



Society of Actuaries in Ireland

Predicting health through the analysis of food-related data

7th September, 2016

Disclaimer

The views expressed in this presentation are those of the presenter(s) and not necessarily of the Society of Actuaries in Ireland



Introduction

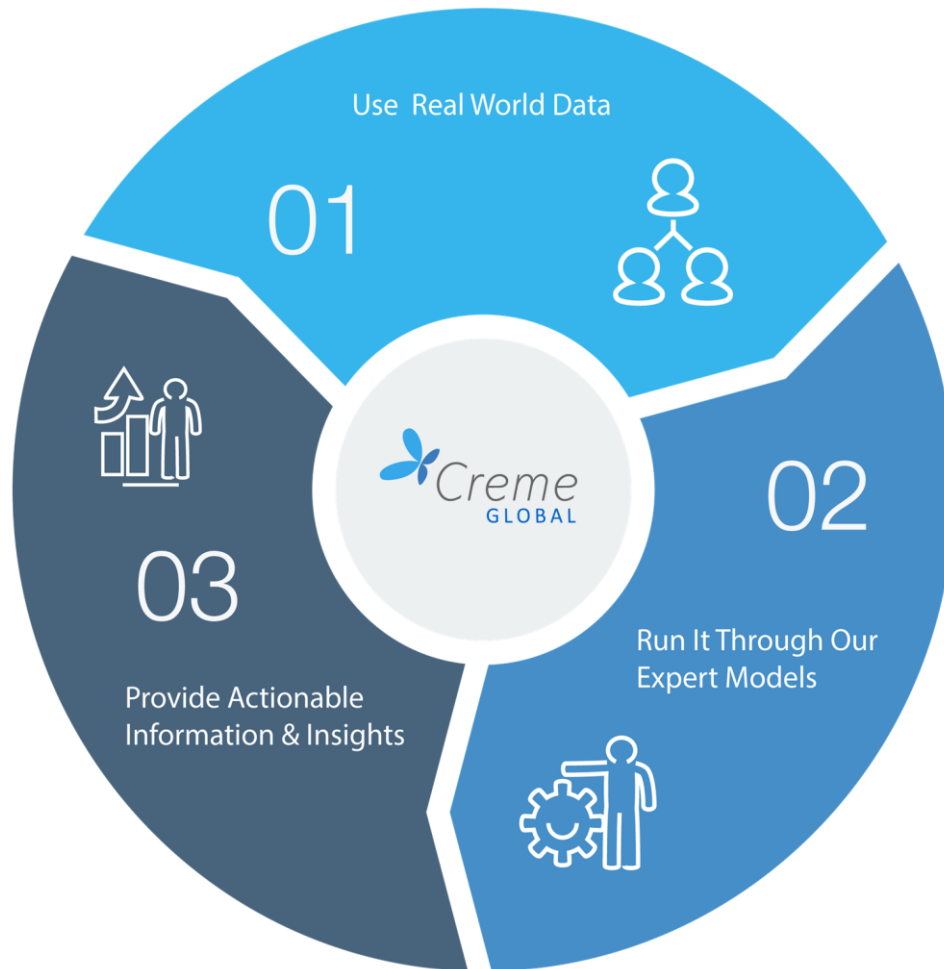
- What we do
- Data sources
- Working example
- Models overview
- What can be done in the future?
- Q&A



WHAT WE DO



Who we are and what we do



Use Real-World Data

- Actual Consumer Habits & Practices
- Food/ Product Composition
- Chemical Concentration/ Occurrence
- Market Share & Sales Data
- US, EU, China, Brazil, Mexico, etc.

Run it through our Expert Models

- Probabilistic Exposure Assessment
- Predictive Intake Modelling
- Total Aggregate Exposure
- What-If Scenario Analysis
- Population Dietary Intake

Provide Actionable Information and Insights

- Innovation/ R&D Decisions
- Investment Decisions
- Policy Decisions



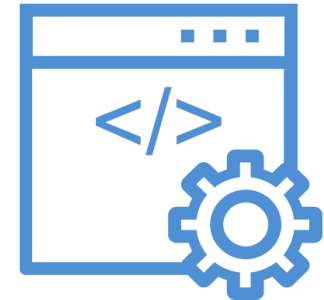
Our Services



High Performance
Cloud Software
Licensing



Technical Services &
Scientific Projects



Data Collection,
Validation &
Modelling



Our Products

Food Safety



Aggregate Exposure Models for
Food Safety Assessment

Nutrition



Nutritional Intake Modelling and
Scenario Analysis

Crop Sciences



Aggregate Exposure Models
Focussed on Crop Sciences

Care & Cosmetics



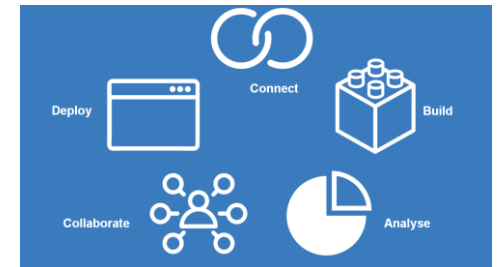
Exposure Models for Personal
Care & Cosmetics

Microbial



Microbial Growth, Stability and
Risk Modelling

EXPERT MODELS





DATA SOURCES



Data on food consumption can be retrieved from two groups of sources:

- Traditional sources:
 - National surveys
 - In Europe, EFSA created the comprehensive & compiled databases
 - Retail and manufacturers data
- New sources:
 - Social media
 - Apps
 - Sensors

EU's Horizon 2020 Richfields project



Data sources – Pros & cons

Desired Characteristics	Traditional Sources	New sources
Long-term	X	✓
Controlled & harmonized data	✓	X
Data representative of the entire population	✓	X
Freely-available	X	✓

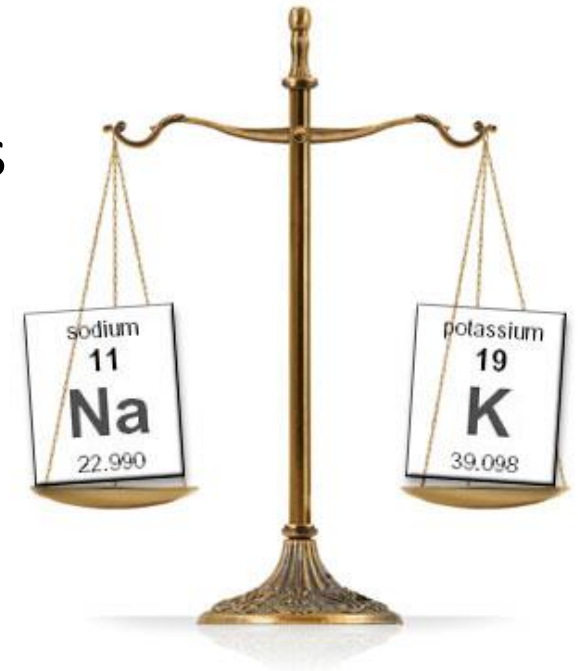


WORKING EXAMPLE



Sodium vs Potassium

- Both nutrients have opposite effects on the risk of stroke:
 - ↑ Sodium raises it
 - ↓ Potassium decreases it
- Each year, ~10,000 Irish people have a stroke and 2,000 die (Irish Heart Foundation)
- Both nutrients are nearly ubiquitous so virtually everybody consumes them

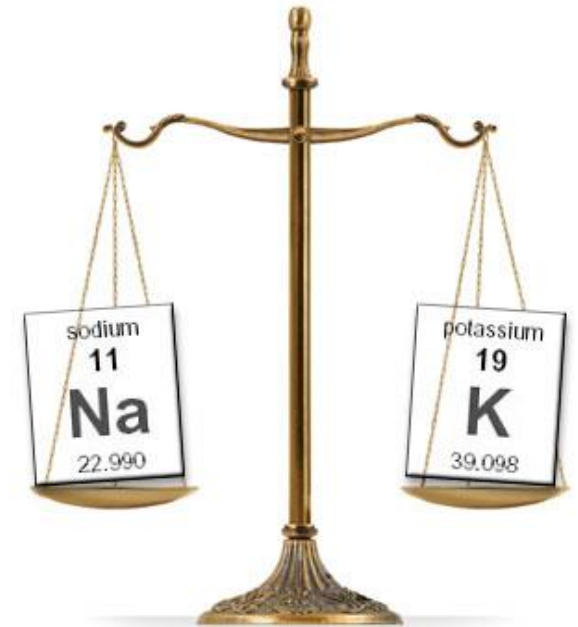




Sodium vs Potassium

This type of analysis requires:

- Total diet data for the population of interest
- Concentration data in foods for the two nutrients
- Statistical model on food consumption

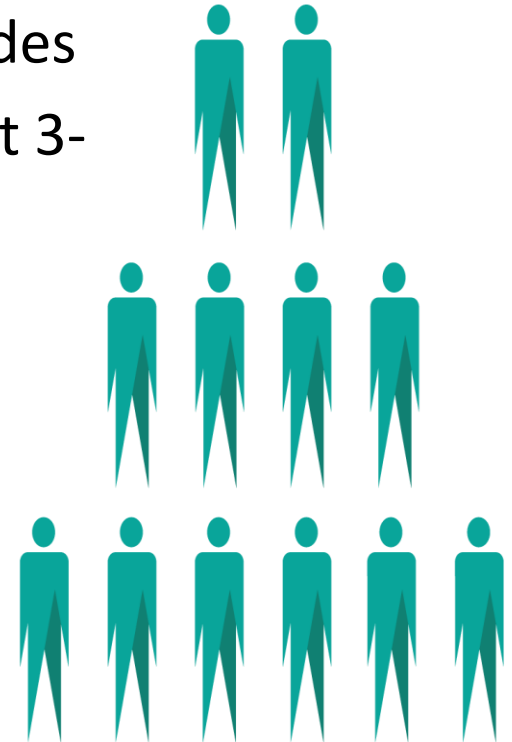




Sodium vs Potassium

Total diet data:

- UK National Diet and Nutrition Survey (NDNS) carried out from 2008 to 2012
- 7,000 subjects of 1.5 years and older
- Subjects randomly selected from 799 postcodes
- 3,450 adults age 19+ years completed at least 3-days diaries
- This analysis is based on 2,083 adults





ALGORITHM FOR DIETARY ANALYSES



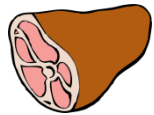
Frequency



X 1



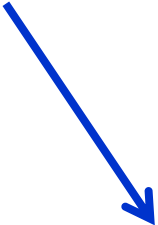
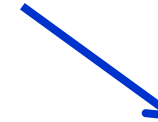
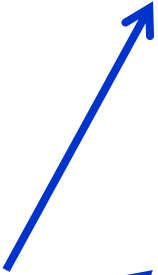
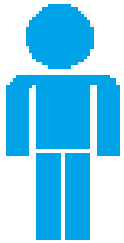
X 2



X 2



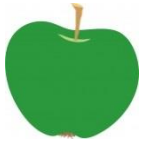
X 3





Frequency

Amount



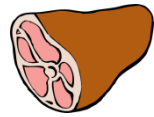
X 1

40 g



X 2

500 g



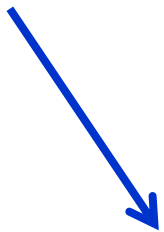
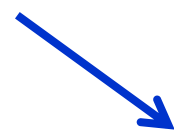
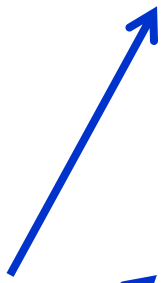
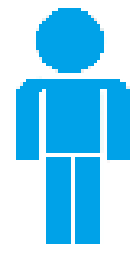
X 2

100g



X 3

200 g

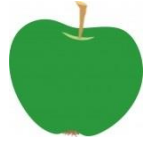




Frequency

Amount

Nutrient
Concentration



X 1

40 g

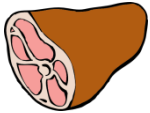
0.006 %



X 2

500 g

0.02 %



X 2

100g

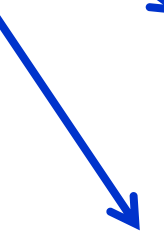
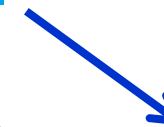
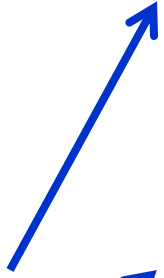
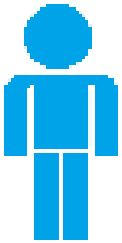
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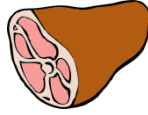


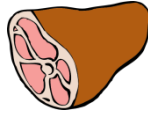
X 3

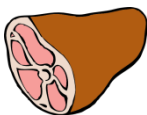
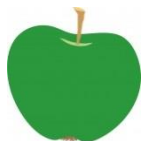
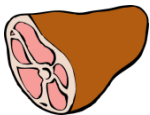
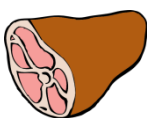
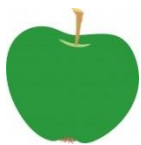
200 g

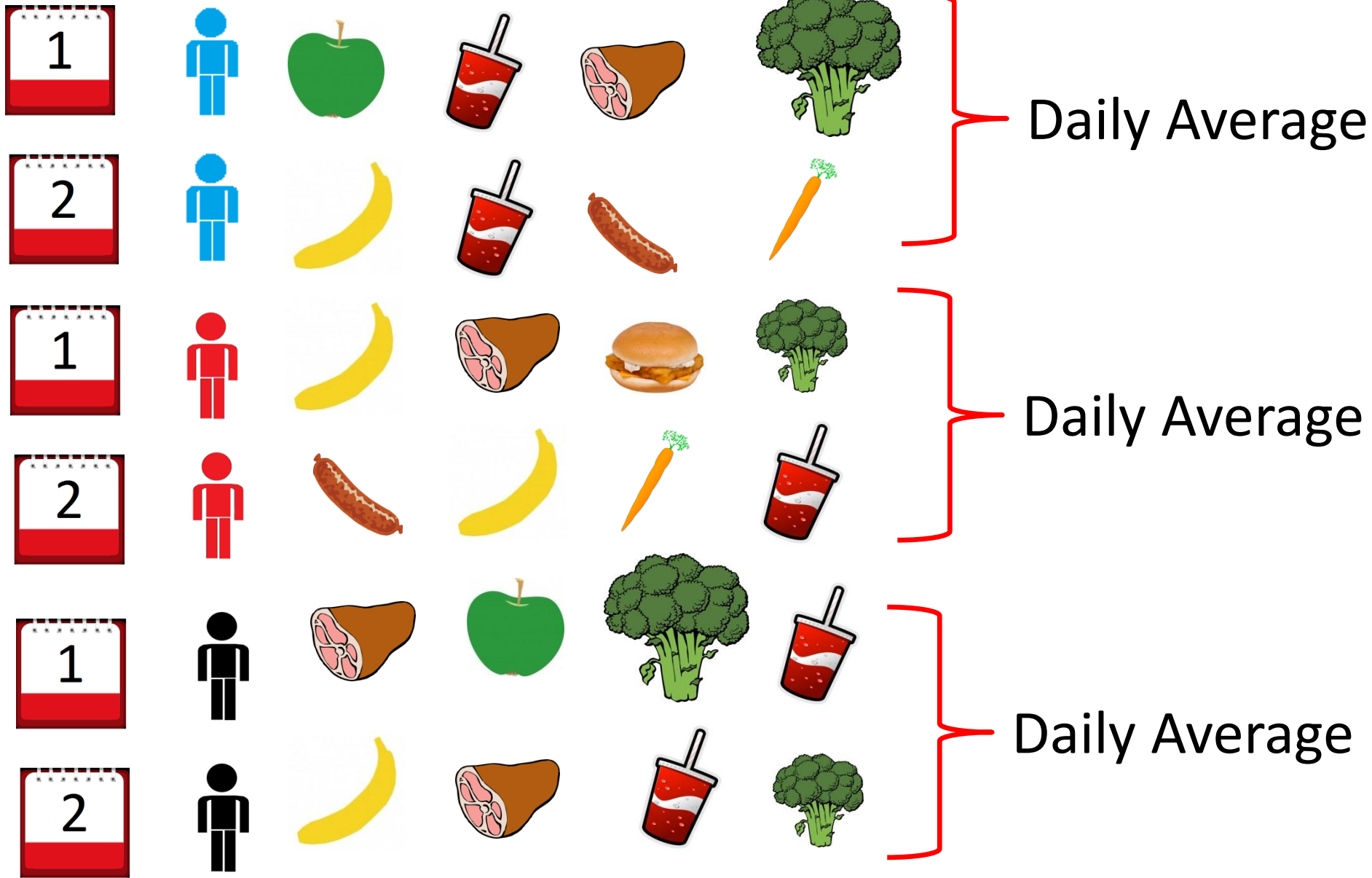
0.0005%

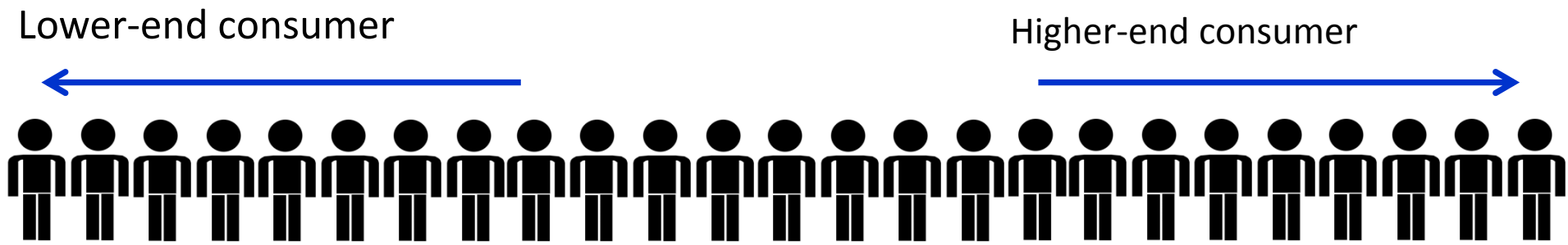


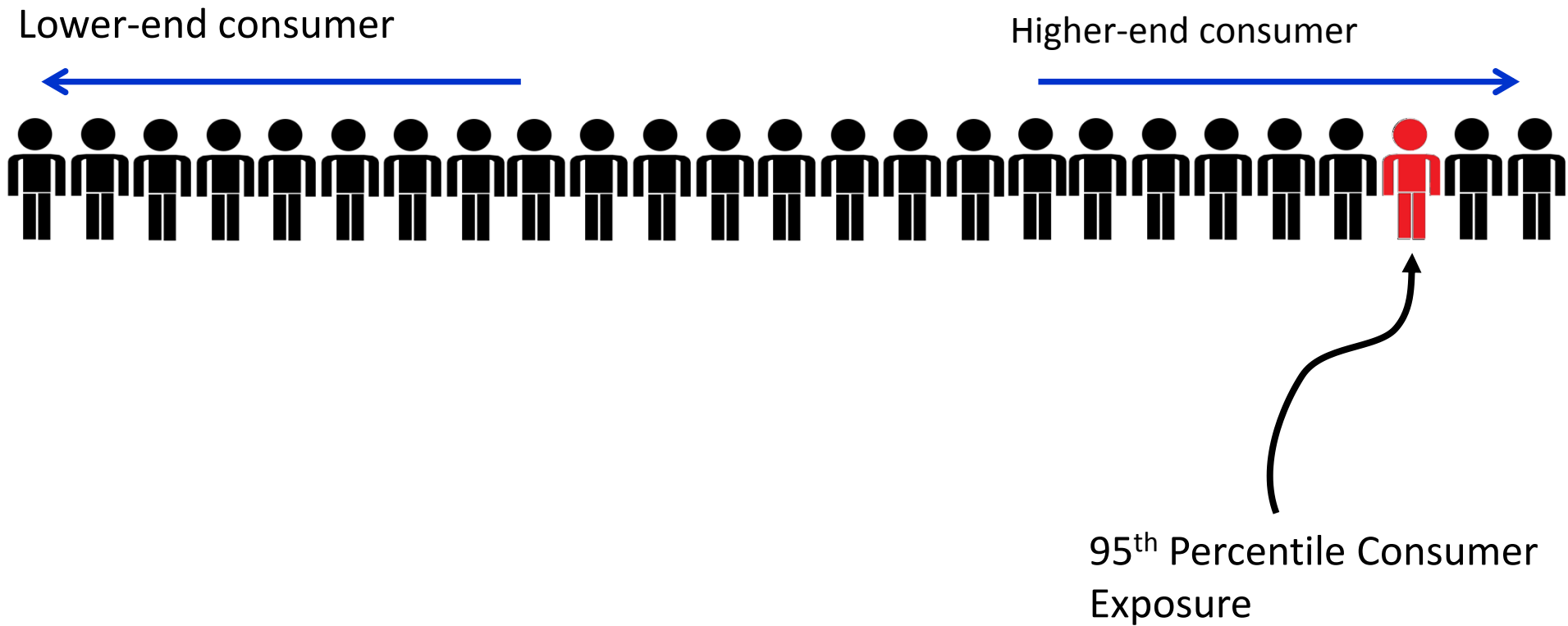


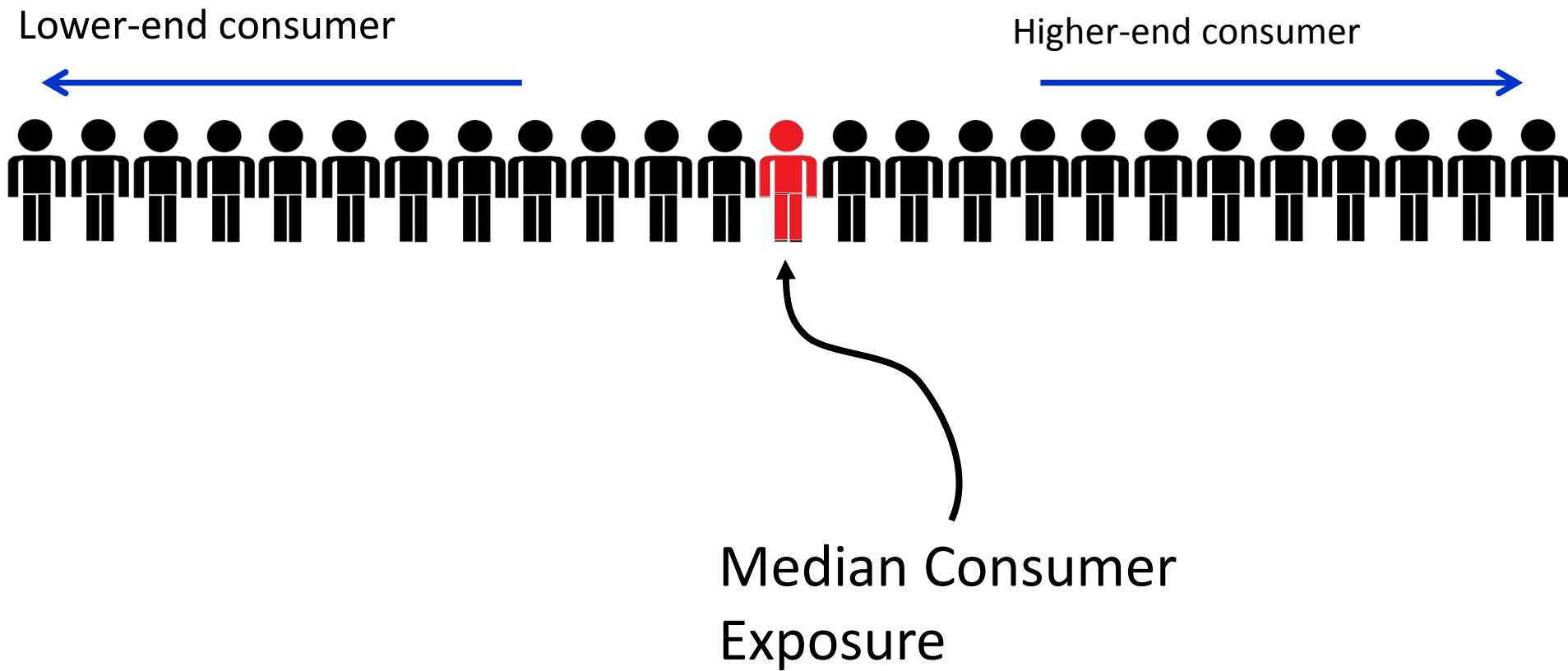


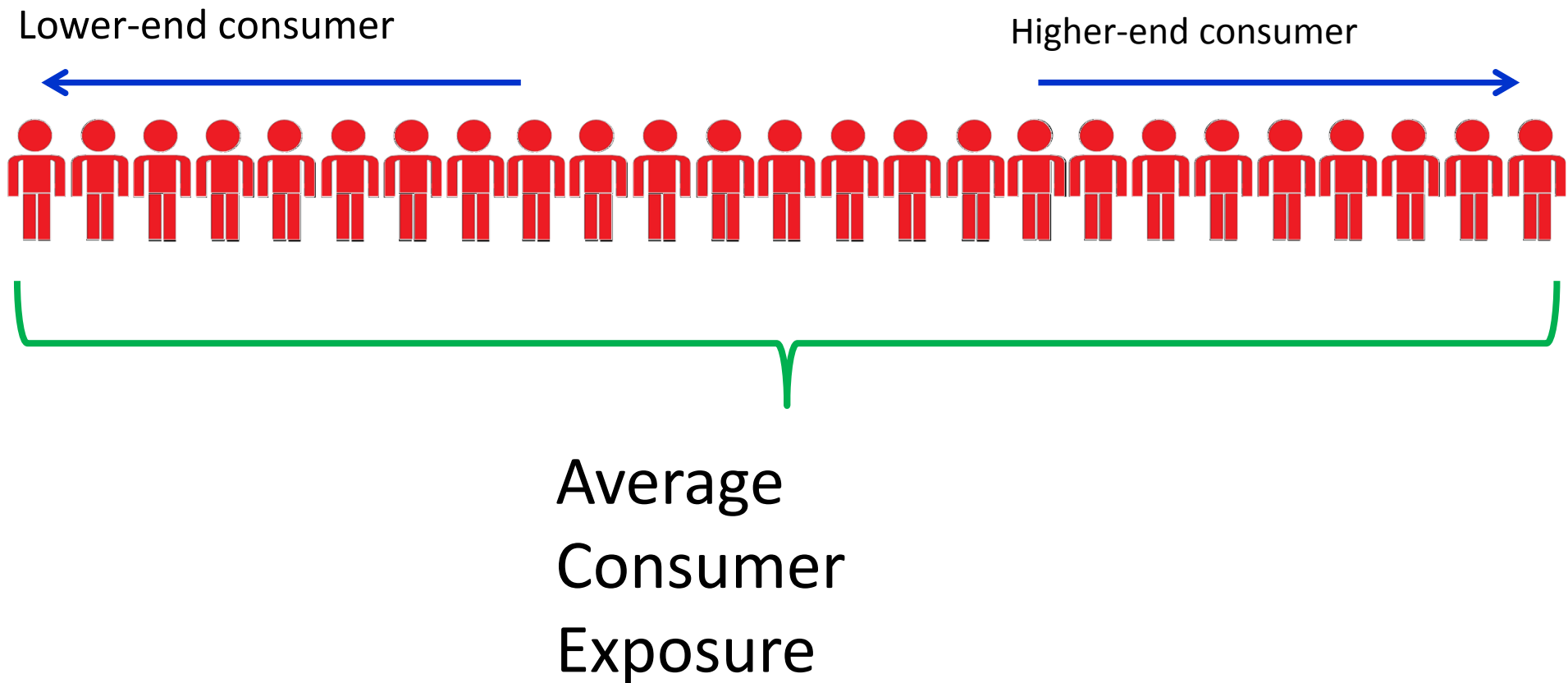














THE TOOL



Creme Nutrition

Assessments | **Data** | Distributions | Documents

File | View | Graph | Exit

admin nutritiondemo (nutritiondemo)

Updates

237 NDNS Adults 2008 2012 Consumption Table (Validated by Creme Global™)
 Consumption Table
 Displaying rows 1 to 25 of 220905

View Mode | Edit Mode | Reorder Fields

Filters: Select a field =
 Filter
 Remove filters

All	_P	Subject Code	Day	Time	Food Code	Brand Code	Amount	Meal	Meal Consumed With	Place Of Consumption	Watching Tv	Diarymth	Survey Year	Country	Day Of Week
			No Filter					No Filter	No Filter	No Filter	No Filter	No Filter	No Filter	No Filter	No Filter
			1					1	A - Alone	Bus, car, train	No	NDNS Year 1	England	Friday	
			2				2	B - Partner	Carer's home	Not Specified	NDNS Year 2	Northern Ireland	Monday		
			3				3	C - Partner & Children	Coffee shop, cafe, shop, deli, sandwich bar	Yes	NDNS Year 3	Scotland	Saturday		
1	187	10101111	1	07:59:59	205	null	30	1	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
2	188	10101111	1	07:59:59	608	null	100	1	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
3	189	10101111	1	07:59:59	2349	null	57	1	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
4	190	10101111	1	07:59:59	5101	null	240	1	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
5	191	10101111	1	10:00:00	2349	null	57	2	O - Not specified	Work - Desk	Not Specified	13438656000	NDNS Year 1	England	Thursday
6	192	10101111	1	10:00:00	5101	null	240	2	O - Not specified	Work - Desk	Not Specified	13438656000	NDNS Year 1	England	Thursday
7	193	10101111	1	13:30:00	313	null	60	3	L - Work colleagues	Work - Other	Not Specified	13438656000	NDNS Year 1	England	Thursday
8	194	10101111	1	12:29:59	10001	null	34.5	3	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
9	195	10101111	1	12:29:59	8099	null	50	3	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
10	196	10101111	1	12:29:59	2349	null	57	3	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
11	197	10101111	1	13:30:00	2349	null	57	3	L - Work colleagues	Work - Other	Not Specified	13438656000	NDNS Year 1	England	Thursday
12	198	10101111	1	12:29:59	5101	null	240	3	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
13	199	10101111	1	13:30:00	5101	null	240	3	L - Work colleagues	Work - Other	Not Specified	13438656000	NDNS Year 1	England	Thursday
14	200	10101111	1	12:29:59	8020	null	72	3	A - Alone	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
15	201	10101111	1	19:00:00	2447	null	250	5	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
16	202	10101111	1	19:00:00	1573	null	225	5	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
17	203	10101111	1	19:00:00	10015	null	250	5	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
18	204	10101111	1	19:00:00	2349	null	57	5	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
19	205	10101111	1	19:00:00	5101	null	240	5	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
20	206	10101111	1	22:00:00	8352	null	250	7	B - Partner	Home - Living Room	Yes	13438656000	NDNS Year 1	England	Thursday
21	207	10101111	2	07:59:59	205	null	30	1	A - Alone	Home - Living Room	Yes	13438742400	NDNS Year 1	England	Friday
22	208	10101111	2	07:59:59	608	null	100	1	A - Alone	Home - Living Room	Yes	13438742400	NDNS Year 1	England	Friday
23	209	10101111	2	07:59:59	2349	null	57	1	A - Alone	Home - Living Room	Yes	13438742400	NDNS Year 1	England	Friday
24	210	10101111	2	07:59:59	5101	null	240	1	A - Alone	Home - Living Room	Yes	13438742400	NDNS Year 1	England	Friday
25	211	10101111	2	10:00:00	2349	null	57	2	O - Not specified	Work - Desk	Not Specified	13438742400	NDNS Year 1	England	Friday



Creme Nutrition

New Assessment - Creme Client 3.1

Go to a Website

Assessment Type

Assessment Wizard

[Help](#)

- 1. **Assessment Type**
- 2. Dataset
- 3. Groups
- 4. Options
- 5. Summary

Select Assessment Type:

Nutrient Assessment: Use this assessment type to assess the intake of a particular nutrient (or multiple nutrients) within foods. Requires a [Nutrients Table](#) within the selected survey folder.

Cancel « Previous Next » Submit Assessment



New Assessment - Creme Client 3.1

Go to a Website

Dataset Assessment Wizard Help

1. Assessment Type
2. Dataset
3. Groups
4. Brands
5. Concentrations
6. Options
7. Summary

DATASETS

- Ireland
 - NDNS Adults (2001)
 - NDNS Adults (2008-2009)
 - NDNS Adults (2008-2010)
 - NDNS Adults (2008-2011 Year)
 - NDNS Adults (2008-2011)
 - NDNS Adults (2008-2012)
 - NDNS Children (1993)
 - NDNS Children (2008-2009)
 - NDNS Children (2008-2010)
 - NDNS Children (2008-2011 Year)
 - NDNS Children (2008-2011)
 - NDNS Children (2008-2012)
 - NDNS Elderly (1995)
 - NDNS Merged (2008-2012)
 - NDNS Young People (1997)
- United Kingdom
 - NDNS Children (2008-2012)**
- USA

United Kingdom
NDNS Children (2008-2012)

Number of selected subjects: **686** Recount

Gender: All Age: between (inclusive) 13 and 18

Hide advanced subjects filters

- Weighting: between (inclusive) 0.11 and 1.41
- Day Count: between (inclusive) 3 and 4
- Bodyweight: between (inclusive) 8.6 and 125.3
- Height: between (inclusive) 0 and 194.4
- Bmi: between (inclusive) 0 and 44.45
- Age Group 1: 1.5-3 years, 4-10 years, 11-18 years
- Age Group 2: Child 1.5-18 years
- Marital Status: Item not applicable, single, that is, never married, married and living with your husband/wife, On not applicable to survey year
- Pregnant Or Breastfeeding: Item not applicable
- Finished Education At Age: between (inclusive) 15 and 18

Cancel « Previous Next » Submit Assessment



New Assessment - Creme Client 3.1

Go to a Website

Concentrations Assessment Wizard [Help](#)

[Add/Remove Chemicals](#) [Nutrient % Contribution](#) [Open Table](#) [Save Table](#)

- 1. Assessment Type
- 2. Dataset
- 3. Groups
- 4. Brands
- 5. Concentrations
- 6. Options
- 7. Summary

Add/Remove Chemicals

Changes from the initial assessment will be highlighted in red.

[New Chemical](#)

Select All Chemicals.

Chemical
<input type="checkbox"/> Saturated Fatty Acids
<input type="checkbox"/> Selenium
<input checked="" type="checkbox"/> Sodium
<input type="checkbox"/> Southgate Fibre
<input type="checkbox"/> Starch
<input type="checkbox"/> Sucrose
<input type="checkbox"/> Thiamin
<input type="checkbox"/> Total carotene

[Cancel](#) [OK](#)

[Cancel](#) [« Previous](#) [Next »](#) [Submit Assessment](#)



THE RESULTS



Sodium vs Potassium effects

Sodium

- A daily average consumption higher than 2 g/day is associated with a 23% greater stroke risk (Hankey, 2012).
- Some studies have shown that a reduction of sodium intake by 0.8-0.92 g is associated with a reduction in stroke by 20%.

Potassium

- The recommended daily intake of potassium is 3.5 g/day for adults (British Nutrition Foundation, 2015)
- A daily average intake higher than 1.64 g/day is associated with a 21% reduced stroke risk.
- 1 g/day increase in potassium intake decreases the stroke risk by 11% (Hankey, 2012).



Sodium vs Potassium

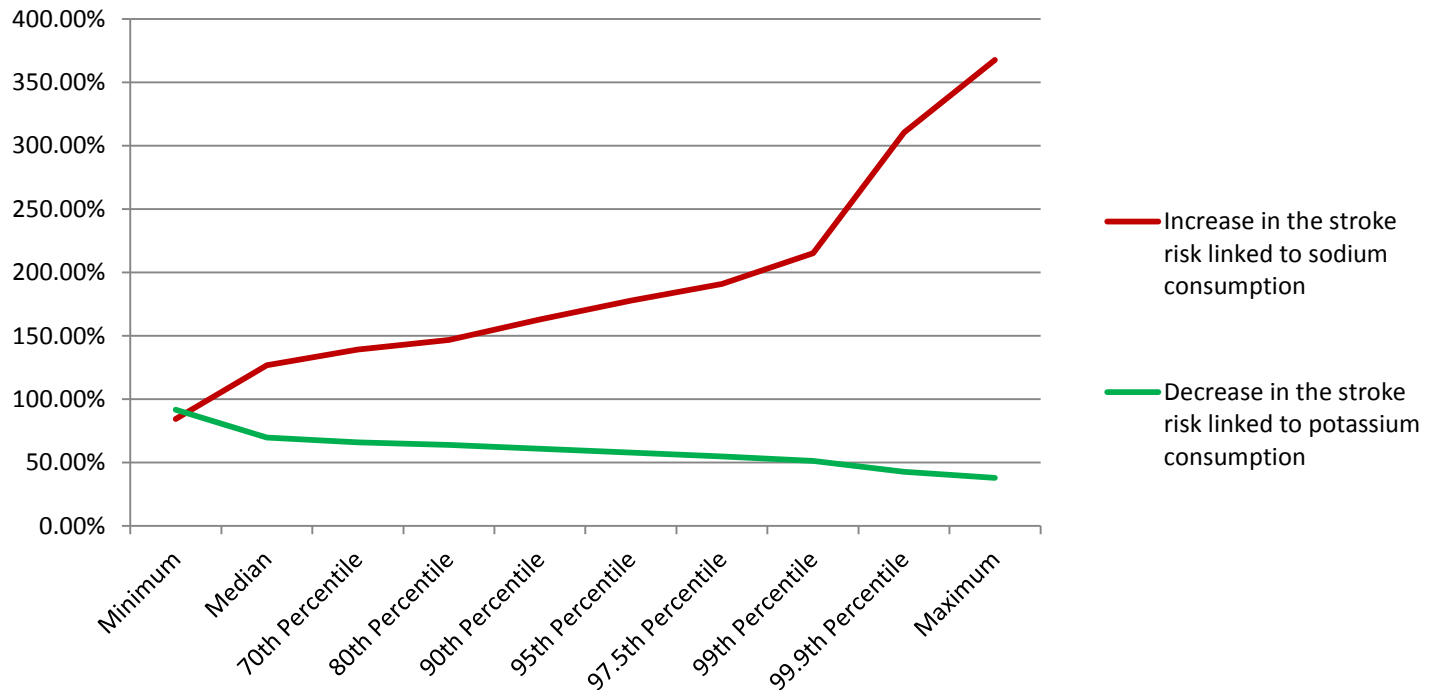
Population Statistic	Sodium intake (mg/d)	Increase in the risk of stroke
Mean	2258	129.59%
Minimum	134	84.28%
Maximum	7405	367.68%
Median	2149	126.77%
70 th Percentile	2605	139.04%
80 th Percentile	2872	146.76%
90 th Percentile	3386	162.86%
95 th Percentile	3818	177.78%
97.5 th Percentile	4169	190.86%
99 th Percentile	4759	215.12%
99.9 th Percentile	6568	310.31%

Population Statistic	Potassium intake (mg/d)	Decrease in the risk of stroke
Mean	2813	68.91%
Minimum	372	91.58%
Maximum	7968	37.79%
Median	2729	69.59%
70 th Percentile	3182	66.00%
80 th Percentile	3457	63.92%
90 th Percentile	3897	60.73%
95 th Percentile	4328	57.76%
97.5 th Percentile	4764	54.89%
99 th Percentile	5347	51.29%
99.9 th Percentile	6952	42.54%



Sodium vs Potassium - results

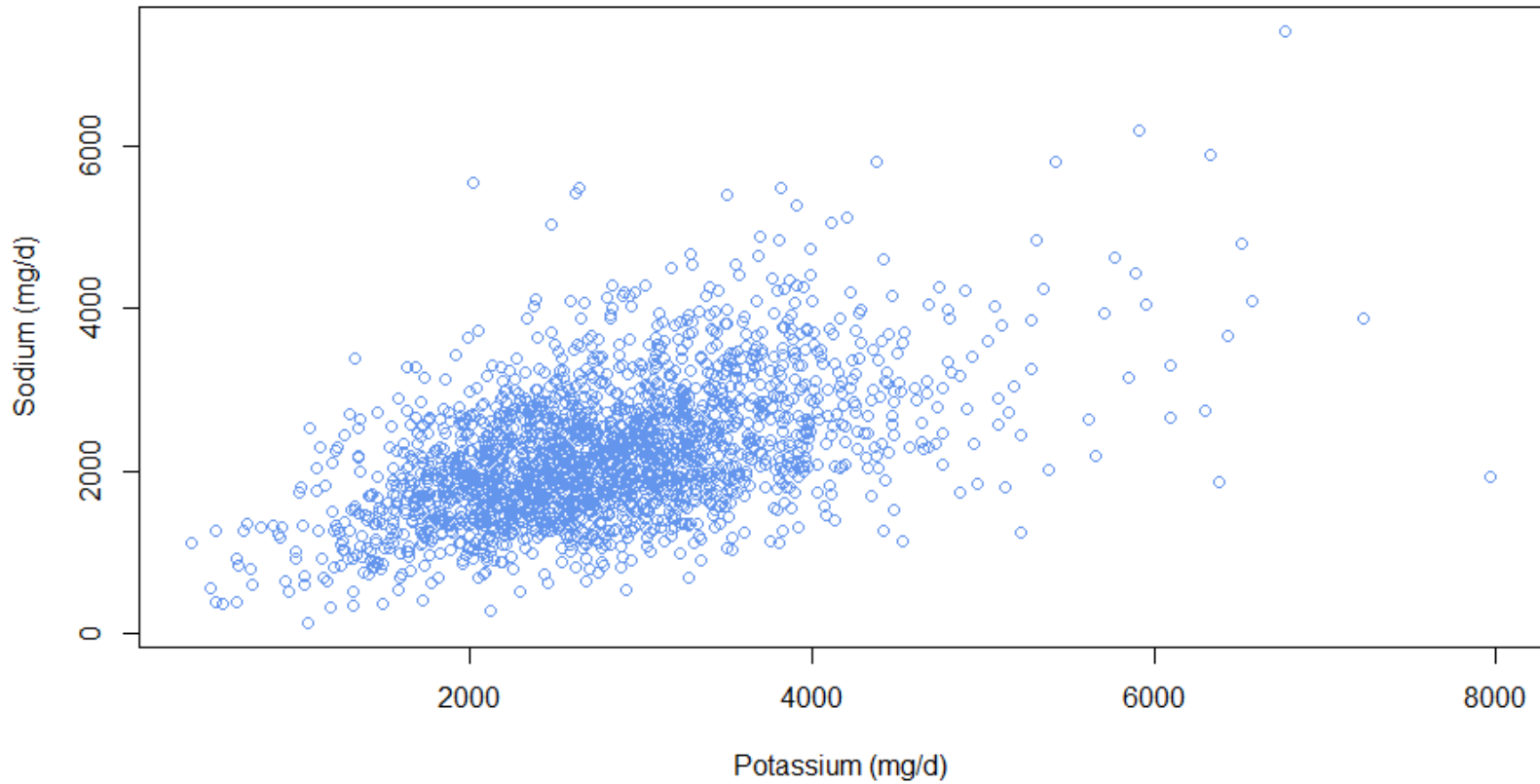
Effect of sodium and potassium consumption on the risk of stroke





Sodium vs Potassium

Scatterplot - Consumption of Potassium and Sodium





MODELS OVERVIEW



Models overview

Predictive models have been developed to carry out long-term analyses on food consumption. Some examples are:

- Creme internal model
- EFSA compiled model
- National Cancer Institute (NCI) model
- CARES NG dietary model
- Benefit-Risk Analysis Foods (BRAFO) model
-





What can be done in the future?

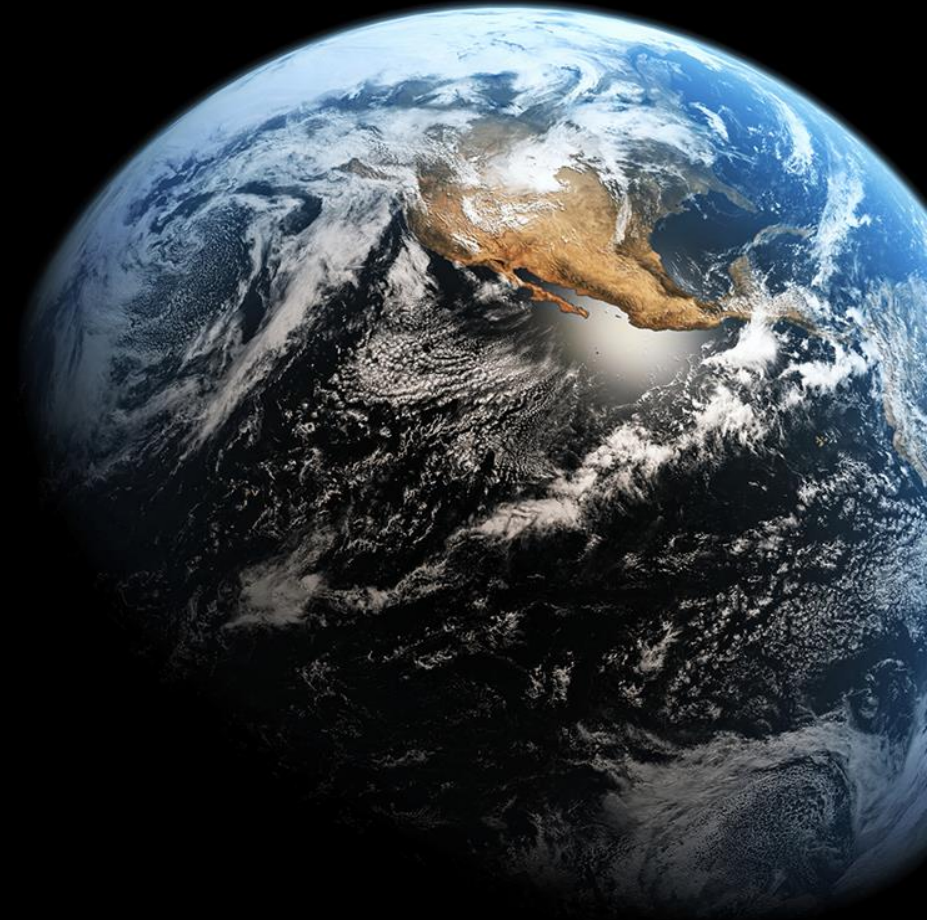
- Improve knowledge on joint effects of several nutrients on people's health
- Integrate the new diet-health models into the actuarial models for
 - Product underwriting
 - Product pricing
 - Claim processes



Predict

CONFERENCE 2016

4-5th October



For more details

Please go to www.predictconference.com or contact susan.hogan@cremeglobal.com for any queries.

Discount code - PredictActuary



QUESTIONS & ANSWERS