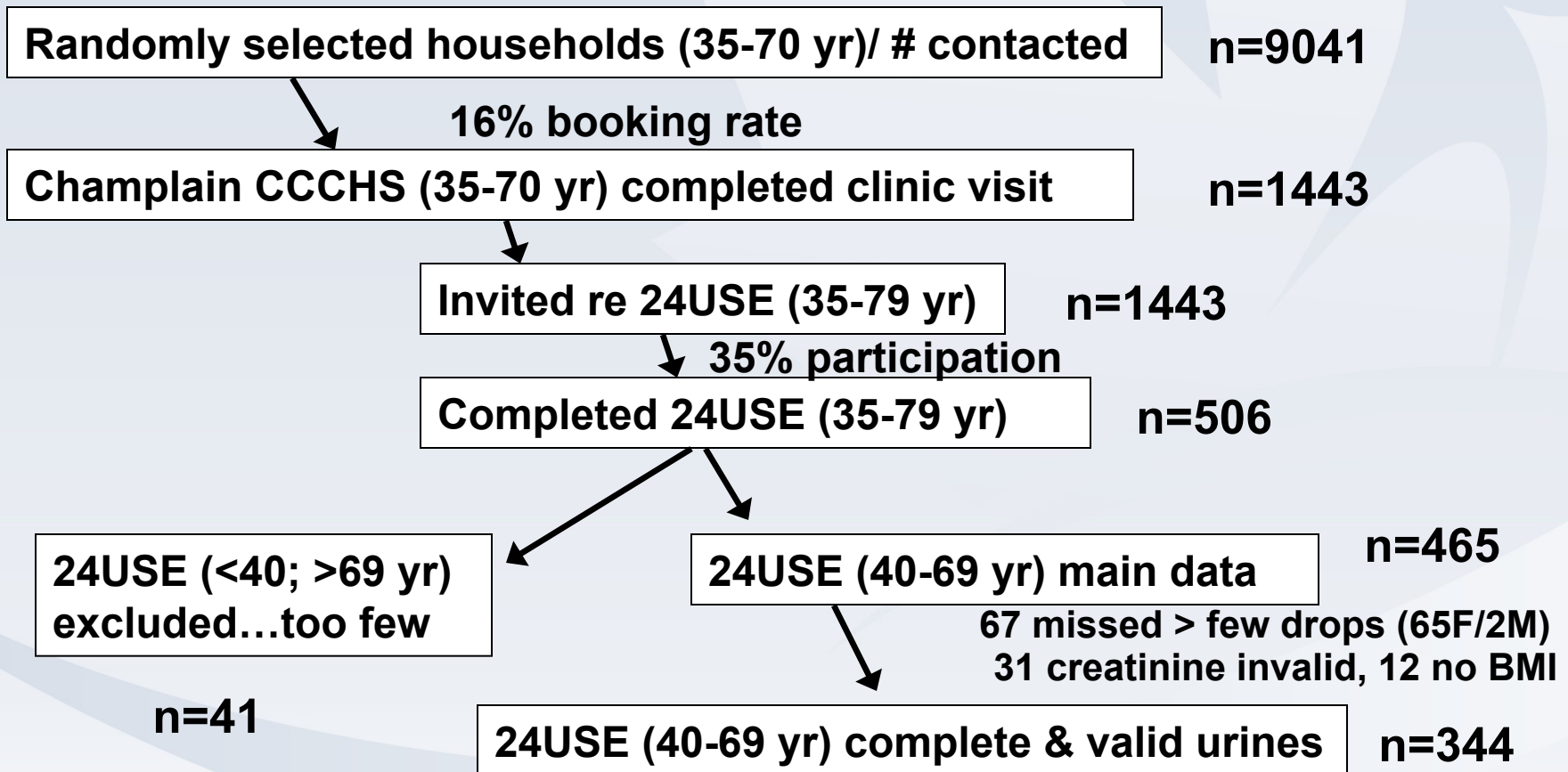
# Champlain Health District



# 24 USE: Methods

- **Recruitment** pop-based survey, not a convenience sample:
  - Random mail-outs to households, with phone follow up for booking clinic.
  - select participant with dob nearest call-date.
  - start/end: March – Sept 30/09 (7 months)
  - \$15 honorarium (& drop off/ pick up container)
- **Restrictions**
  - ages 40-69 (main dataset)
  - other exclusions: pregnancy, menstruation
- **24USE stratified sub-sample**
  - stratified by age/sex, urban/rural.

# Schematic: Resulting Sample



→ Weighting by age, sex, BMI, urban/rural

# 24 USE: Methods

## •Urine collection & storage

- Collection within 12 hours (pick up available)
- To be stored in “cool place” (e.g. fridge)
- No boric acid used (preservative)

## •Completeness of urine collection

- urine volume ( $\geq 0.5$  litres)
- self-reported “complete”: missed only few drops
- Creatinine (e.g. Reinivuo EJCN'06; Finland)
  - Exclude: ( $<5$ mmol/d) or ( $6$  mmol/d & vol $<1$ litre)
- no use of PABA tablets

# How to Best Monitor Sodium Intake in Canada?

## CONCLUSIONS

- There is a need to track sodium intake in the Canadian population
- 24h urinary sodium is the gold standard and until spot urine methodology is perfected and properly validated, 24h collections are indicated.

# How to Best Monitor Sodium Intake in Canada?

## CONCLUSIONS

- Even 24h collections should be standardized for the same days of the week, same season, usual diet and usual activities.
- Dietary data can provide useful tracking information and cross validation.

Thank you for your attention

# A method for tracking sodium intake

comprises the steps of:

- **determining an amount by weight, of a standard measurement system, of dietary sodium a subject is allowed to consume during an intake period;**
- **converting the amount by weight of dietary sodium so determined into intake points by use of a preset ratio of the amount by weight of the standard measurement system to intake points;**
- **determining the amount by weight of the standard measurement system of dietary sodium in a portion of food that will be consumed by the subject;**
- **converting the amount by weight of the standard measurement system of dietary sodium in the portion of food to be consumed to intake points by use of said preset ratio; and**
- **maintaining a running sum of intake points which are equivalent to dietary sodium consumed by the subject during the intake period.**