Creme GLOBAL

Expert Models for Decision Makers ™
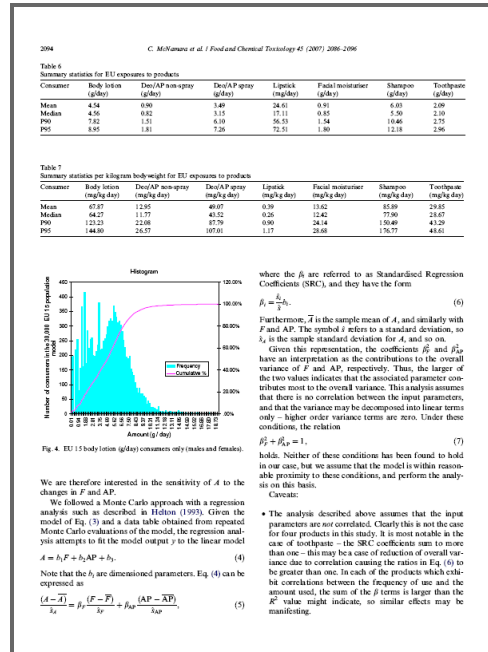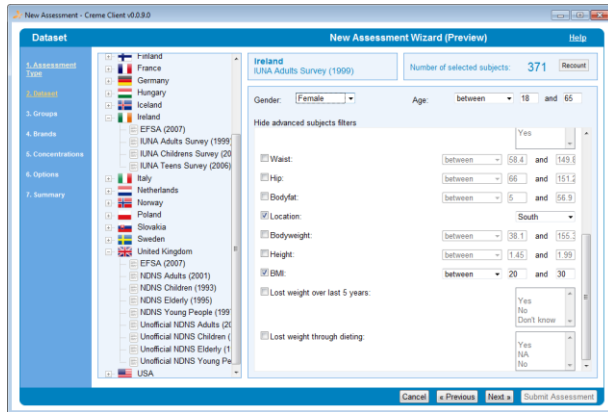
Mapping Dietary Intake Impact on Consumer Health

Cronan McNamara
Founder & CEO, Creme Global

Dubai International Food Safety Conference 2014
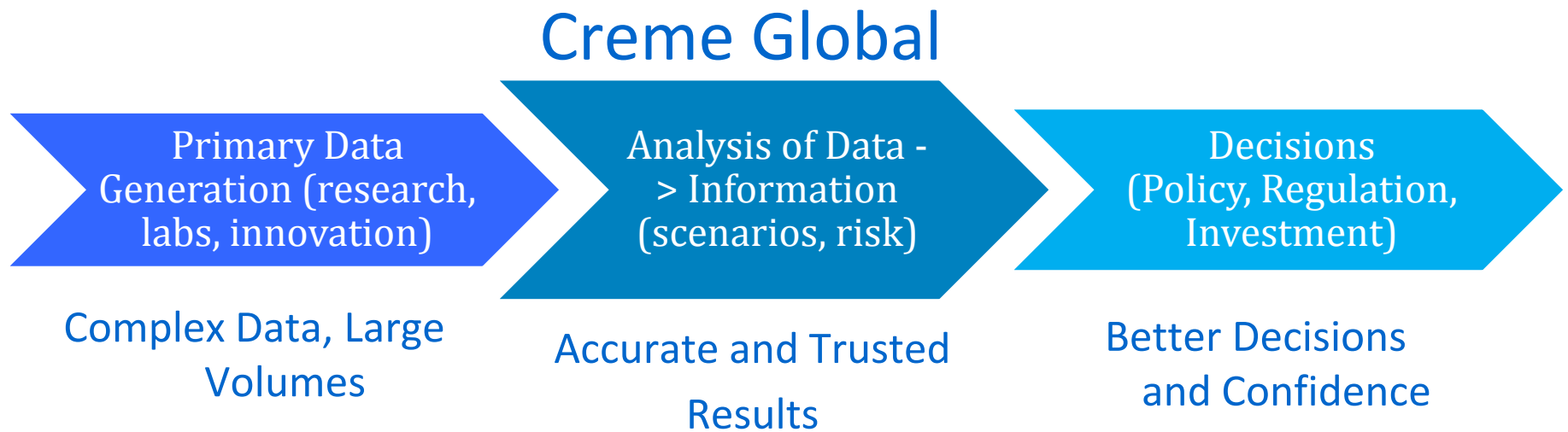
Creme Global - Services

High Performance
Cloud Software

Technical Services
& Projects

Data Collection
& Modeling

Area of Interest

Creme Global

| Primary Data Generation (research, labs, innovation) | Analysis of Data -> Information (scenarios, risk) | Decisions (Policy, Regulation, Investment) |

Complex Data, Large Volumes

Accurate and Trusted Results

Better Decisions and Confidence

Exposure Assessment & the Flaw of Averages
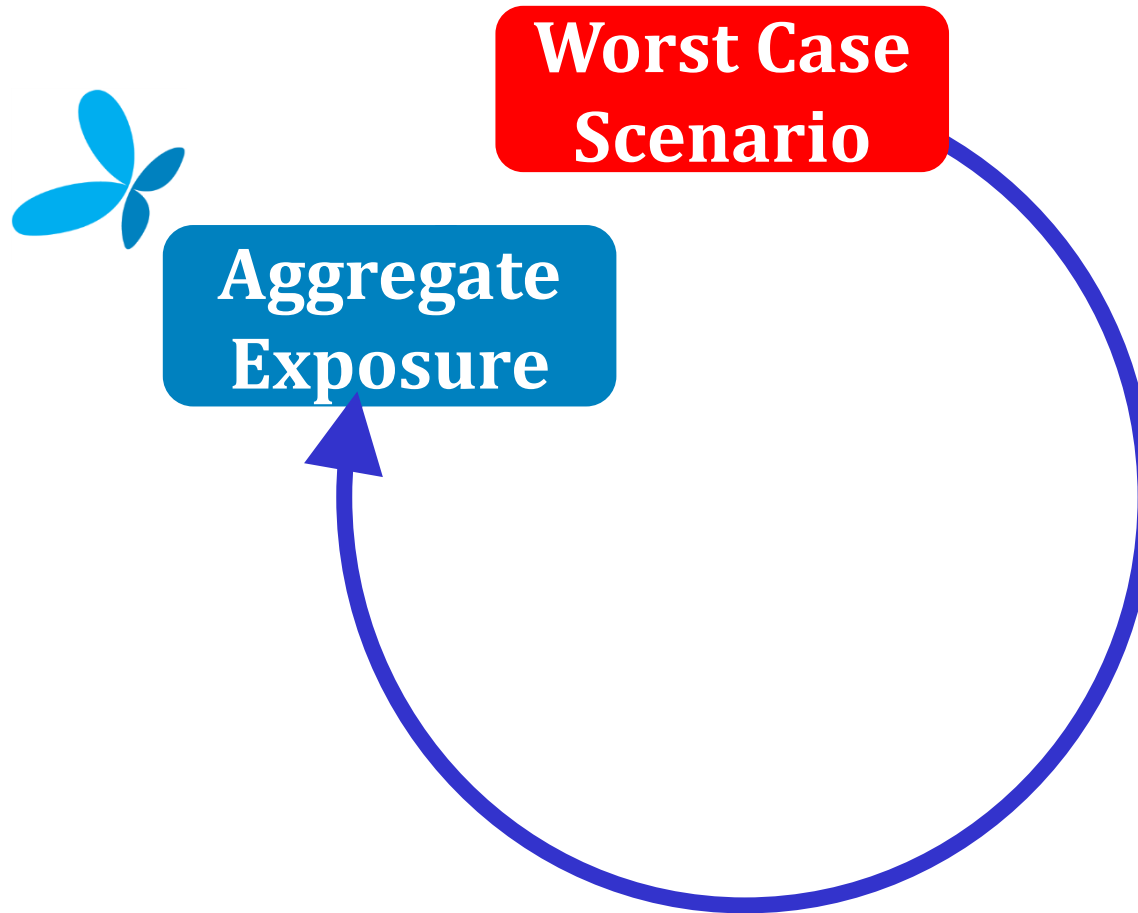
FLAW of AVERAGES
AVERAGE DEPTH 3 ft.

DANZIGER

Revolution in Consumer Intakes & Exposure Assessment

Worst Case Scenario

Aggregate Exposure

Revolution in Consumer Intakes & Exposure Assessment

Revolution in Consumer Intakes & Exposure Assessment

Revolution in Consumer Intakes & Exposure Assessment
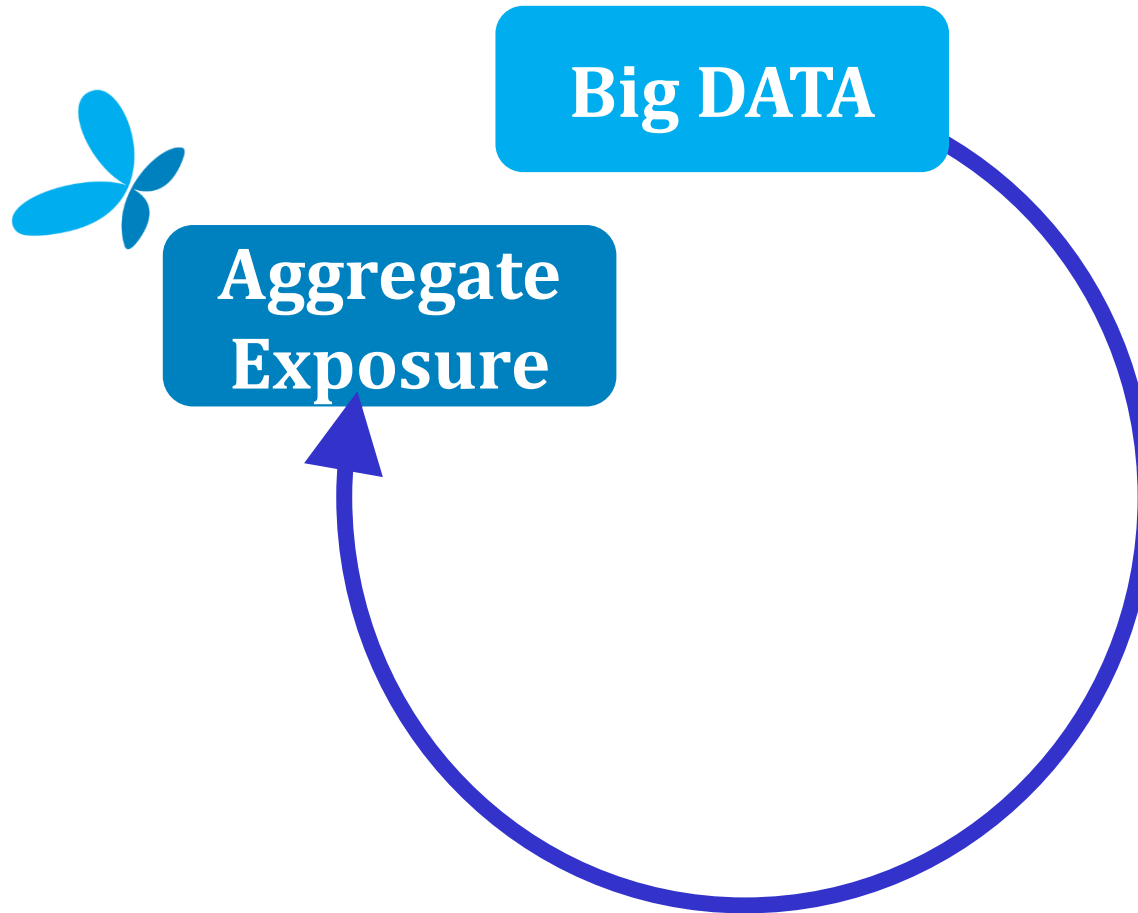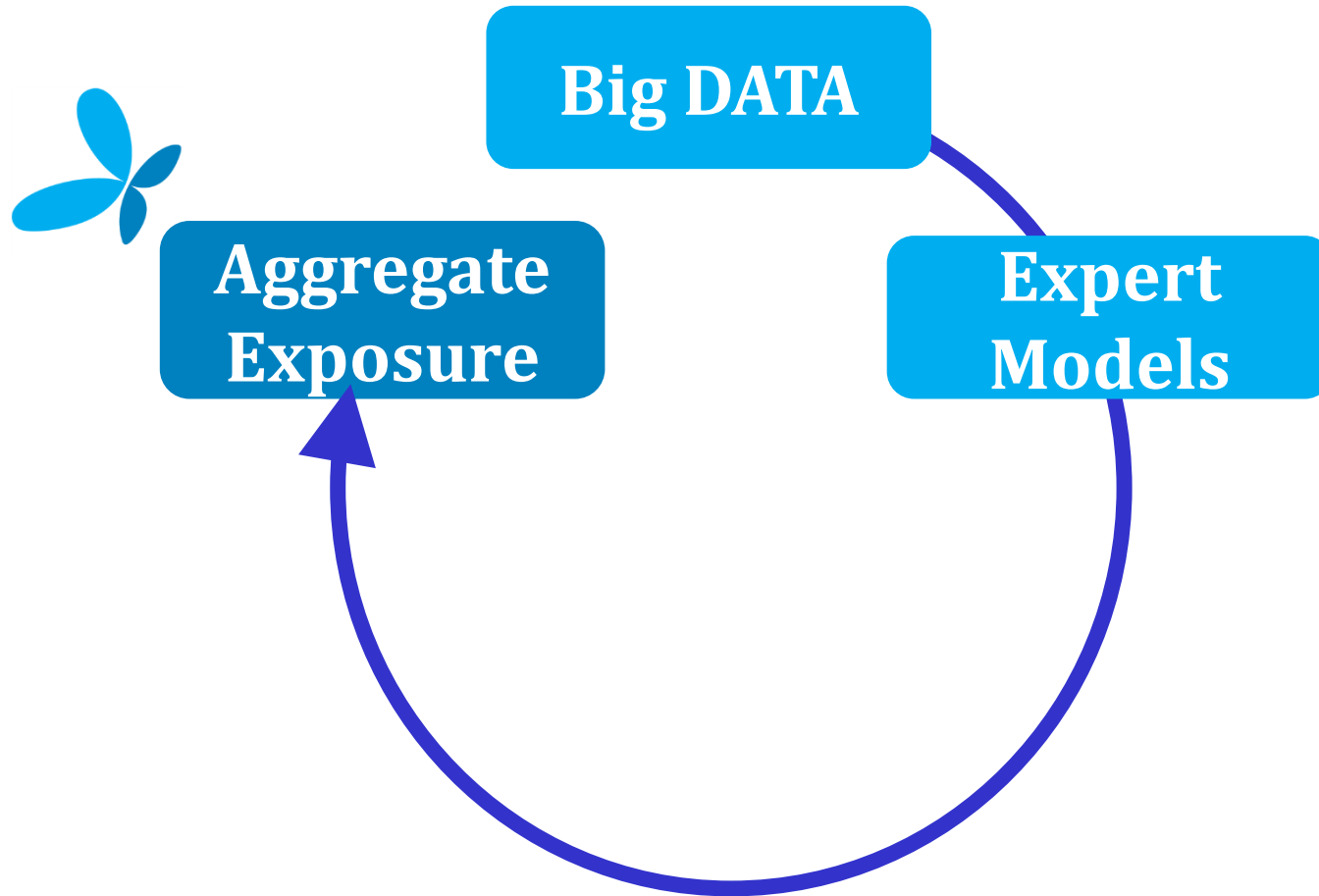
Revolution in Consumer Intakes & Exposure Assessment

Revolution in Consumer Intakes & Exposure Assessment

Revolution in Consumer Intakes & Exposure Assessment

Creme GLOBAL

Big DATA

Expert Models

Aggregate Exposure

Statistical Analyses

Cloud Computing

Intuitive Software
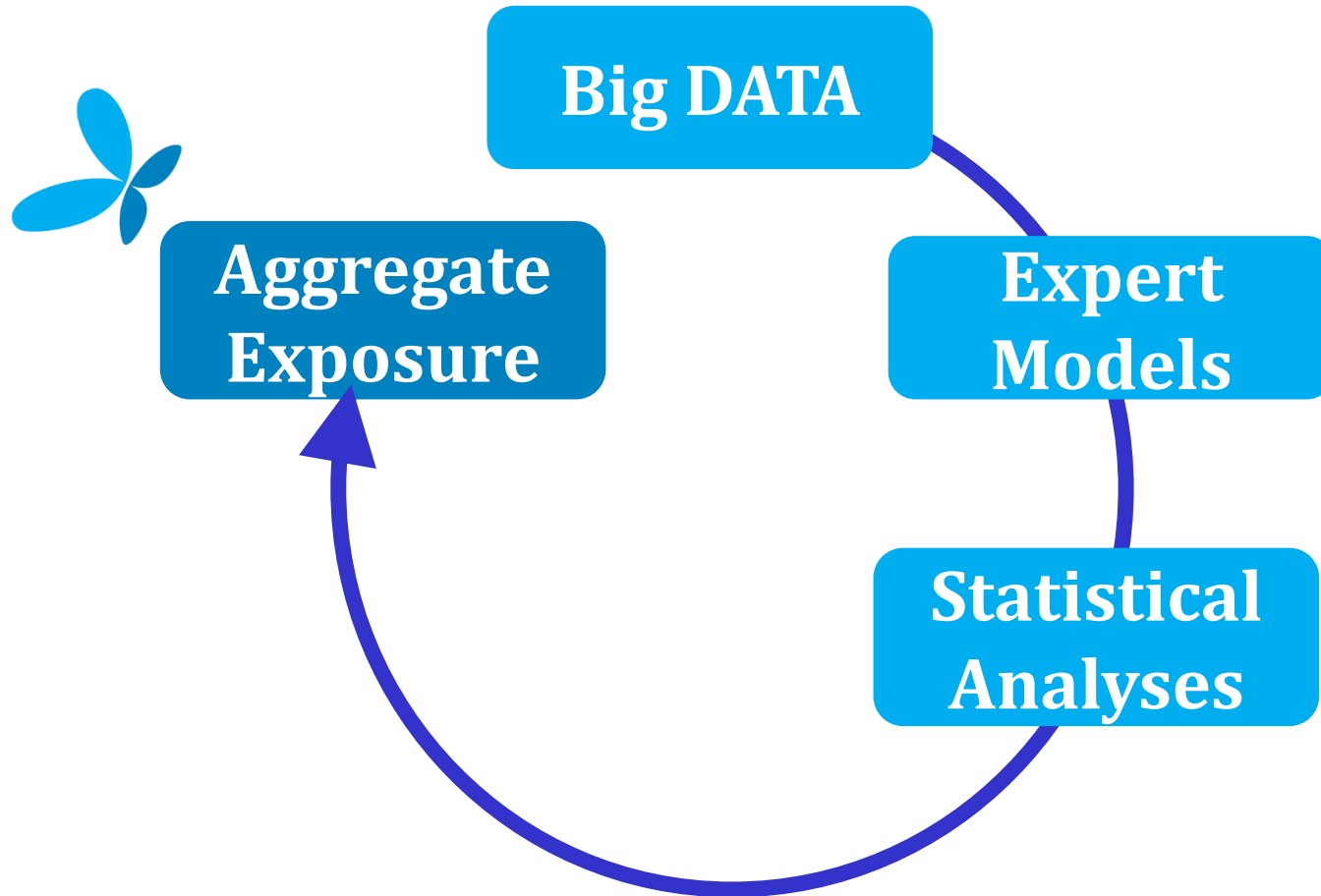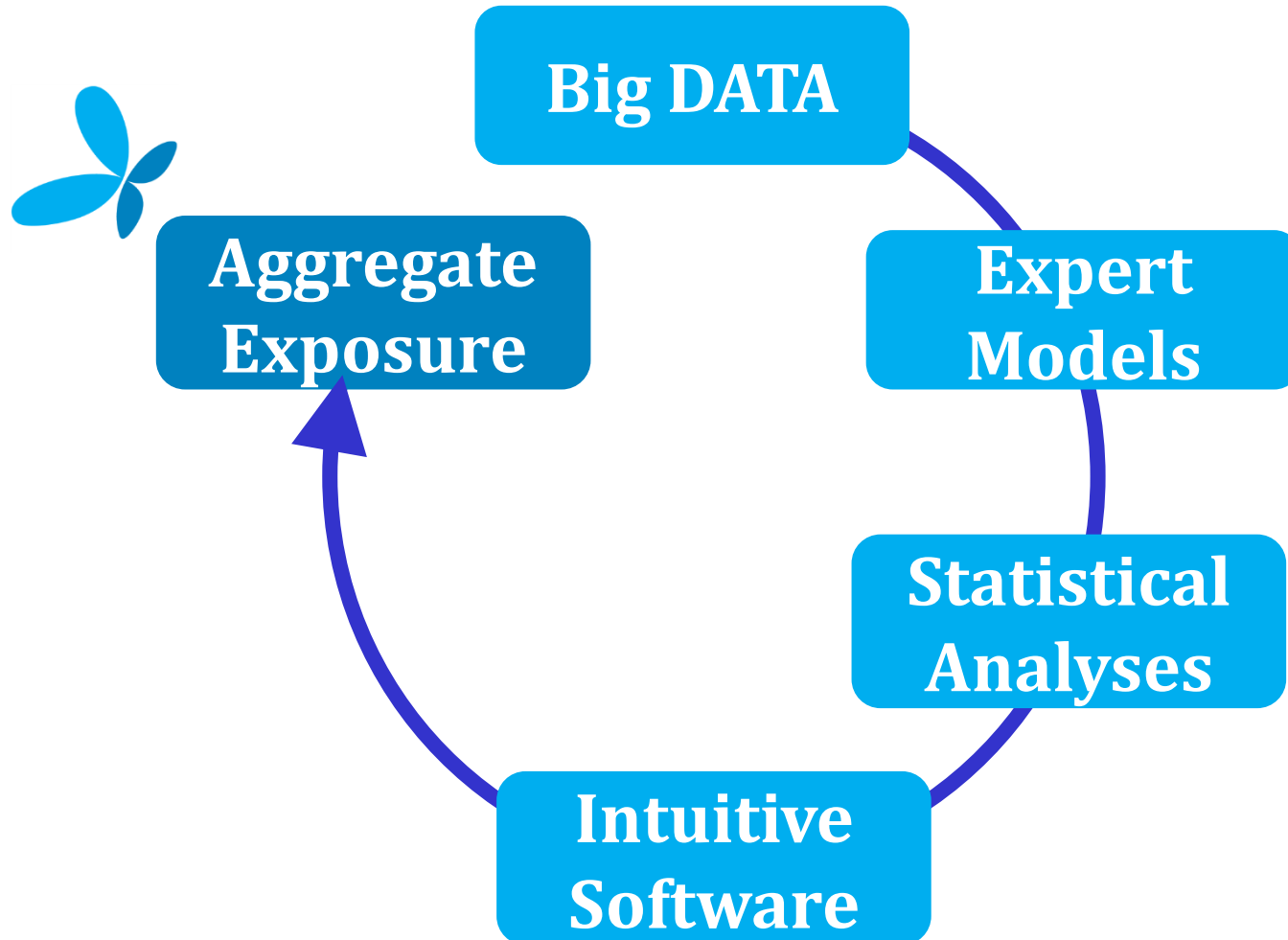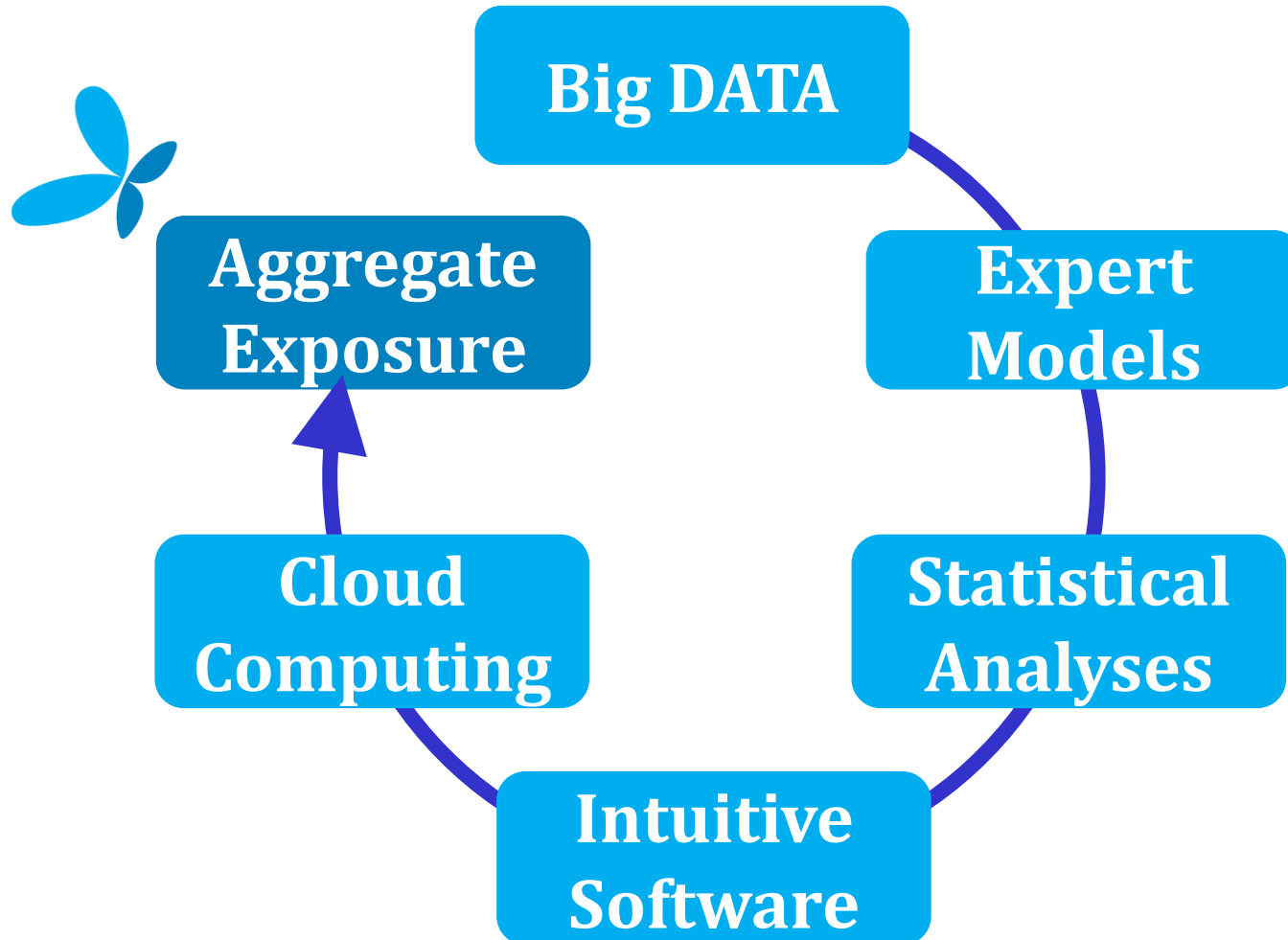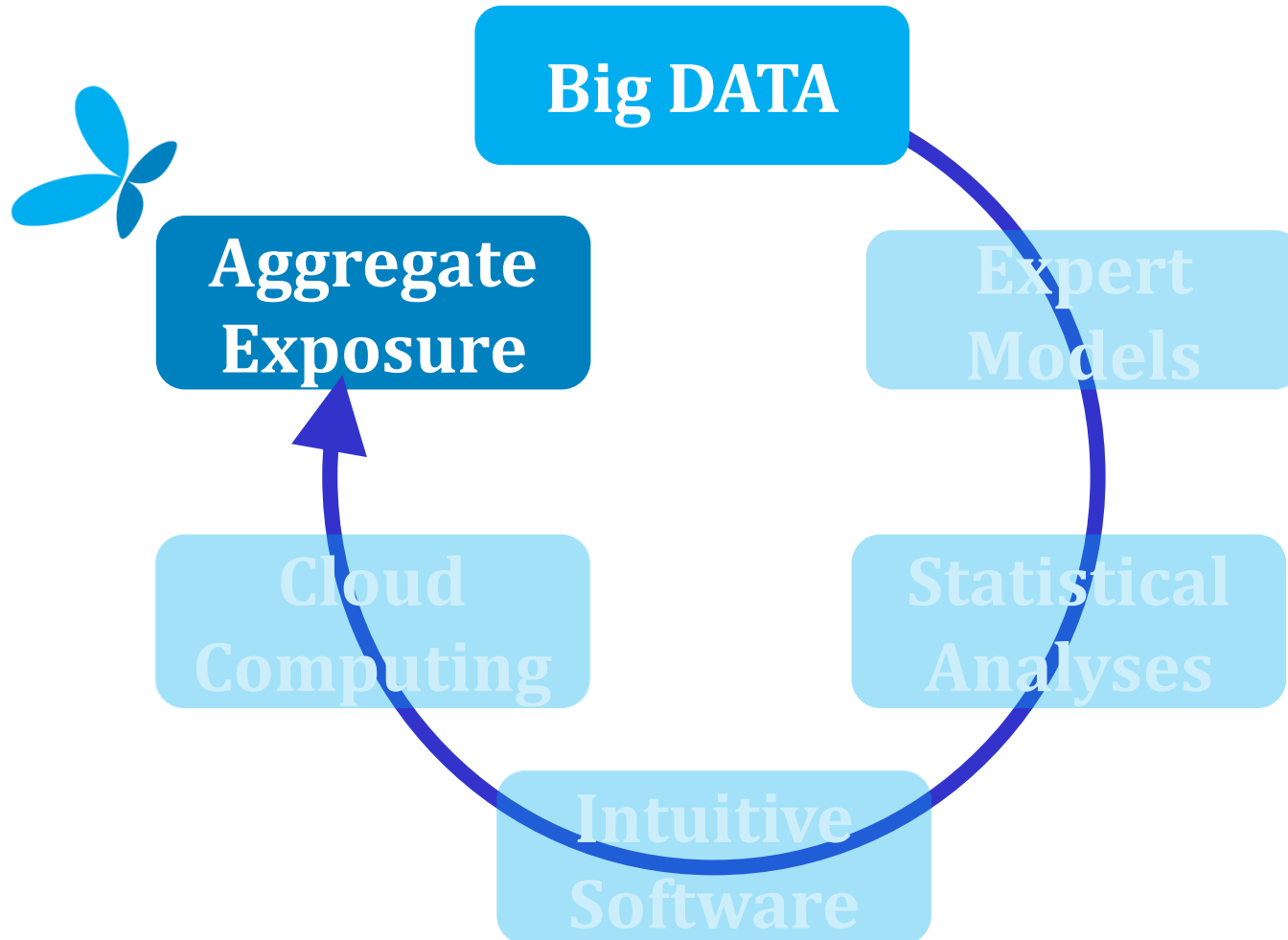
Food Consumption Data

Food Consumption Surveys

- Eating event level detail
- Typical Information
  - Time, survey day, meal
  - Food consumed and amount
  - Classification of foods
  - Anthropometrics
  - Gender, Age
  - Socio-demographics
  - Biomarker data
  - ...

| Country	Survey	Age Range	Subject Count
United Kingdom	National Diet and Nutrition Survey: Adults 2000-2001	19-64	1724
	National Diet and Nutrition Survey: Year 1-3 of the Rolling Programme (2008-2011)	1-94	2126
	National Diet, Nutrition and Dental Survey: Children (1992-1993)	1.5-4.5	1717
	National Diet and Nutrition Survey: Young People (1997)	4-18	1701
	National Diet and Nutrition Survey: People Aged 65 Years and Over (1994-1995)	65-104	1733
	Low Income Diet and Nutrition Survey (2003-2005)	2-102	3728
	Diet and Nutrition Survey of Infants and Young Children (2011)	4 -18 months	2683
Ireland	North/South Ireland Food Consumption Survey (NSIFCS) Adults 1999	18-65	1379
	National Children's Food Survey 2004	5-12	594
	National Teens' Food Survey 2006	13-17	441
Europe*	EFSA Comprehensive European Food Consumption Database		32 surveys from 22 EU member states
The Netherlands	Dutch National Food Consumption Survey - Young adults 2003 (including nutrient composition data NEVO)	19-30	750
	Dutch National Food Consumption Survey - Young Children 2006 (including nutrient composition data NEVO)	2-6	1279
	Dutch National Food Consumption Survey 2007-2010 (including nutrient composition data NEVO)	7-69	3819
China	China Health and Nutrition Survey (2004 and 2006)	0-100	~26,000
Mexico	ENSANUT: Mexican National Health and Nutrition Survey 2006	1.5-99	48304
United States	National Health And Nutrition Examination Survey (NHANES)/What We Eat In America 2002-2010	0+	7000-10,000

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Instructions for Completing the Food Frequency Questionnaire (FFQ)

This questionnaire will take 30 minutes to complete.

Please try and complete this FFQ in one sitting.

For security reasons, if the system is left idle for more than 30 minutes, you will automatically be logged off.

The data will be saved for 24 hours after such point it will be lost.

This questionnaire asks you about the foods you eat. For each food listed, please select the correct option to indicate how often, on **average**, you have eaten the food during the past month.

Once you select how often you consume a food, you will be shown pictures displaying various portion sizes eg. small, medium, large or a common household unit, such as a glass or bottle. The picture will usually be of one food only from each line but it is intended to represent all the foods from that line.

Please estimate your average food consumption as best you can. Below are the bowls and plates used throughout the pictures with dimensions indicated.

27cm

15.5cm

5.8cm

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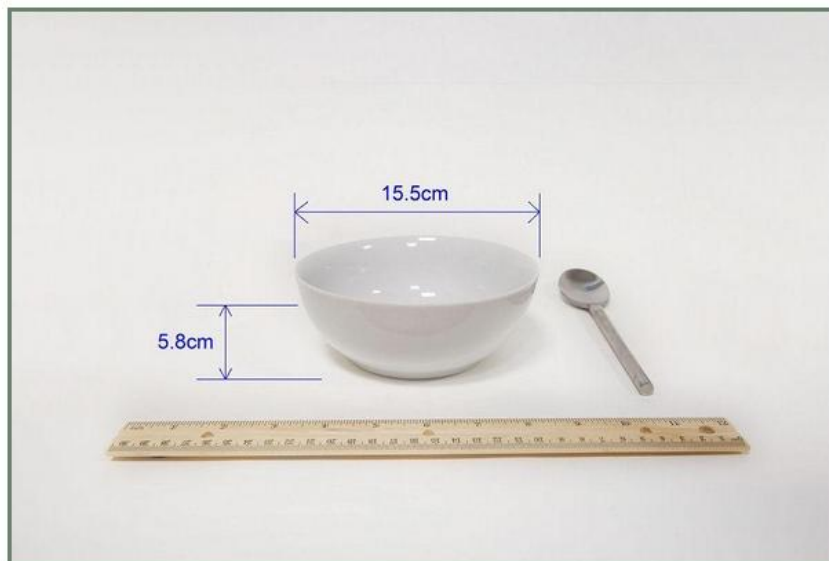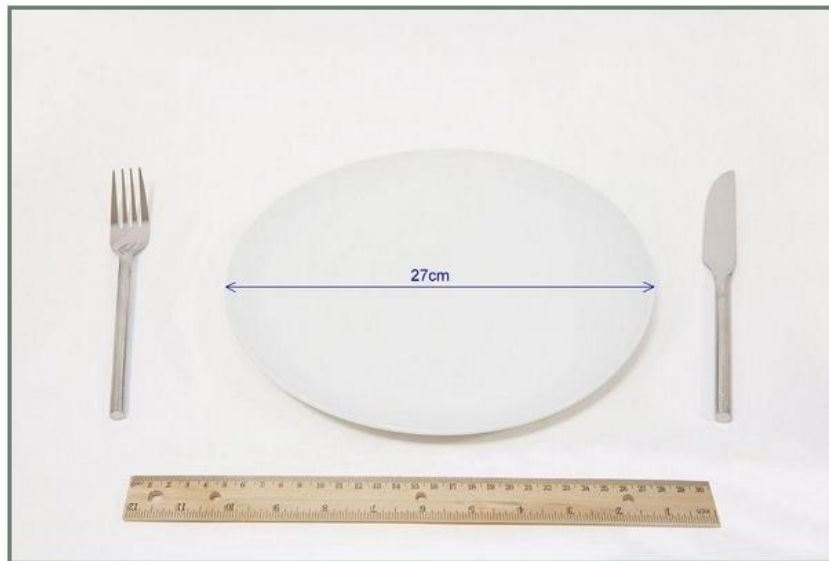
Information required before starting FFQ

Current Weight (kg):   `95`

To input imperial values, click here

Current Height (m):   `1.80`

To input imperial values, click here

Feet `5`   Inches `11`

Waist Circumference (cm):   `96`

Upper Leg Circumference (cm):   `60`

Hip Circumference (cm):   `97`

Occupational Physical Activity Level:

○ Light   *Professional and technical workers; Administrative and managerial; Sales representatives; Clerical and related workers; Housewives; Unemployed.*

○ Moderate   *Sales workers; Service workers; Domestic helpers; Students; Transport workers; Some construction workers (e.g. Joiners, Roofing workers)*

○ Heavy   *Equipment operators; Labourers; Agricultural (e.g. Animal husbandry, Forestry and fishing); Some construction workers (e.g. Bricklayers, Masons)*

Non-Occupational Physical Activity Level:

○ Non-Active   *Daily routine involves little walking / cycling / exercise*

● Moderately Active *Undertake intense exercise lasting 20-45 minutes at least twice per week*

○ Very Active   *Undertake intense exercise lasting at least an hour per day*

Start FFQ

Extranet Volunteer Section

Logged in (johnsmith@cremeglobal.com) | Log Out

Home   About   Expected outcomes   Research   News   Partners   Contact

Food Frequency Questionnaire (FFQ)

Cereal

How often would you have consumed each of the following in the past month?

	Portion size	Never (<1 per month)	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day
Porridge, readybrek		○	○	○	○	○	○	○	○	○
Breakfast cereals, wholegrain e.g. branflakes, barley flakes		○	○	○	○	○	○	○	○	○
Breakfast cereals, non-wholegrain e.g. cornflakes		○	○	○	○	○	○	○	○	○
Breakfast cereals e.g. muesli, cruesli		○	○	○	○	○	○	○	○	○
	Portion size	Never (<1 per month)	1-3 per month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 per day	4-5 per day	6+ per day

Bread and Savoury Biscuits
Potatoes, Rice and Pasta
Meat and Fish
Dairy Products
Fats and Spreads
Sweets and Snacks
Soups, Sauces, and Spreads
Drinks
Fruit
Vegetables
Dietary Habits

Save & Exit   Submit FFQ

Home
About
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Research
News
Partners
Contact

Probabilistic Dietary Exposure

AGGREGATE EXPOSURE MODEL

Probabilistic Dietary Exposure

AGGREGATE EXPOSURE MODEL

Additive Exposure Algorithm

GLOBAL

```
┌─────────────────────────────────────────┐
│      1. Choose Additive of interest      │
└─────────────────────────────────────────┘
                    │
                    ▼
┌───────────────────────────────────────────────────────┐
│      2. Find all foods that contains that additive     │
└───────────────────────────────────────────────────────┘
                    │
                    ▼
┌───────────────────────────────────────────────────────┐
│  3. Find all consumption events in the Diary involving those foods  │
└───────────────────────────────────────────────────────┘
                    │
                    ▼
┌───────────────────────────────────────────────────────┐
│  4. Determine the exposure to the additive at each eating event  │
└───────────────────────────────────────────────────────┘
                    │
                    ▼
┌───────────────────────────────────────────────────────┐
│  5. Collate exposures from each consumption event to give the distribution of  │
│            exposure to the additive in the population            │
└───────────────────────────────────────────────────────┘
```

http://www.cremesoftware.com/food/jobs/newjob_dev/wizard.php?location=Assessments/Additives/&pjid=46

Dataset

New Assessment Wizard (Preview)

Help

1. Assessment Type

2. Dataset

3. Groups

4. Brands

5. Concentrations

6. Options

7. Summary

- ⊞ 🇦🇹 Austria
- ⊞ 🇧🇪 Belgium
- ⊞ 🇧🇬 Bulgaria
- ⊞ 🇨🇿 Czech Republic
- ⊞ 🇩🇰 Denmark
- ⊞ 🇪🇪 Estonia
- ⊞ 🇫🇮 Finland
- ⊞ 🇫🇷 France
- ⊞ 🇩🇪 Germany
- ⊞ 🇭🇺 Hungary
- ⊞ 🇮🇸 Iceland
- ⊞ 🇮🇪 Ireland
- ⊞ 🇮🇹 Italy
- ⊞ 🇳🇱 Netherlands
- ⊞ 🇳🇴 Norway
- ⊞ 🇵🇱 Poland
- ⊞ 🇸🇰 Slovakia
- ⊞ 🇸🇪 Sweden
- ⊞ 🇬🇧 United Kingdom
- ⊟ 🇺🇸 USA
  - NHANES Day One (2002)
  - NHANES Day One (2004)
  - NHANES Day One (2006)
  - NHANES Two Day (2004)
  - NHANES Two Day (2006)

USA
NHANES Day One (2006)

Number of selected subjects: **293** [Recount]

Gender: [All ▼]   Age: [between ▼] [0] and [85]

Hide advanced subjects filters

☑ Country of Birth:
- Refused
- Born in 50 US States or Washington, DC
- Born Elsewhere
- Born in Mexico

☐ Citizenship Status:
- Citizen by birth or natuaralization
- Refused
- Not a citizen of the US

☐ Length of time in US:
- Refused
- Less than 1 year
- Don't know

☑ Education Level - Children or Youth 6-19:
- Don't know
- High School Graduate
- Some College, No Degree

☑ Education Level - Adults 20+:
- High School Grad/GED or Equivalent
- Less Than 9th Grade
- College Graduate or above

☐ Now attending school?:
- On vacation from school (between grades)
- Neither in school or on vacation from school (between grad
- In school

☐ Marital Status:

[Cancel] [« Previous] [Next »] [Submit Assessment]

FACET Dietary Surveys
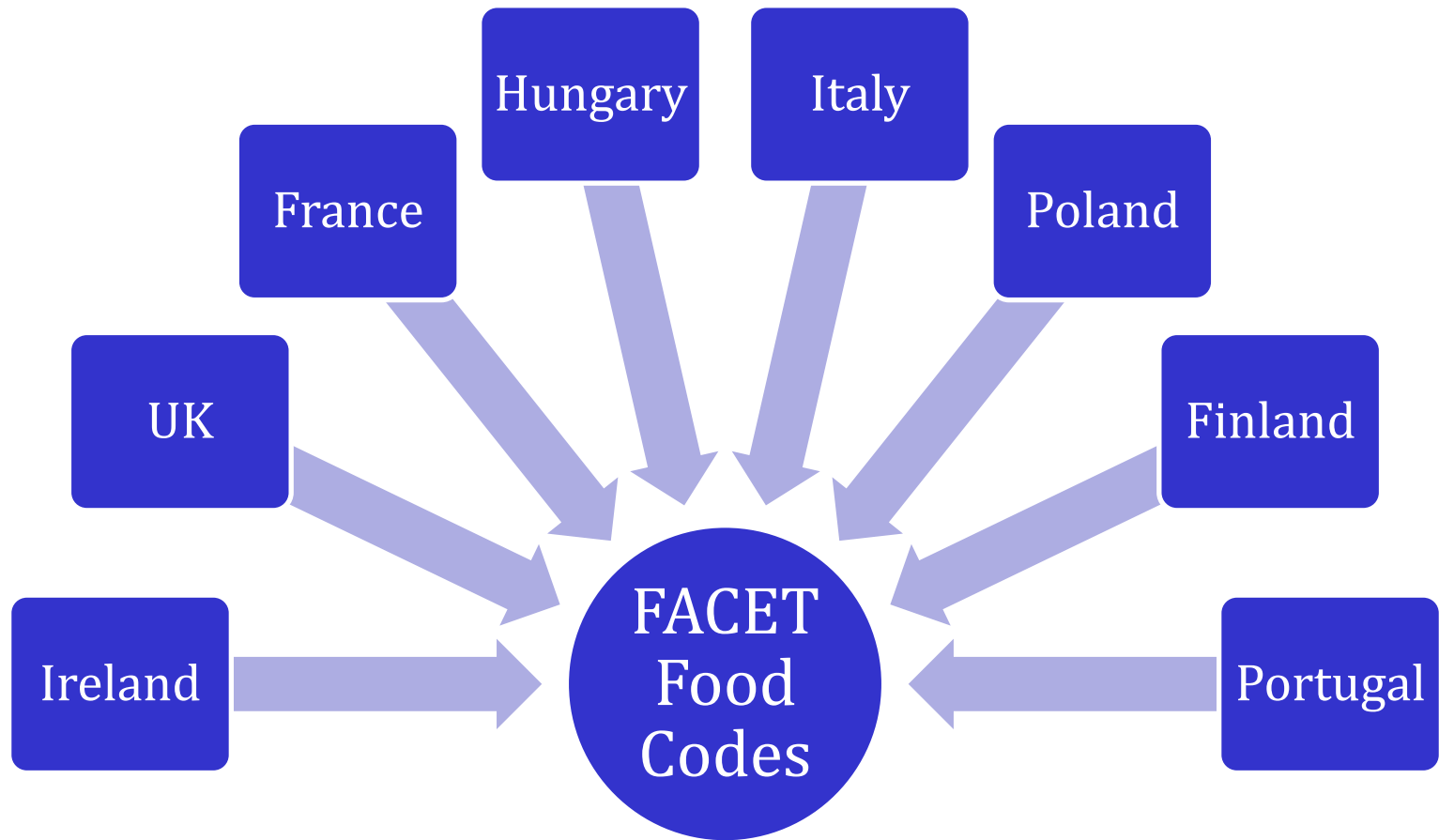
FACET Food Codes

- System is tiered, e.g.
  - ➤ A.05: Chocolate products and confectionary
    - ➤ A.05.1: Cocoa and chocolate products
      - ➤ A05.1.2: Cocoa-based spreads
    - ➤ A.05.2: Confectionary including hard and soft candy
      - ➤ A.05.2.1: Glucose syrup-based confectionery
      - ➤ A.05.2.2: Sugar confectionary
- More information specific to food can be included via additive flags:
  - Nutritional information (e.g. Low fat, sugar reduced)
  - Topping (e.g. Chocolate topping, whipped cream)
  - Coating
  - Filling

Additive Exposure Algorithm

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```
┌─────────────────────────────────────────────────────┐
│         1. Choose Additive of interest                │
└─────────────────────────────────────────────────────┘
                          │
                          ▼
┌─────────────────────────────────────────────────────────────────┐
│         2. Find all foods that contains that additive             │
└─────────────────────────────────────────────────────────────────┘
                          │
                          ▼
┌─────────────────────────────────────────────────────────────────┐
│   3. Find all consumption events in the Diary involving those foods │
└─────────────────────────────────────────────────────────────────┘
                          │
                          ▼
┌─────────────────────────────────────────────────────────────────┐
│   4. Determine the exposure to the additive at each eating event   │
└─────────────────────────────────────────────────────────────────┘
                          │
                          ▼
┌─────────────────────────────────────────────────────────────────┐
│   5. Collate exposures from each consumption event to give the     │
│   distribution of exposure to the additive in the population       │
└─────────────────────────────────────────────────────────────────┘
```
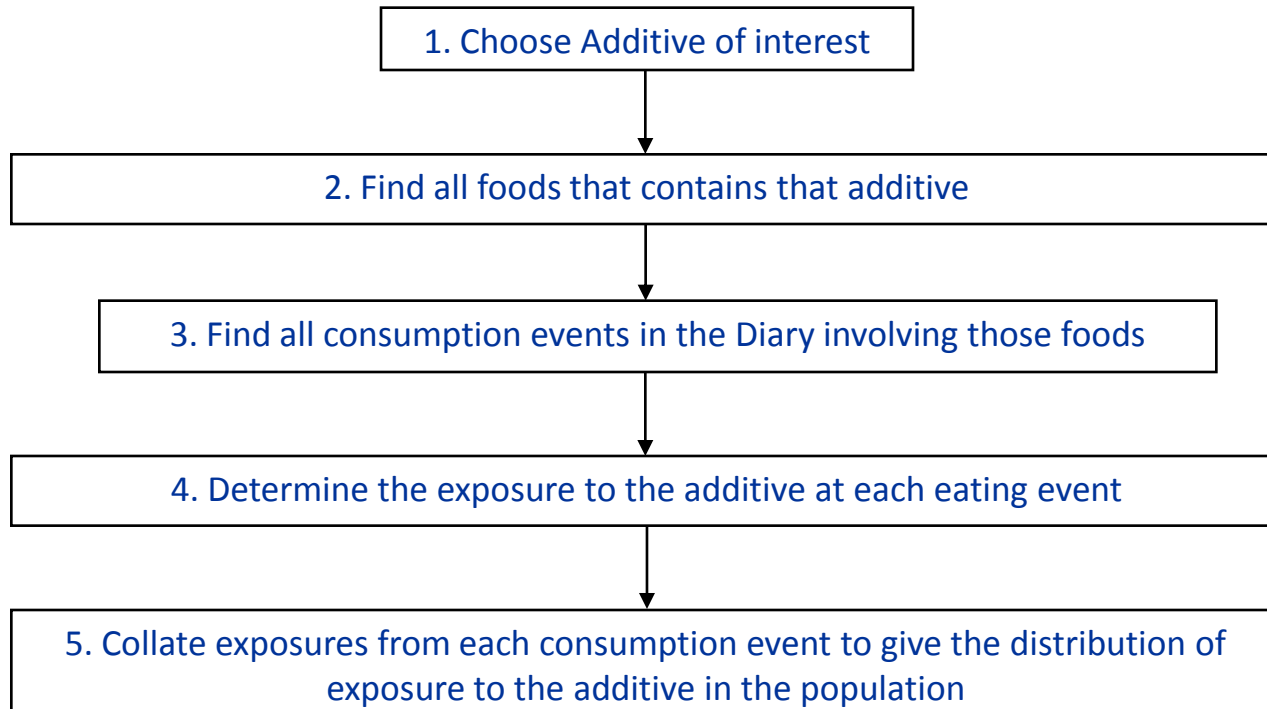
Determining Exposure

- To determine exposure at each event:

$$\text{Exposure} = \sum_{\substack{\text{Food quanta} \\ \text{consumed}}} [\text{Food Amount}] \times [\text{Concentration of Additive}]$$

- Food amount:
  - Deterministic, given by food consumption diary
- Concentration:
  - *Variable*, and occurs with a certain probability

Concentration in Food Sources

$$\text{Exposure} = \sum_{\substack{\text{Food quanta} \\ \text{consumed}}} [\text{Food Amount}] \times [\text{Concentration of Additive}]$$

- Regulatory data
  - Maximum Permitted Levels (MPLs)
- Industry Data
  - Typical Min
  - Typical Max
  - Extreme Min
  - Extreme Max
  - Fitted distribution
- Can be assessed with or without probability of occurrence

Additive Occurrence Data

- Can be interpreted as a presence probability for a particular substance in a food category

- Statistically, can be interpreted as a Bernoulli distribution:

  - Takes a value 1 with a probability p
  - Takes a value 0 with a probability (1-p)

- Used in Monte Carlo simulations to give more realistic exposure estimates

Additive Exposure Algorithm

1. Choose Additive of interest

2. Find all foods that contains that additive

3. Find all consumption events in the Diary involving those foods

4. Determine the exposure to the additive at each eating event

5. Collate exposures from each consumption event to give the distribution of exposure to the additive in the population

File   Edit   View   Tools

http://www.cremesoftware.com/food/jobs/manager.php?v=r

Assessment Manager : Creme Food

Creme FOOD   **Assessments**   Data   Distributions   CRN   Release Notes (3.3.8)   Cronan McNamara (consultancy)   Log-out

File   Assessments   Help

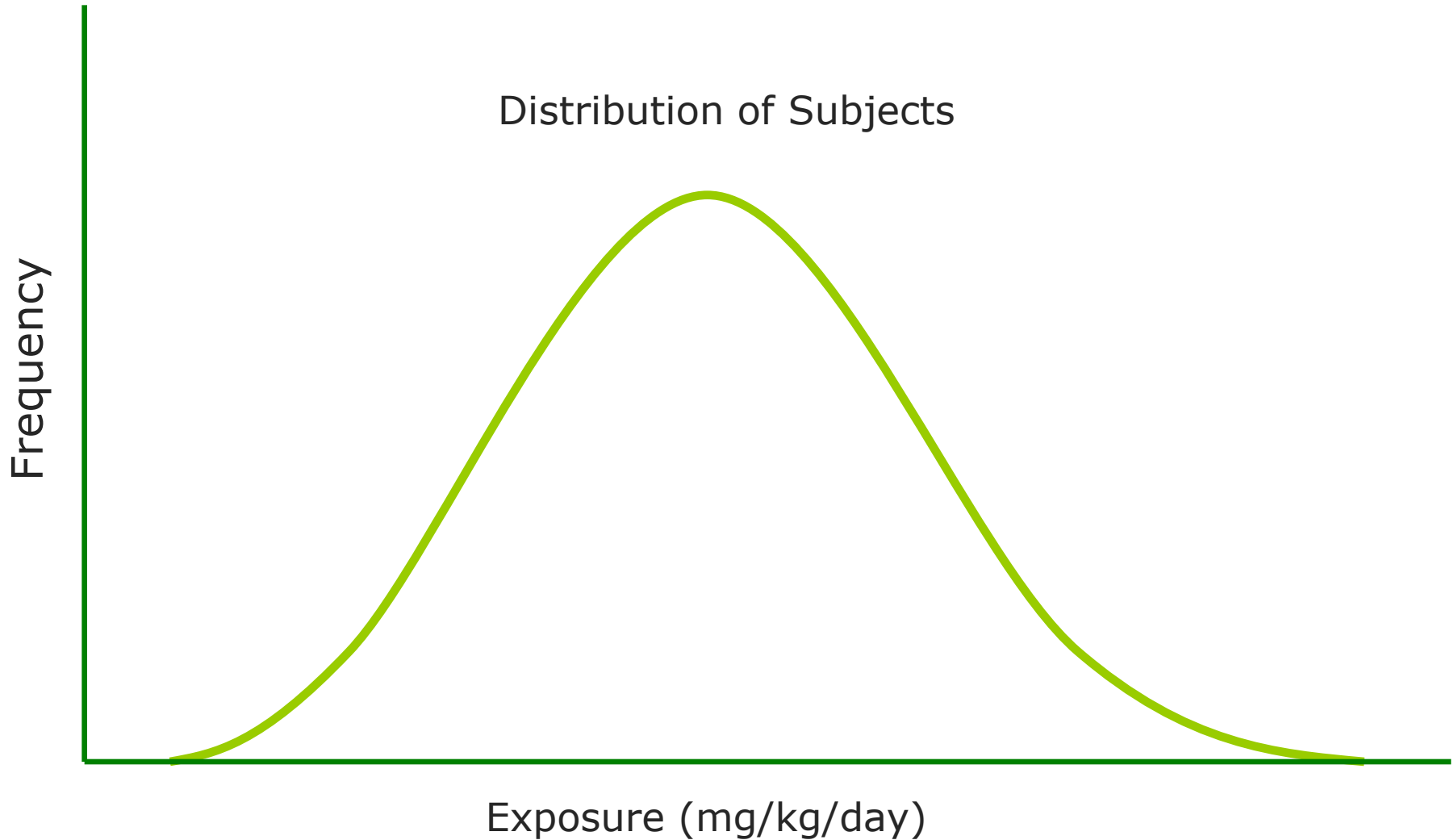- Assessments
  - Nutrients
  - Microbial contaminants
  - Pesticides
  - Chemical contaminants
  - **Additives**
  - Projects
  - Deleted Assessments

Assessments/Additives

«Previous   Next»   Showing 20   Items

	Id	Name	Description	Status	Type	Date	Owner
	111	Neotame Replacing Aspartame	*Relacement of Aspart...*	0%	*Additive*	2010/05/14 10:44	consultancy_cronan
	61	Aspartame in Low Cal or Sugar Free Foods	*5% level Assumed (ex...*	Completed	*Additive*	2010/03/19 16:32	consultancy_admin
	46	Neotame Replacing Aspartame		Completed	*Additive*	2010/03/19 10:48	consultancy_pdempsey
	45	Aspartame in Low Cal or Sugar Free Foods	*5% level Assumed (ex...*	Completed	*Additive*	2010/03/19 10:48	consultancy_pdempsey

Model Output

Distribution of Subjects

Model Output

Distribution of Subjects

Frequency

Exposure (mg/kg/day)

ADI
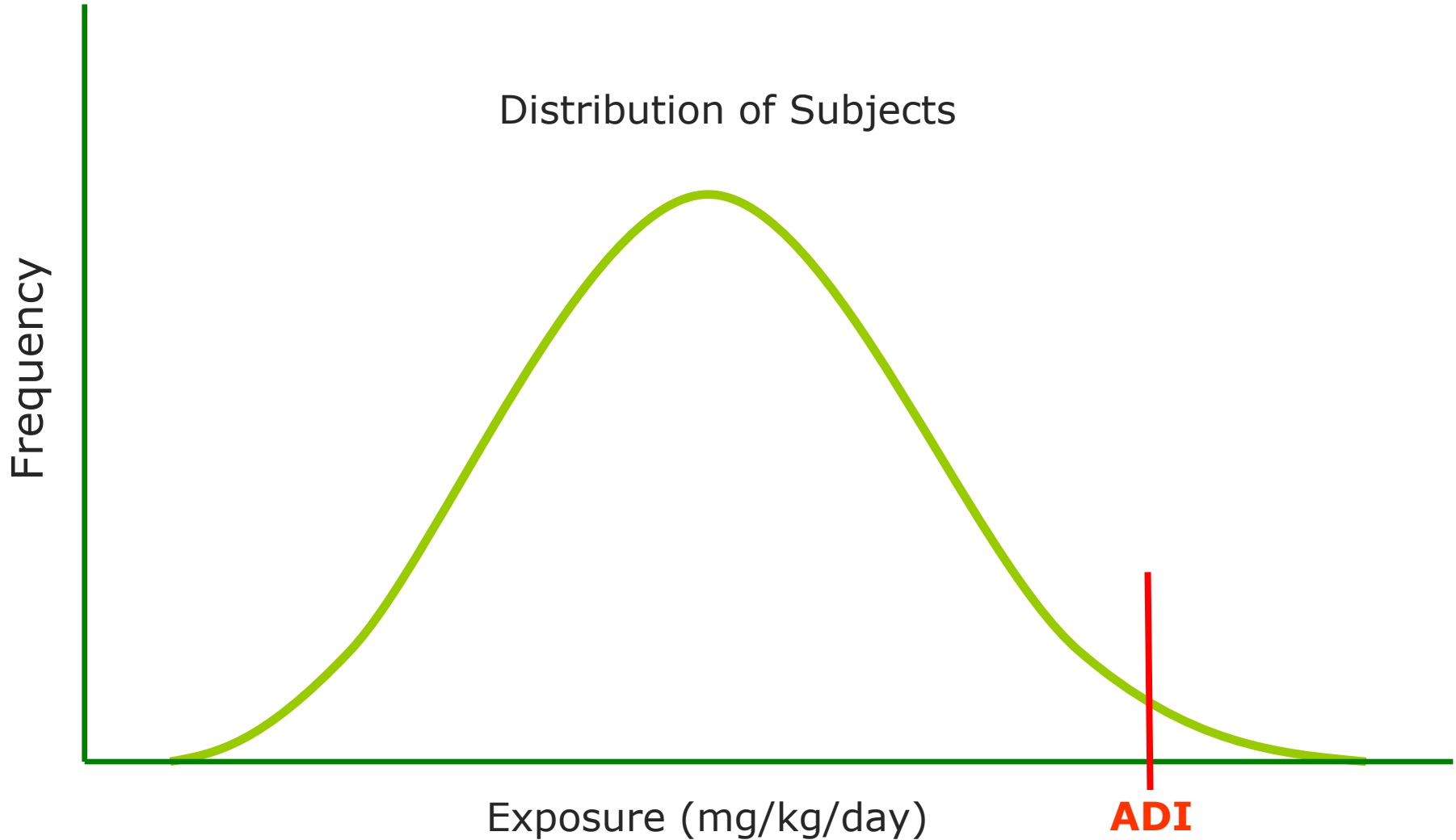
Selection of Calculation Types:

- ☑ Daily Average (vs ADI)
- ☑ Acute (vs ARfD)
    - ☑ Maximum Day
    - ☑ Exceeded ARfD
    - ☑ Num Days over ARfD
    - ☑ Maximum Meal
    - ☑ Serving Size
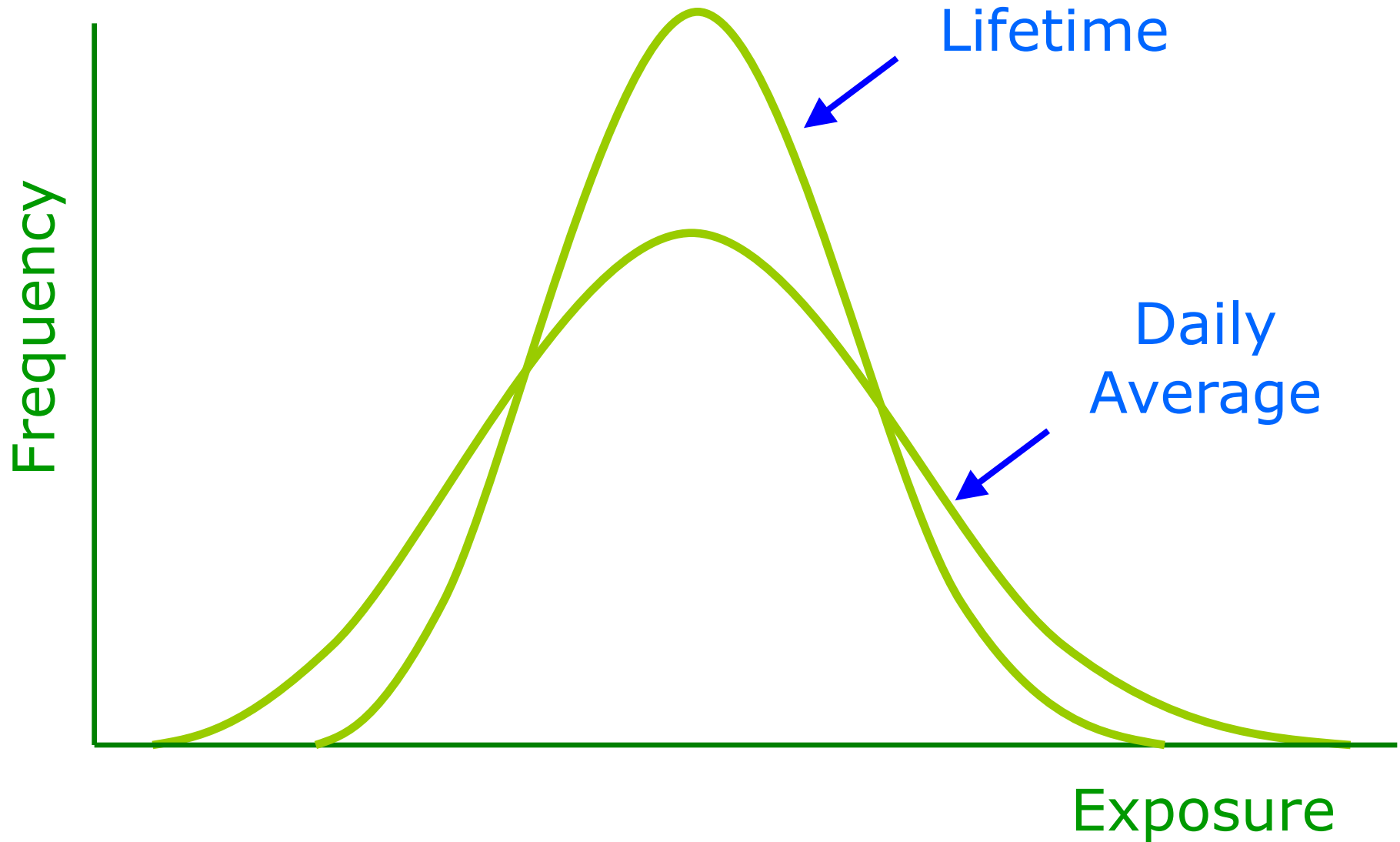- ☑ Lifetime (vs ADI)
    - ◯ Nusser Method
    - ◉ NCI Method

Daily Average & Lifetime Exposure

Selection of Output Types:

☑ Absolute
☑ Per Unit Bodyweight

Consumer Type

Total Population	
Product Consumers	
Substance / Chemical Consumers	

Select Subject Percentiles:

- ☑ P75
- ☑ P90
- ☑ P95
- ☑ P97.5
- ☑ P99

Extra Percentiles:

99.9, 99.99

File   Changes   New   Help

Home   Assessments   FACET Data   My Data   Results - Sodium...

Food - Per unit body weight - Total Population - PDF

Probability Distribution

0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0

0   20   40   60   80   100   120   140   160   180
Food Intake

Food - Per unit body weight - Food Consumers - PDF

Probability Distribution

0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0

0   20   40   60   80   100   120   140   160   180
Food Intake

	Survey	Additive / Food	Intake Type	Consumer T...	FACET Category ...	FACET Category Na...	Statistic	Value	Units	Standar
1308	France INCA 2	Food	Per unit body weigh	Total Population	A.14	NON ALCOHOLIC BEVERAGE	PDF	Distributi	g/kg bw	NULL
1332	France INCA 2	Food	Per unit body weigh	Food Consumers	A.14	NON ALCOHOLIC BEVERAGE	PDF	Distributi	g/kg bw	NULL
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...

46 - Assessment Report - Creme Food - Creme Client v0.0.9.1

File   Edit   View   Tools

http://www.cremesoftware.com/food/results/report.php?f=/medusa_out/food/food_consultancy/consultancy_pdempsey/46/4___46_Assessment_Report.html#Chemical: Aspartame|per unit Bodyweight|Daily Av

Results of Job 46 : Creme Food   46 - Assessment Report - Creme Food   46 - Assessment Report - Creme ...

Creme Assessment Report

Exposure Type	Output Type	Calculation Type	Consumer Type	Graph Type	
Chemical: Aspartame	per unit Bodyweight	Daily Average	Chemical Consumers	Errorbar chart of Subject	Go

Value (mg/kg/d)
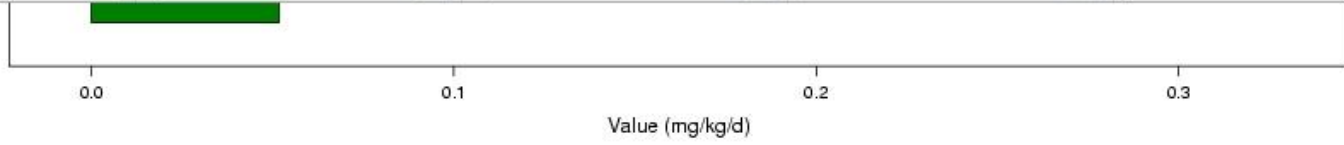
Barchart over Groups
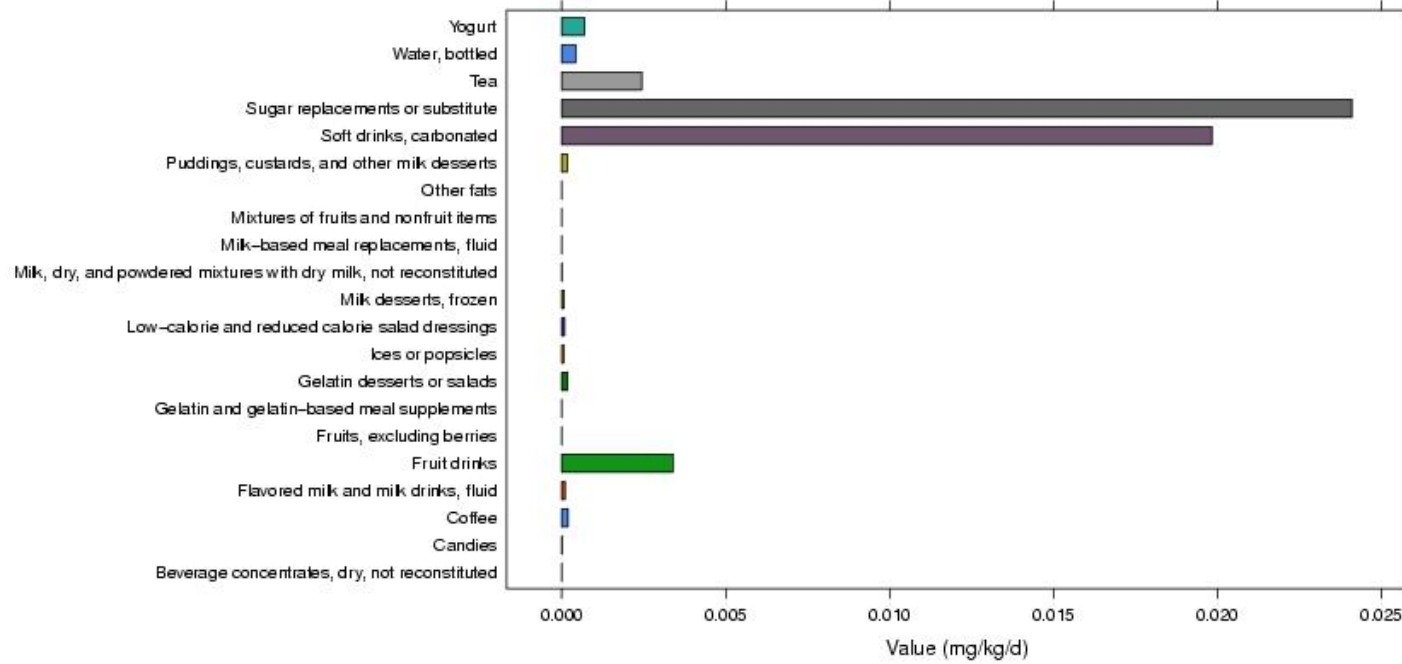
Value (mg/kg/d)

Plechart over Groups

FACET

File Changes New Help

Home | Assessments | FACET Data | My Data | Results - Lycope... ✕

E160d - Per unit body weight - Total Population - Mean

Chemical Exposure (mg/kg bw) vs FACET Category (A.1, A.3, A.5, A.7, A.8, A.9, A.12, A.14, A.16, A.17)

E160d - Per unit body weight - Food Consumers - Mean

Chemical Exposure (mg/kg bw) vs FACET Category (A.1, A.3, A.5, A.7, A.8, A.9, A.12, A.14, A.16, A.17)
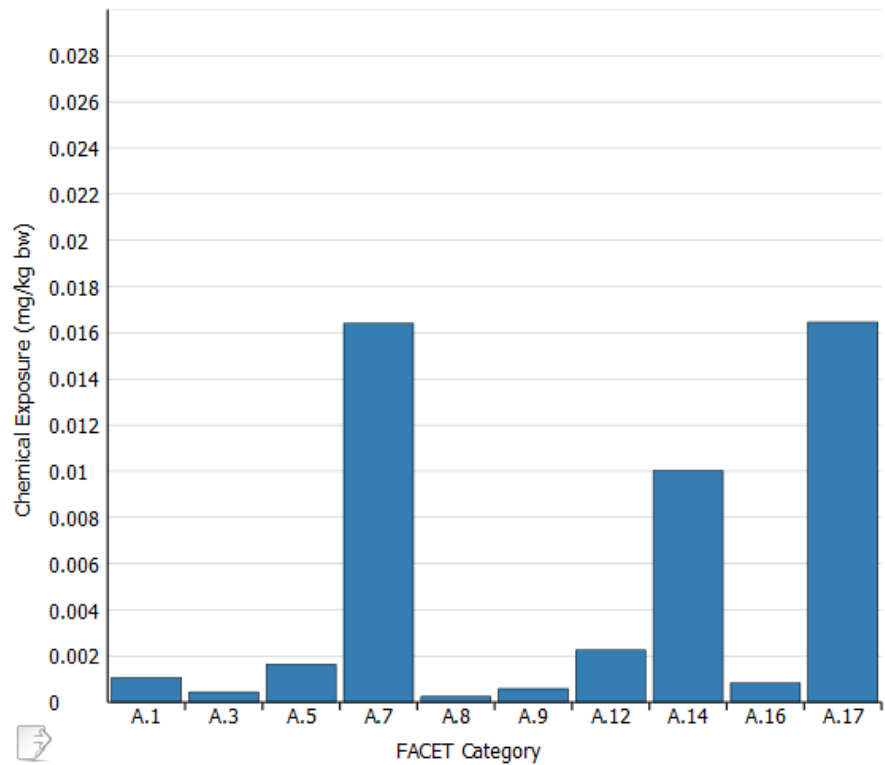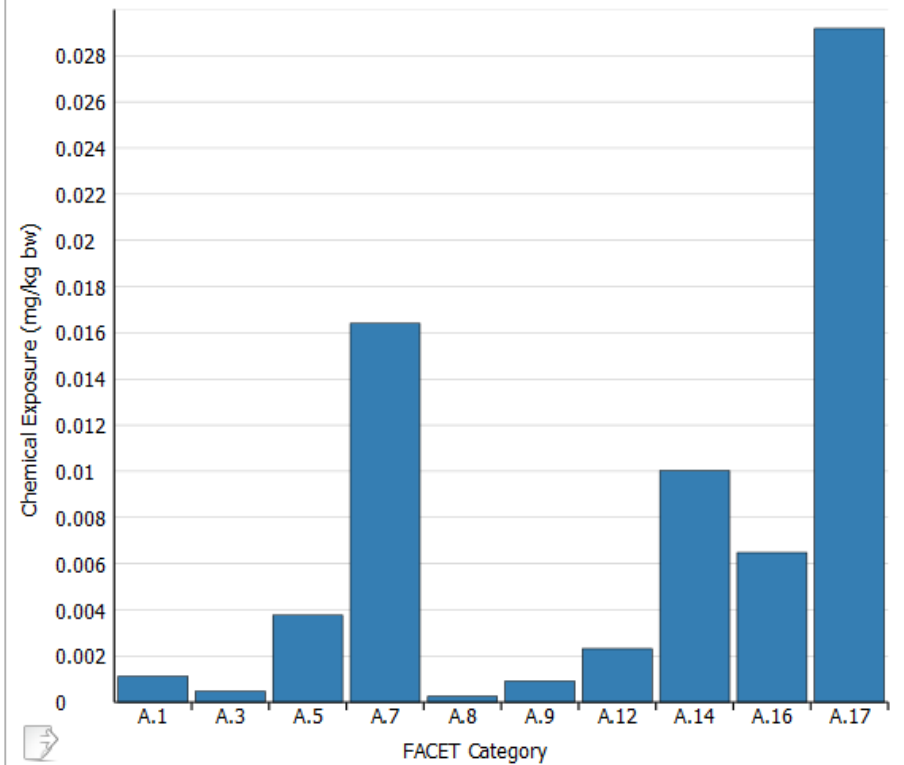
	Survey	Additive ...	Intake Type	Consumer T...	FACET Category ...	FACET Category Name	Statistic	Value	Units	Standard Error
58	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Total Population	A.1	DAIRY PRODUCTS AND ANALOGUES	Mean	0.00106445	mg/kg bw	0.000131009
80	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Food Consumers	A.1	DAIRY PRODUCTS AND ANALOGUES	Mean	0.00112199	mg/kg bw	0.000128858
234	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Total Population	A.3	FRUITS, NUTS AND SEEDS	Mean	0.000439859	mg/kg bw	5.5824e-005
256	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Food Consumers	A.3	FRUITS, NUTS AND SEEDS	Mean	0.000476514	mg/kg bw	7.43347e-005
410	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Total Population	A.5	CHOCOLATE PRODUCTS AND CONFEC	Mean	0.00164146	mg/kg bw	0.000109211
432	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Food Consumers	A.5	CHOCOLATE PRODUCTS AND CONFEC	Mean	0.0037657	mg/kg bw	0.000207907
586	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Total Population	A.7	BREADS AND BAKERY WARES	Mean	0.0164024	mg/kg bw	0.000531722
608	Italy INRAN SCAI 2005	E160d	Per unit body weigh	Food Consumers	A.7	BREADS AND BAKERY WARES	Mean	0.0164024	mg/kg bw	0.00054954

Food - Per unit body weight - Total Population - Mean
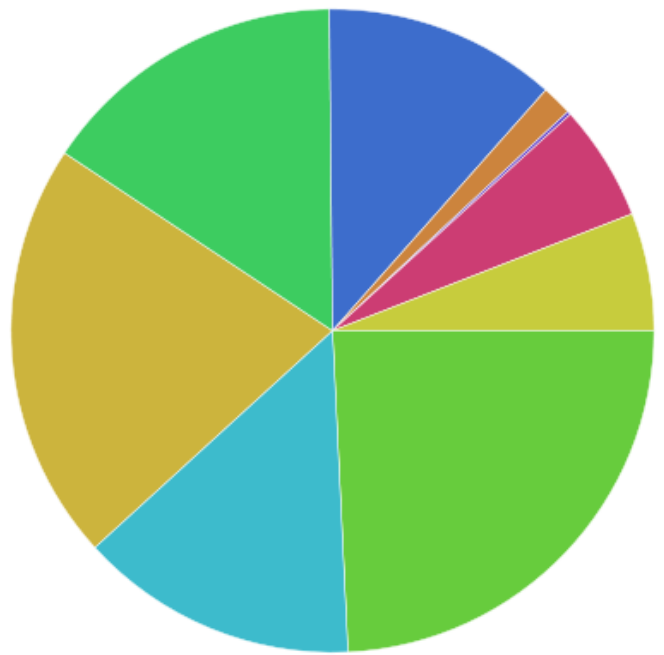
- ■ A.1: DAIRY PRODUCTS AND ANALOGUES (24.24%)
- ■ A.3: FRUITS, NUTS AND SEEDS (13.99%)
- ■ A.4: VEGETABLES, STARCHY ROOTS, LEGUMES AND SEAWEEDS (21.09%)
- ■ A.6: CEREALS AND CEREALS PRODUCTS (15.53%)
- ■ A.8: MEAT AND MEAT PRODUCTS (11.70%)
- ■ A.12: SALT, SPICES, SAUCES AND SOUPS (1.53%)
- ■ A.13: NUTRITIONAL FOODSTUFFS (0.18%)
- ■ A.15: ALCOHOLIC BEVERAGES (5.83%)
- ■ A.17: DESSERTS (EXCEPT BAKERY AND FRUIT DESSERTS) (5.92%)

	Survey	Additive / Food	Intake Type	Consumer T...	FACET Category ...	FACET Category Na...	Statistic	Value	Units	Standar
51	France INCA 2	Food	Per unit body weigh	Total Population	A.1	DAIRY PRODUCTS AND ANAI	Mean	4.58499	g/kg bw	0.082592
243	France INCA 2	Food	Per unit body weigh	Total Population	A.3	FRUITS, NUTS AND SEEDS	Mean	2.64743	g/kg bw	0.040370
339	France INCA 2	Food	Per unit body weigh	Total Population	A.4	VEGETABLES, STARCHY ROO	Mean	3.98999	g/kg bw	0.034681
531	France INCA 2	Food	Per unit body weigh	Total Population	A.6	CEREALS AND CEREALS PRO	Mean	2.93743	g/kg bw	0.027595
723	France INCA 2	Food	Per unit body weigh	Total Population	A.8	MEAT AND MEAT PRODUCT!	Mean	2.21257	g/kg bw	0.019235
1107	France INCA 2	Food	Per unit body weigh	Total Population	A.12	SALT, SPICES, SAUCES AND S	Mean	0.290034	g/kg bw	0.003521
1203	France INCA 2	Food	Per unit body weigh	Total Population	A.13	NUTRITIONAL FOODSTUFFS	Mean	0.0331303	g/kg bw	0.012721
1395	France INCA 2	Food	Per unit body weigh	Total Population	A.15	ALCOHOLIC BEVERAGES	Mean	1.10362	g/kg bw	0.033389

Limit Analysis

Analyse % Above and Below Requirements

Revolution in Consumer Intakes & Exposure Assessment
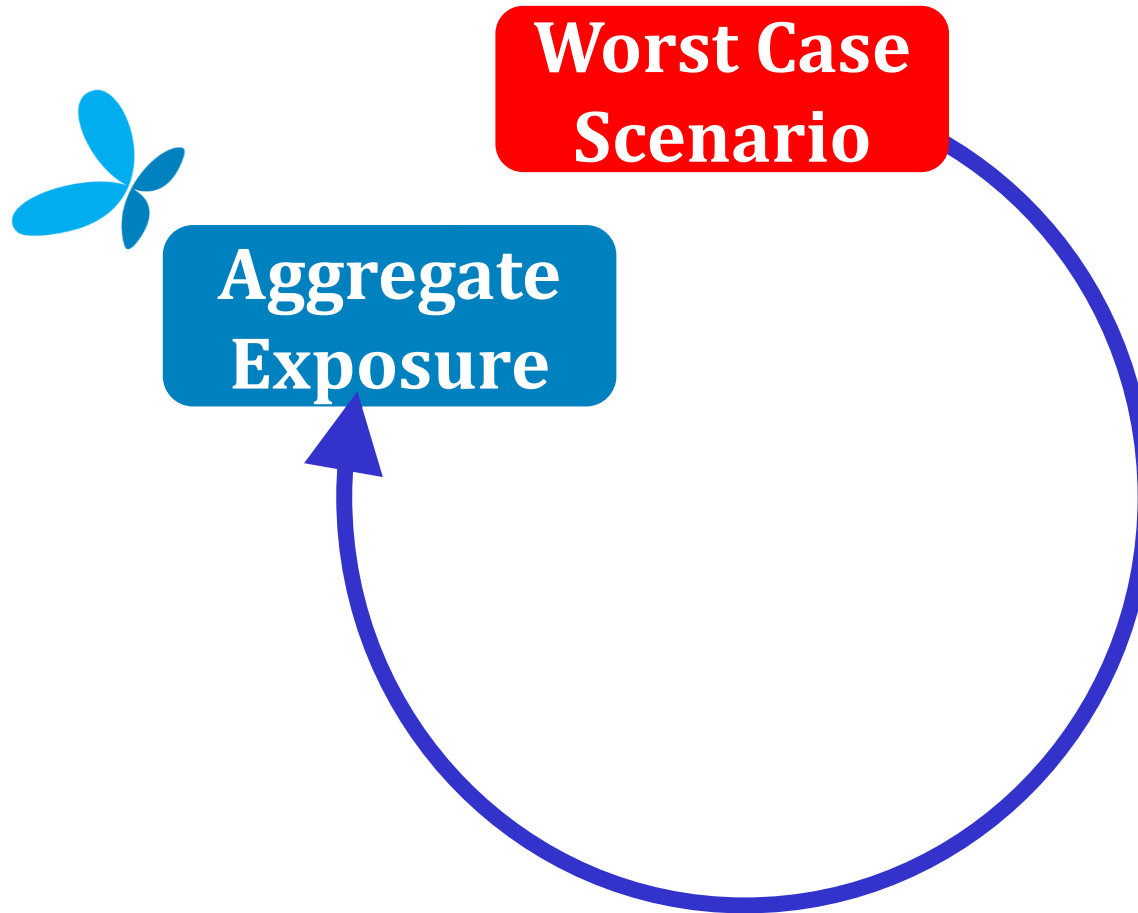
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Worst Case Scenario

Aggregate Exposure

Revolution in Consumer Intakes & Exposure Assessment

Big DATA

Aggregate Exposure
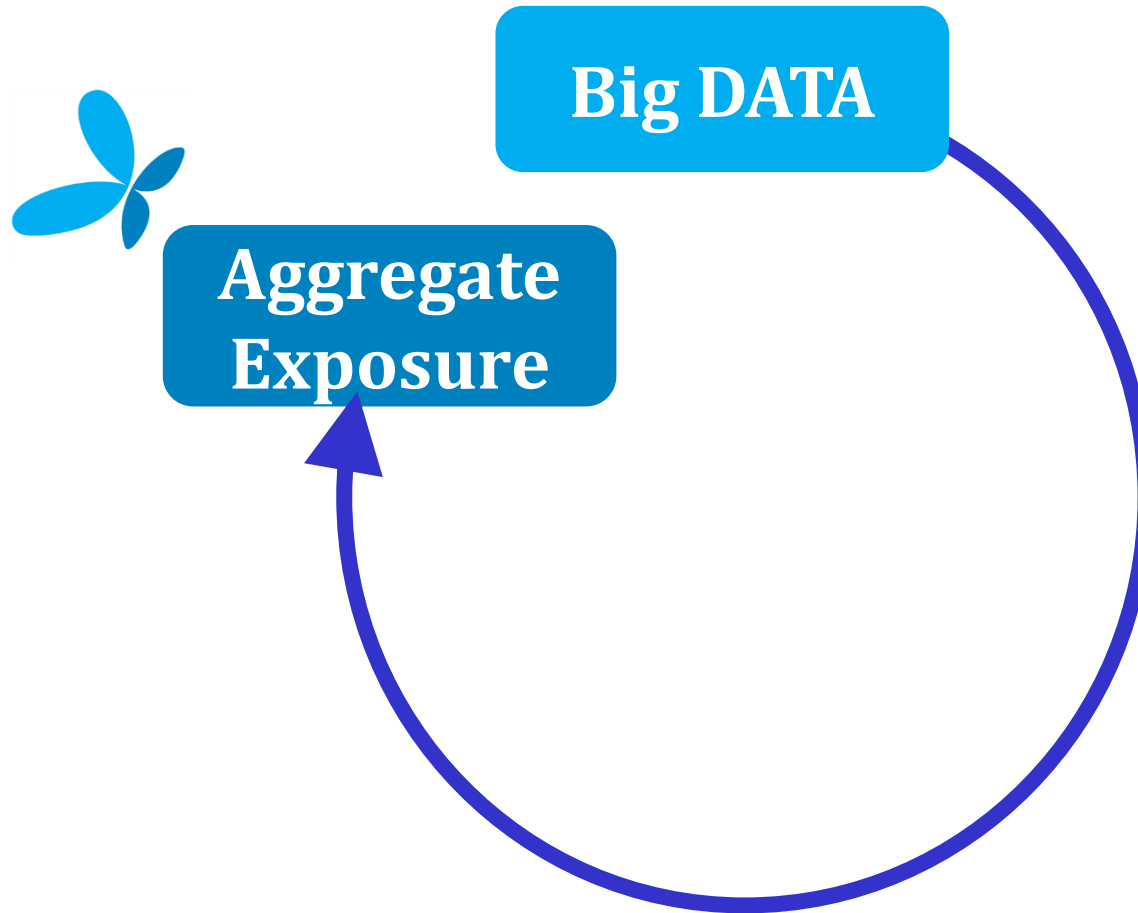
Revolution in Consumer Intakes & Exposure Assessment

Expert Models for Decision Makers ™

Thank you

Answering Your Predictive Intake Modelling Questions

Contact: Cronan McNamara
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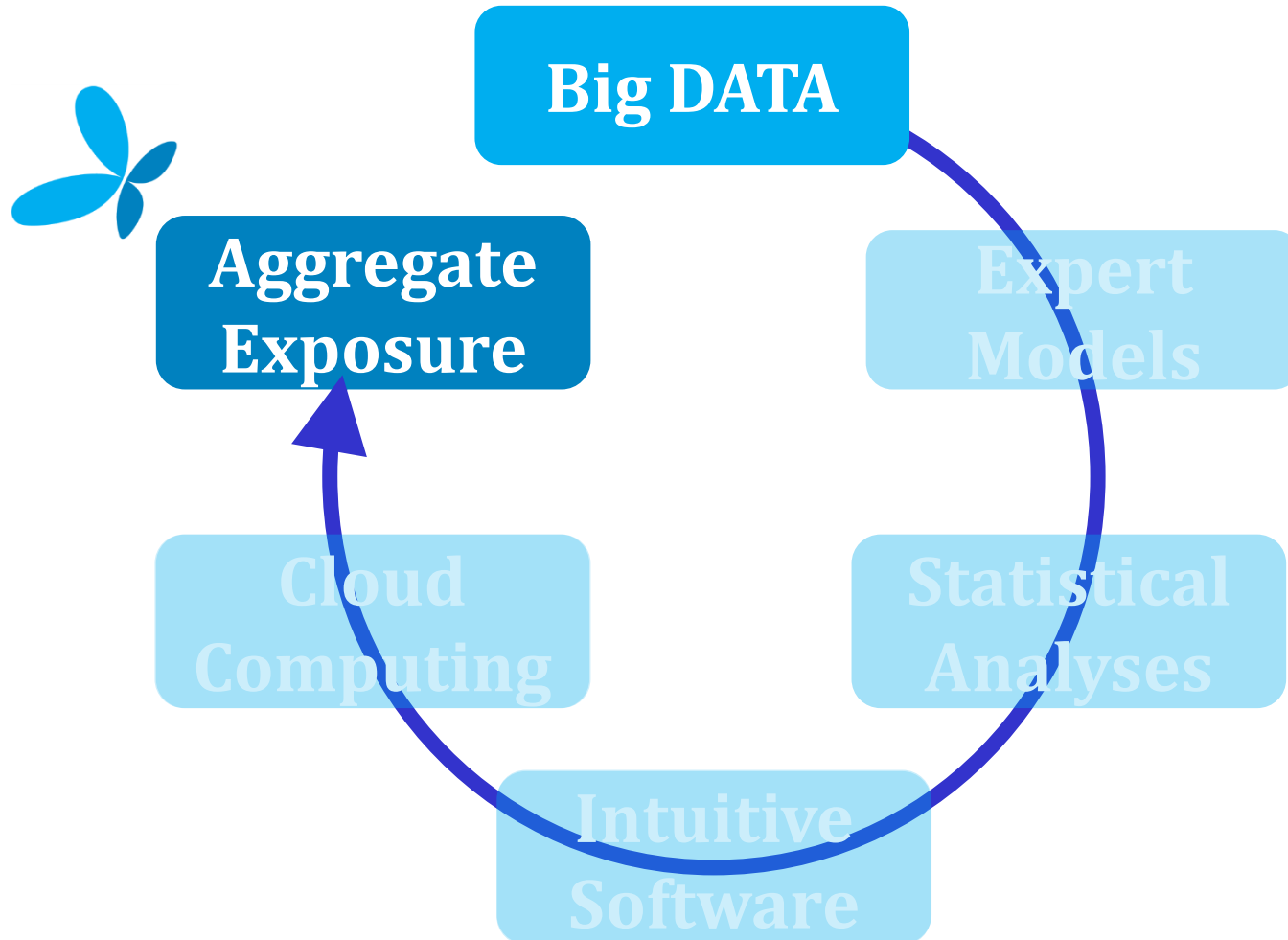
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