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Combining nutritional data from two surveys to augment dietary intake estimates

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Introduction

- 1. Rationale for combining survey data
- 2. The data mapping process
- 3. Results for Foods 'Covered' / 'Not Covered'
- 4. Results for Sugar Analysis
- 5. Conclusions and Future Work

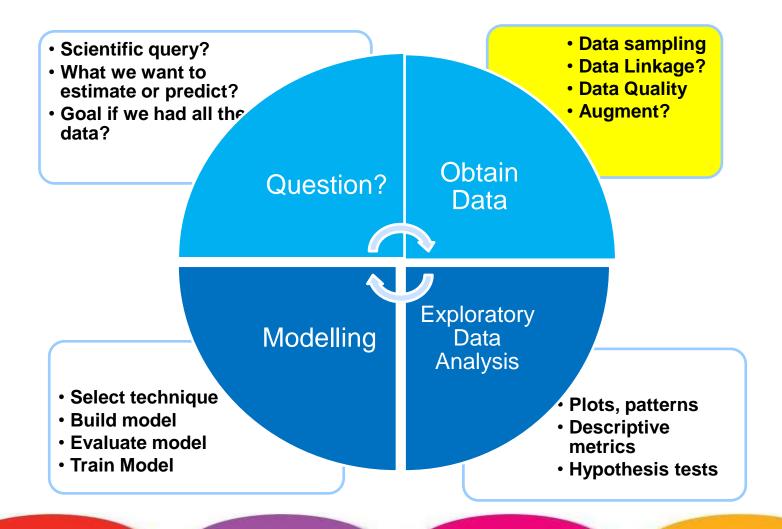


Rationale for combining survey data

- Increase information limited resources
- Augment database with additional information from another source
- Improve precision
- Synergies from data combination
- Multidisciplinary benefits mixed methods research

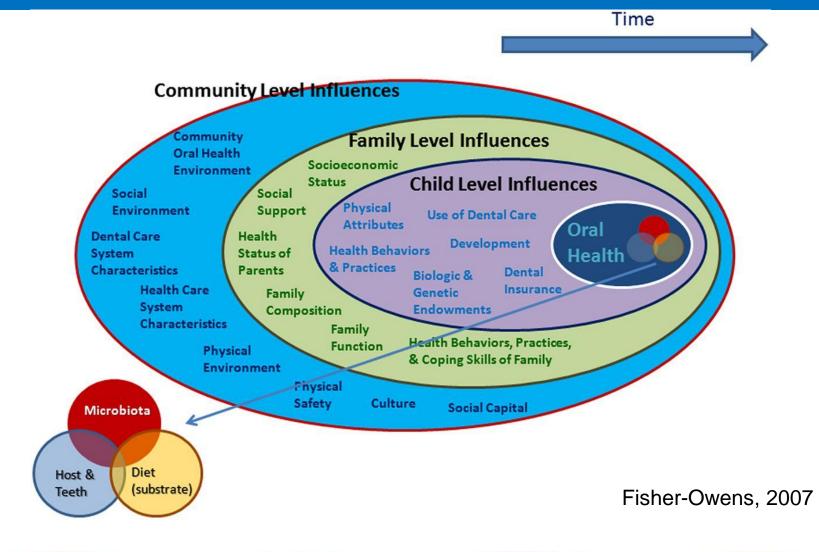


'Data Science'





Dental Problems





Why augment?

- Diet-Health relationships¹
- Decision Trees food categories GUI²
- Common Risk Factors: dental caries and obesity
- Improve accuracy of food intake data and reduce attenuation

 ¹ Crowe, M., et al. "Early Childhood Dental Problems Classification Tree Analyses of 2 Waves of an Infant Cohort Study." *JDR Clinical & Translational Research* (2016).
 ² Crowe, M., et al. "Dental problems and weight status in early childhood: classification tree analysis of a national cohort" (submitted)



Why augment?

- Foods were found to be low level predictors in Classification tree analysis for GUI infants at 3 years – why was this?
- Is the frequency or amount of food more important?
- Sugar is there a link between dental caries and obesity?



- Aim of study- e.g. GUI v IUNA-NPNS
- Comparability of data, population, time frame
- All self report dietary instruments contain
 measurement error
- Describe usual daily mean intake distributionsfrequency AND Weight
- Short term (24-HR) V long-term (FFQ)



Data sources

	NPNS	GUI
Sample size (n)	500 (126=3yo)	9,793
Study type	Cross- sectional	Longitudinal
Nationally representative	Yes	Yes
Date of survey	Oct 2010-Sept 2011	Dec 2010-July 2011
Food measurement tool	4 day weighed food diary	Modified FFQ





- 1. Primary data GUI and NPNS (IUNA)
- 2. FFQ in GUI 15 food groups, NPNS had 77
- 3. Features were selected for food mapping using shallow Natural Language Processing (NLP)
- 4. Foods not covered by the GUI FFQ- part of risk





- GUI frequency of consumption defined for 0, 1, >1
- BMI, social class, food frequency categories chisquare proportion test and equivalence tests (p<0.05)
- Data files were imported from SPSS (IBM) and csv file formats to R (version 3.2.2) for linkage and analysis



Food Frequency Questionnaires

C24. How old was <child> [in months] when he/she completely stopped being breastfed? _</child>	Months
[Int: Only Accept answer in Months]	

C25. [Card C25] In the last 24 hours has <child> had the following foods and drinks once, more than once, or not at all?

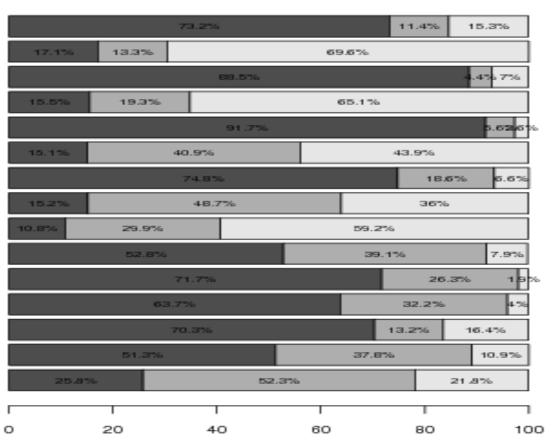
	Not		More than
	At all	Once	Once
A. Fresh fruit			2
B. Cooked vegetables			2
C. Raw vegetables or salad			2
D. Hamburger, hot dog, sausage or sausage roll, meat pie,			2
E. Hot chips or French fries			2
F. Crisps or savoury snacks			2
G. Biscuits, doughnuts, cake, pie or chocolate			2
H. Sweets			2
I. Full fat cheese/yoghurt/ fromage frais			2
J. Low fat Cheese/ low fat yoghurt			2
K. Water (tap water / still water/ sparkling water)			2
L. Fizzy drinks / minerals / cordial / squash (diet)			2
M. Fizzy drinks / minerals / cordial / squash (not diet)			2
N. Full cream milk or full cream milk products			2
O. Skimmed/Semi-skimmed milk or Skimmed/Semi skimmed			
milk products			2



Food and drink FFQ GUI

Food and drink items

Fizzy drinks/minerals/cordial/squash (diet) Tap water, still, sparking Skimmed/Semiskimmed milk or milk products Full cream milk or full cream products Low fat cheese/low fat yoghurt Full fat cheese/low fat yoghurt Raw vegetables or salad Cooked vegetables Fresh fruit Crisps or sayoury snacks Hot chips or French tries Hamburger, hot dog, sausage, meat ple Fizzy drinks/minerals/cordial/squash (not diet) Sweets Biscuits, doughnuts, cake, pie or chocolate



Not at all
 Once

More than price

% consumptions



Data processing steps

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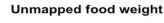


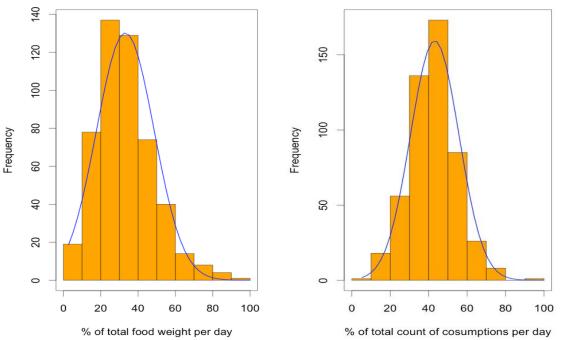
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Food frequency and consumption weight not mapped by GUI survey

Unmapped food items





Histograms represent the distribution of the ratio of consumption counts* or weight of a food item consumed in IUNA that were not mapped by GUI.

* number of food consumptions not represented in GUI divided by the total number of foods consumed in a given day.



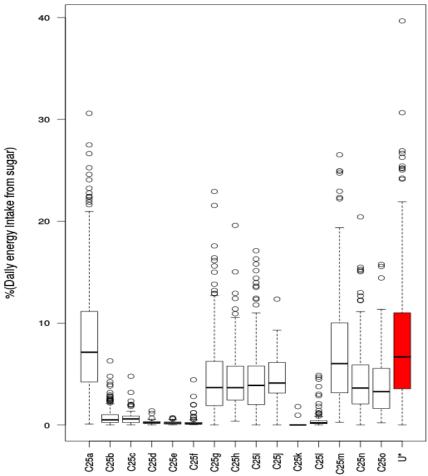
GUI Mapped data

- Advantages and disadvantages of using FFQs
- Quantify bias in results of diet health outcome
- Sufficient to analyse specific food category fully covered but need to establish foods uncovered
- Focus of this group is on sugars, in particular from a dental/weight status perspective



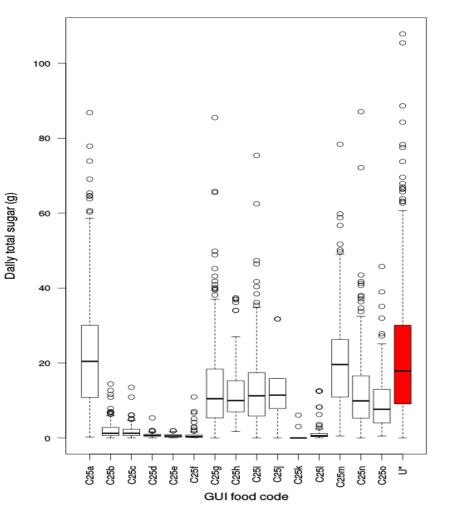
NPNS Total sugar by "GUI codes"

GUI food and daily total sugar



GUI food code

GUI food and daily total sugar

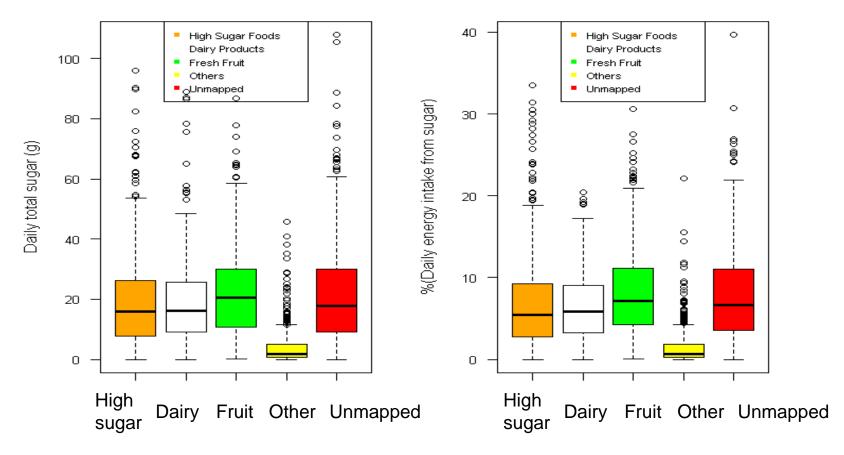




Total sugar-groups

GUI food and daily total sugar

GUI food and daily total sugar





Conclusions

- Combining data surveys by mapping is useful
- Complex protocol 'covered': food item dependant
- Mapping food categories allows us to increase the precision of food estimates
- Survey design and instrument selection should reflect priorities and anticipated outcomes



Conclusions

- Mapping of sugars will allow targeting of specific cariogenic foods
- Diet-disease relationships can be explored using continuous data
- Data linkage (Unique identifier)
- Inform policy food and oral health strategy



Future Analysis (Sugar)

- Generate synthetic data (Monte Carlo simulation) with improved accuracy
- Re-run regression/CTA analyses with GUI data focusing on obesity and dental problems
- Predictive modelling long term goal
- 5 year old FFQ (dental problems-16%)
- Ability to use statistical modelling to investigate role of free sugars in dental problems and obesity



Acknowledgments

Thanks to:



- GUI infants and parents
- ESRI/GUI team
- IUNA/NPNS







Questions?

www.VADLO.com



"I can prove it or disprove it! What do you want me to do?"



References

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Extra Slides

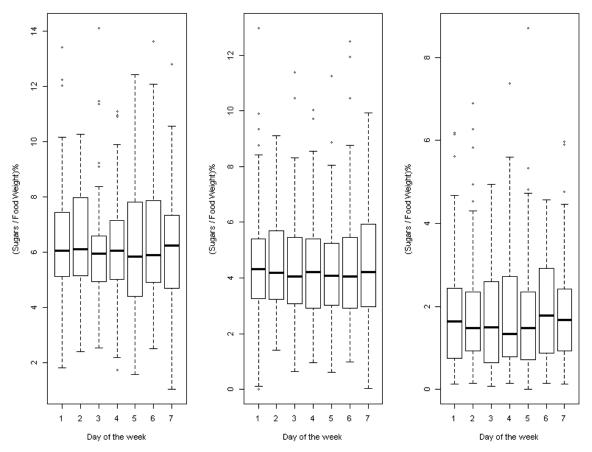


Total sugars

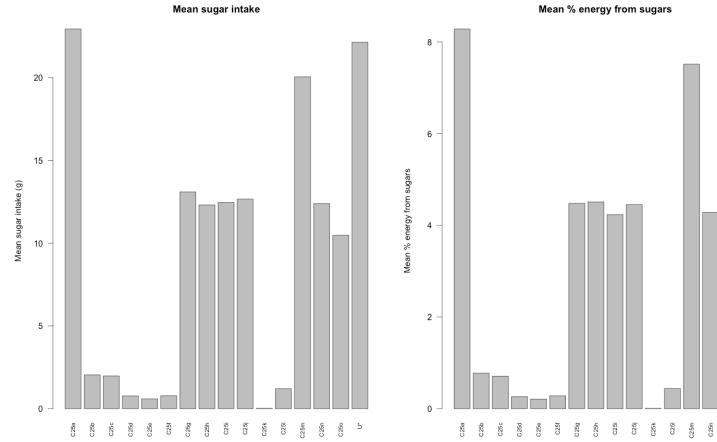
All foods items

Covered

Uncovered







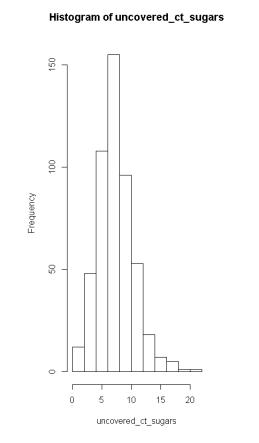
Mean % energy from sugars

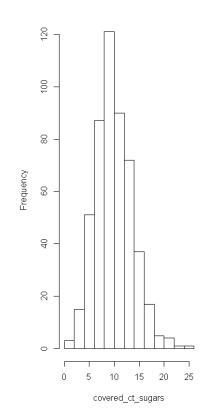
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C250



Sugar frequency consumptions





Histogram of covered_ct_sugars



Top contributors by number of subjects 20 4 09 30 50 Maximum sugar intake (g) Subject count 40 20 30 20 6 6 0 0 C25a C25g C25h C25i C25j C25m U* C25a C25g C25h C25i C25j C25m U* GUI food code GUI food code

Top contributor by consumption



8

09

40

20

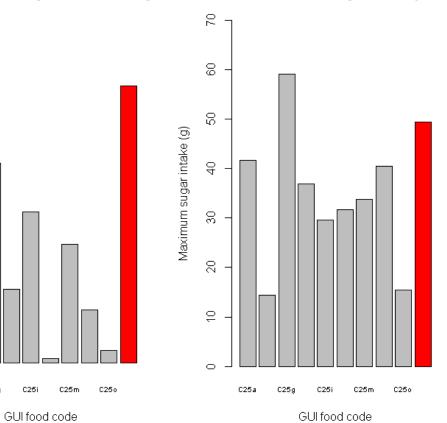
0

C25a

C25g

Subject count

>P95 contributors by number of subject



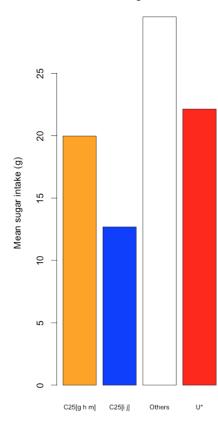
>P95 contributor by consumption

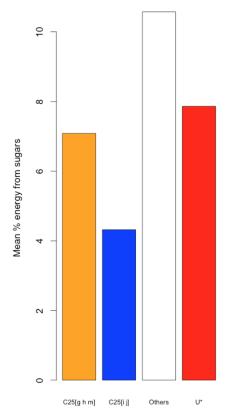


Mean Sugar intake

Mean sugar intake

Mean % energy from sugars







Mapping GUI

	A	В	С	D	E	F
1	FOODNAME	COOKINGMET	IUNA_NPNS_	CMETH -	ct 💌	GUI_CODE 🔽
83	Potatoes	Combination	25	12	1	
34	Potatoes	Unknown	25	13	1	
85	Processed & homemade potato products	Not Cooked	26	1	1	
86	Processed & homemade potato products	Grilled	26	2	12	
87	Processed & homemade potato products	Boiled	26	3	1	
38	Processed & homemade potato products	Fried/stir-fried	26	6	3	
39	Processed & homemade potato products	Baked	26	9	17	
90	Processed & homemade potato products	Combination	26	12	2	
91	Chipped, fried & roasted potatoes	Not Cooked	27	1	1	
92	Chipped, fried & roasted potatoes	Fried/stir-fried	27	6	13	C25e
93	Chipped, fried & roasted potatoes	Deep-Fat Fried	27	7	31	C25e
94	Chipped, fried & roasted potatoes	Roasted	27	8	21	C25e
95	Chipped, fried & roasted potatoes	Baked	27	9	38	C25e
96	Chipped, fried & roasted potatoes	Combination	27	12	1	C25e
97	Chipped, fried & roasted potatoes	Unknown	27	13	2	C25e
98	Vegetable & pulse dishes	Not Cooked	28	1	8	C25c
99	Vegetable & pulse dishes	Boiled	28	3	12	C25b
00	Vegetable & pulse dishes	Stewed	28	5	1	C25b
01	Vegetable & pulse dishes	Fried/stir-fried	28	6	2	C25b
02	Vegetable & pulse dishes	Roasted	28	8	1	C25b
03	Vegetable & pulse dishes	Baked	28	9	1	C25b
04	Vegetable & pulse dishes	Combination	28	12	3	C25b
05	Peas, beans & lentils	Not Cooked	29	1	7	C25c
06	Peas, beans & lentils	Boiled	29	3	67	C25b
07	Peas, beans & lentils	Steamed/blanche	29	4	5	C25b
08	Peas, beans & lentils	Stewed	29	5	2	C25b
09	Peas, beans & lentils	Fried/stir-fried	29	6	1	C25b
10	Peas. beans & lentils	Microwaved	29	10	5	C25b



Classification tree analysis 3 yo GUI

- Ethnicity most NB predictor of Dental problem
- Highest prev. Dental Problems: Children, Irish, obese/underweight with longstanding illness and PCG BMI>24.9
- Food: Low fat cheese/yoghurt. Raw veg/salad,
 Fresh fruit, French fries levels 3 and 4 predictors
- Sociodemographic: HH Annual Income