# What The Data Tells Us – Or Not

A Kurpad

St John's Medical College

Bangalore

What do we want to know

- Is a person eating correctly?
- Is a population eating correctly?
- What are they eating?
- Is this diet appropriate for their lifestyle?
- Is the person/population healthy?

Diminishing protein intakes & per capita availability

Per capita daily availability of food groups - India : 1951 - 2010
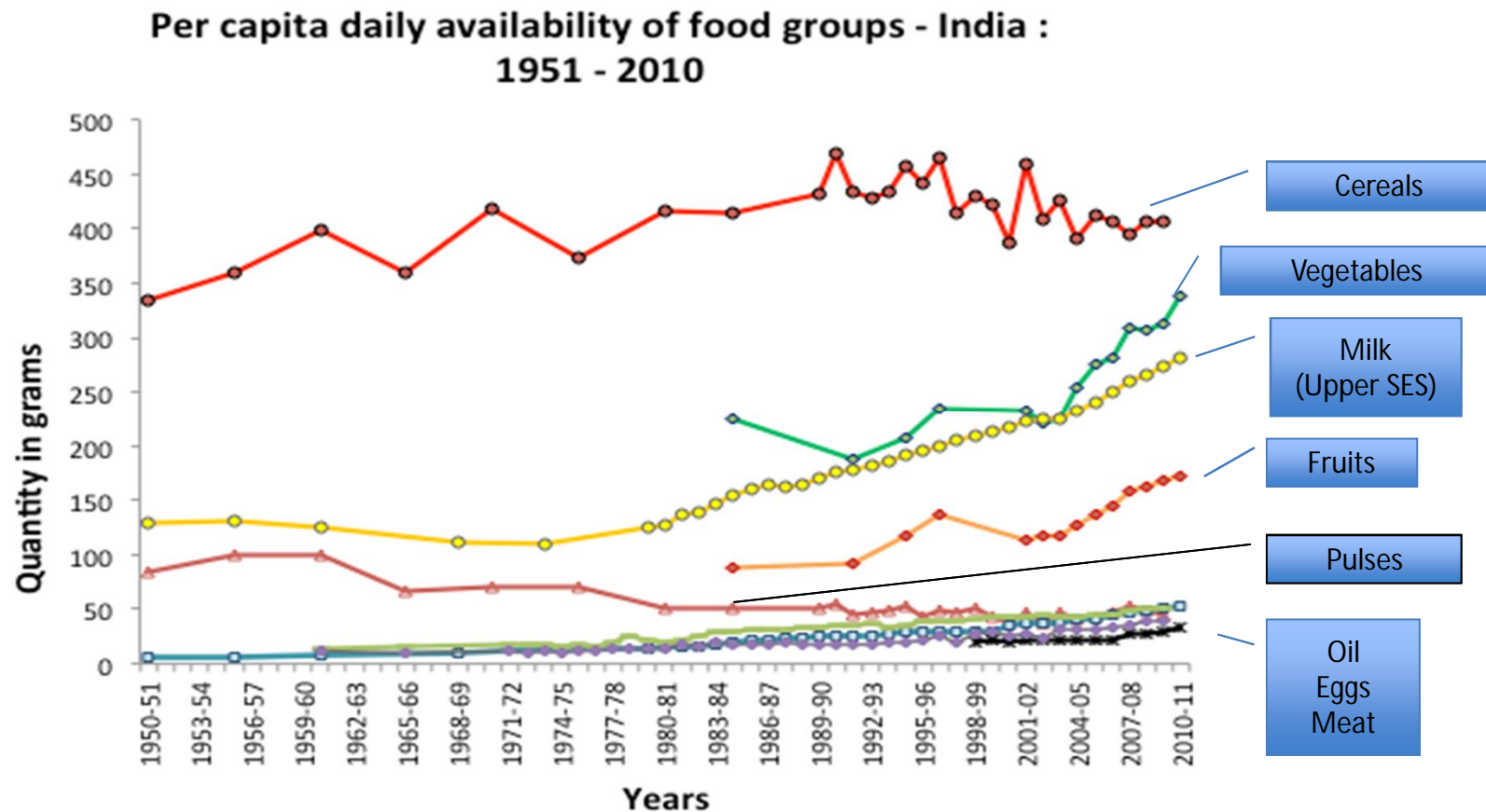
Directorate of Economics and Statistics (2013). *Agricultural Statistics at a Glance 2012.* New Delhi: Ministry of Agriculture, Government of India.

DAHDF (2012). Basic Animal Husbandry statistics, 2012. AHS series 13. New Delhi: Ministry of Agriculture, Government of India.

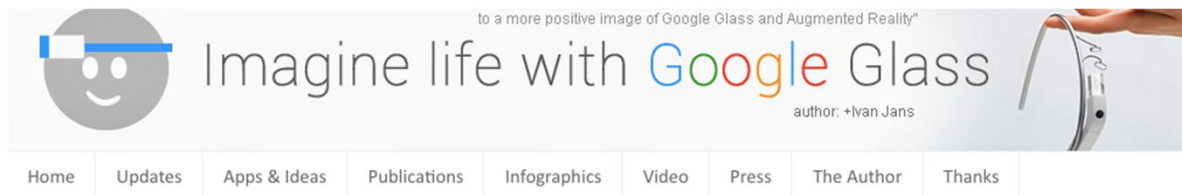Varadharajan, Kurpad et al, APJCN, 2014

What do we need?

- To compare Intake with Requirement
  - If equal = equilibrium
  - Not easy to do

- To compare Intake with Indicators of health

Collecting data

COMPLEXITY OF HUMAN DIET IS A CHALLENGE

- True intakes are extremely difficult to obtain.
- Nevertheless, although nature of diet is complex, representing an unusually complex set of inter-correlated exposures, to assess the effect of dietary exposures it is necessary to measure dietary intakes in nutritional epidemiology.
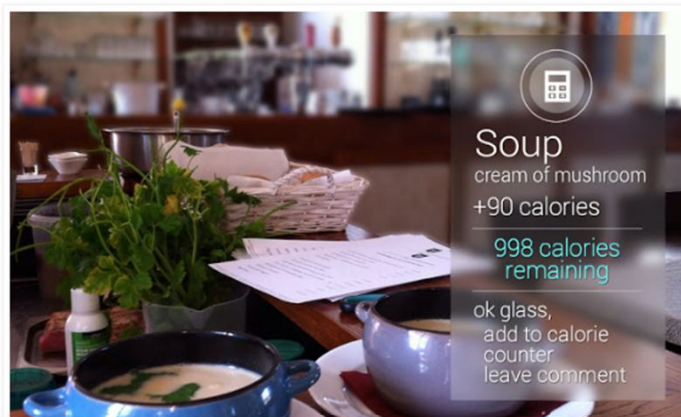
How do we figure out what people eat?

One of the big challenges of this century

to a more positive image of Google Glass and Augmented Reality"

Imagine life with Google Glass
author: +Ivan Jans

Home   Updates   Apps & Ideas   Publications   Infographics   Video   Press   The Author   Thanks

Friday, June 21, 2013

Calorie Counter while eating with Google Glass

+2 Recommend this on Google

Soup
cream of mushroom
+90 calories

998 calories remaining

ok glass,
add to calorie counter
leave comment

Share this content with your friends

Download & read the eBook on your tablet

525 calories per 100g

32% Sugars
Gluten
Egg
Vanillin
No Preservatives

The TellSpec can reportedly calculate all the calories, ingredients, chemicals, and allergens in any given piece of food.

The Inadmissibility of What We Eat in America and NHANES Dietary Data in Nutrition and Obesity Research and the Scientific Formulation of National Dietary Guidelines

When the facts change, I change my mind. What do you do, sir?

John Maynard Keynes[1,p19]

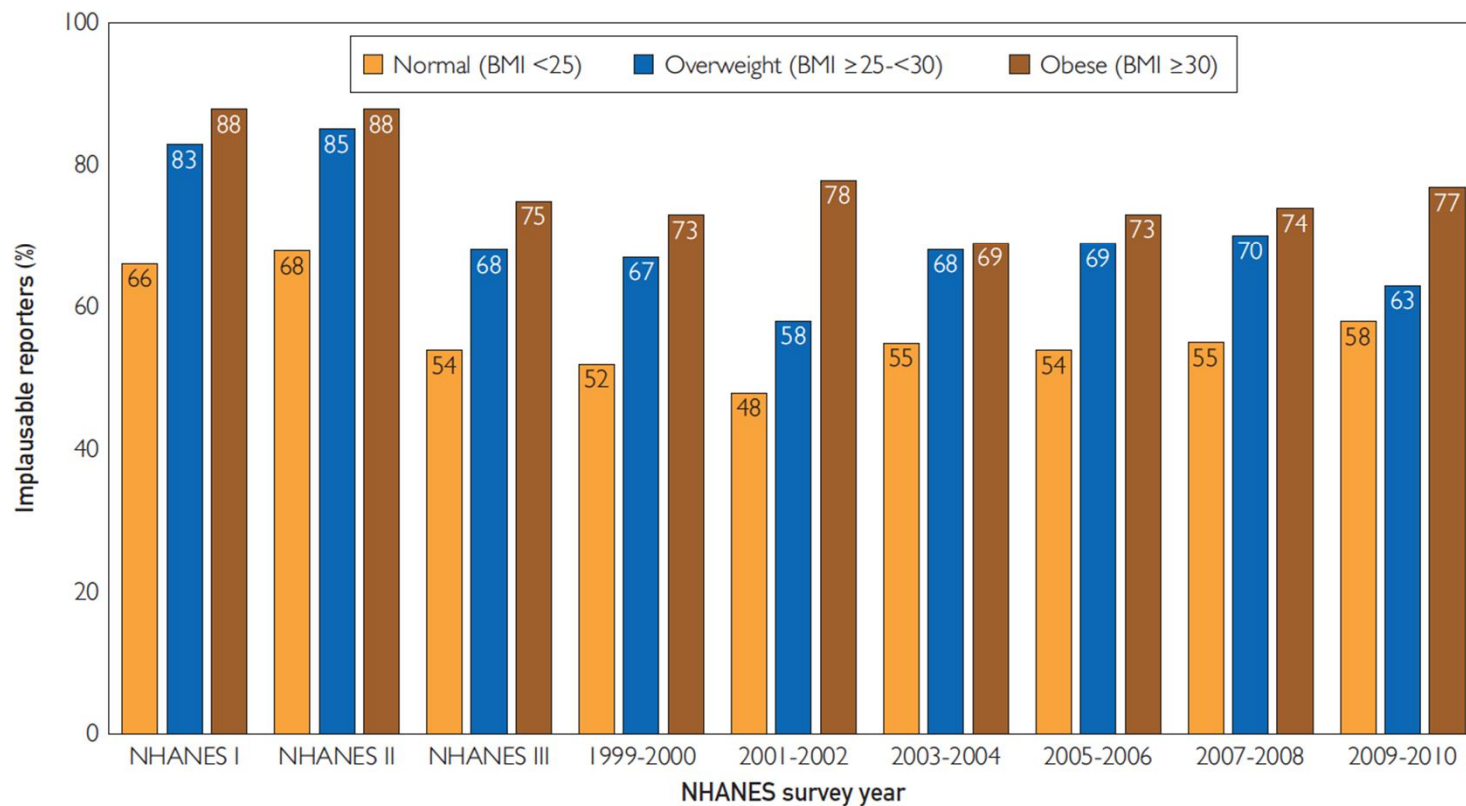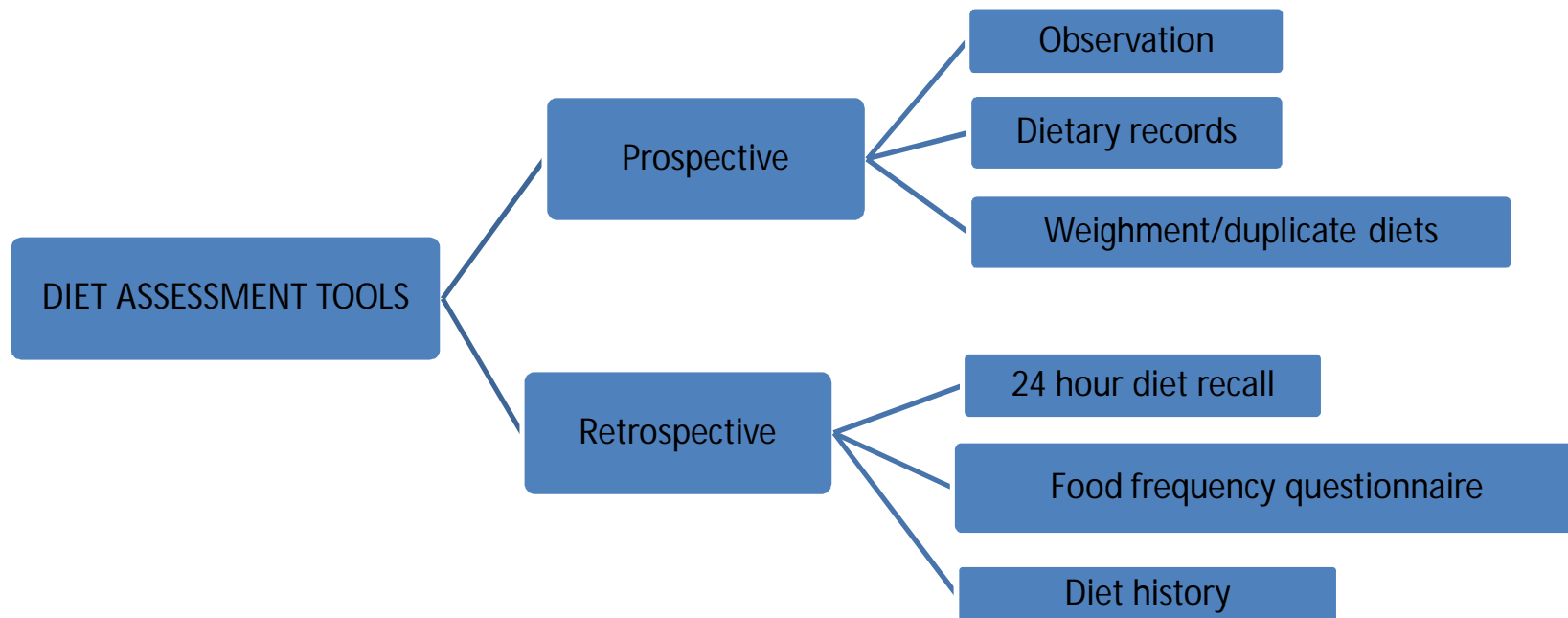Edward Archer, PhD; Gregory Pavela, PhD; and Carl J. Lavie, MD

FIGURE. Percentage of implausible reporters by body mass index (BMI) for US women aged 20 to 74 years in the National Health and Nutrition Examination Survey (NHANES) (1971-2010). Physiologically implausible values were determined via the following equation: (reported energy intake/basal metabolic rate) ≤1.35. Implausible values may be considered "incompatible with life."[11,p7]

DIET ASSESSMENT

```
                                            Observation

                        Prospective         Dietary records

                                            Weighment/duplicate diets
DIET ASSESSMENT TOOLS

                                            24 hour diet recall

                        Retrospective       Food frequency questionnaire

                                            Diet history
```
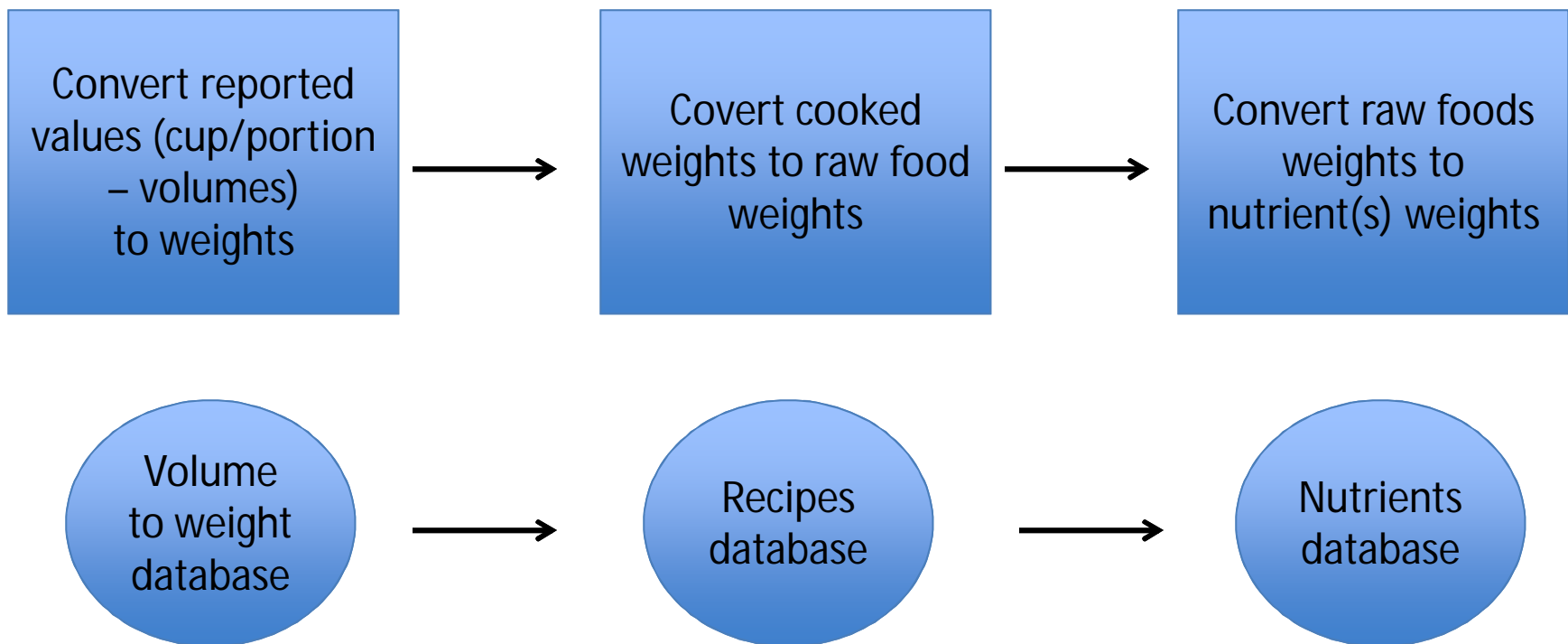
SELECTION OF INSTRUMENT

- Is information on foods, nutrients, other food constituents, or dietary behavior required?

- Is absolute or relative intake required?

- What is the level of accuracy needed?

- What time period is of interest

- What are the constraints- time, personnel, budget, respondent characteristics (age etc)

March 2010

WHAT NEEDS TO BE DONE AFTER DATA COLLECTION?

- **Check for completeness of data**
- **Conversion of intakes in terms of nutrients and food groups**

Convert reported values (cup/portion – volumes) to weights	→	Covert cooked weights to raw food weights	→	Convert raw foods weights to nutrient(s) weights
Volume to weight database	→	Recipes database	→	Nutrients database

ANALYSIS: NUTRIENTS VS FOODS

- Diet can be analyzed as nutrients/specific foods/food groups or combination of these.

- Nutrients- Total intake of a nutrient is most powerful test of a hypothesis (e.g. total fat intake with risk of disease).

- Foods- As specific foods /food groups. Used when hypothesis not specified ,suspicion exists to explore data (e.g. intake of cruciferous vegetables inversely related to colon cancer (indole compounds), CHD lower in Eskimos due to high consumption of fish).

- Foods not fully represented by nutrients- e.g. milk vs. yoghurt. Foods are extremely complex mix of chemicals that may compete with, antagonize or alter bioavailability of any single nutrient in the food.

St John's data

- ## Adult
  - PURE study (urban & rural) – networked- 5000 men&women
  - FFQ/PAQ
  - Incident diabetics – 1000; 24h recall/PAQ
- ## Children
  - PURE Child (1000)- FFQ, networked
  - PEACH Cohort (10,000) – food groups
- ## Pregnant
  - Birth cohort- Bangalore Urban, 3500
  - Birth cohort – Bangalore Urban & Rural, 1000

ASSESSMENT OF PHYSICAL ACTIVITY

PHYSICAL ACTIVITY

Subjective measures

1. Questionnaire
   i. Self-report
   ii. Interview
2. Activity diary

Objective measures

1. Motion sensors
   i. Pedometer
   ii. Accelerometer
2. Heart rate monitor

Criterion standards
1. Doubly labeled water
2. Indirect calorimetry
3. Direct observation

PHYSICAL ACTIVITY- DIMENSIONS & DOMAINS

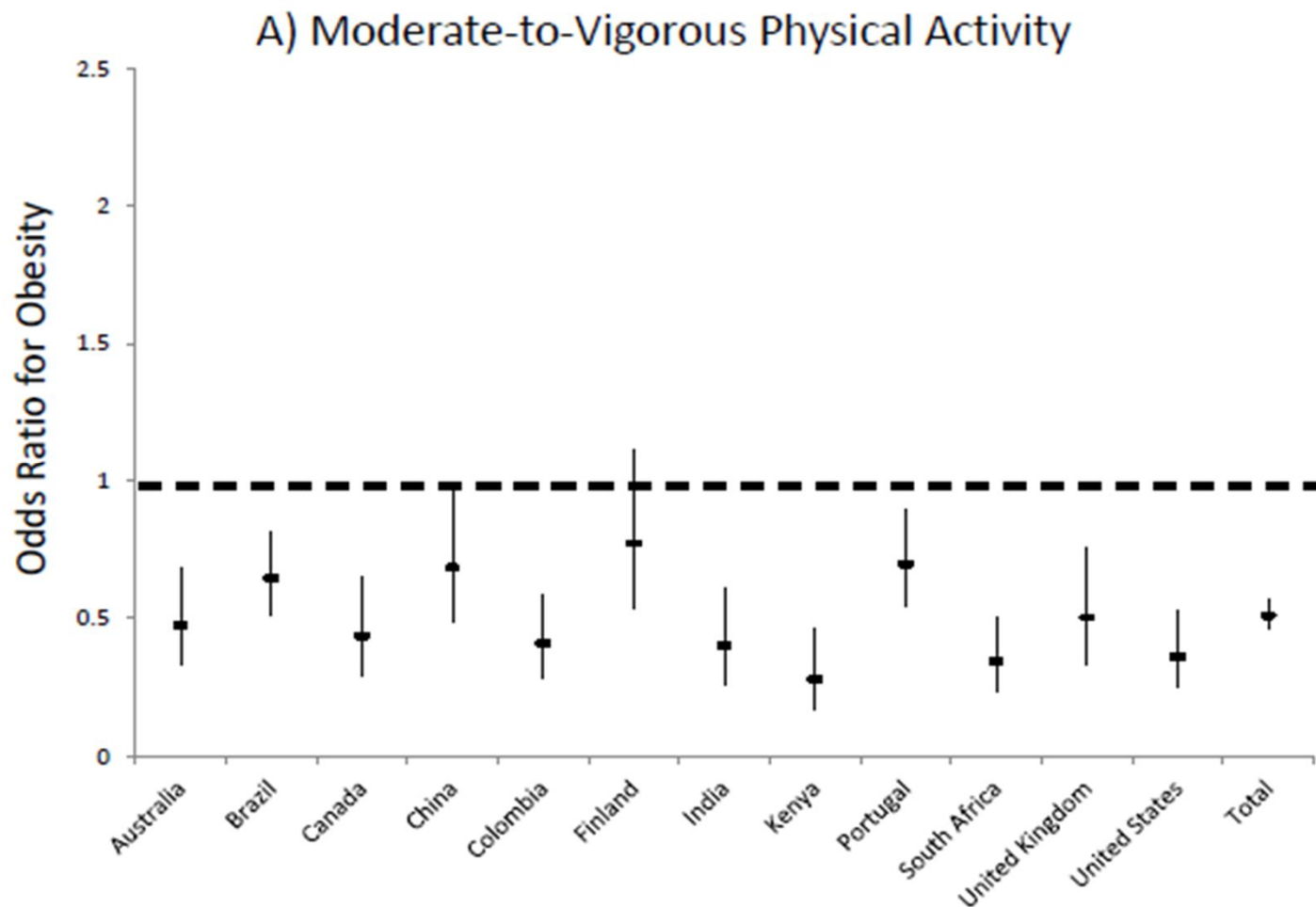- **DIMENSIONS OF PHYSICAL ACTIVITY MEASURED**
  - Mode/type (e.g. walking/cycling)
  - Intensity (light/moderate/vigorous)
  - Frequency (times)
  - Duration (minutes/hours)

  E.g. Individual walking to and from work for ½ an hour twice a day: 3 METs (intensity)* 30 mins (duration)* 2 times/day (frequency)
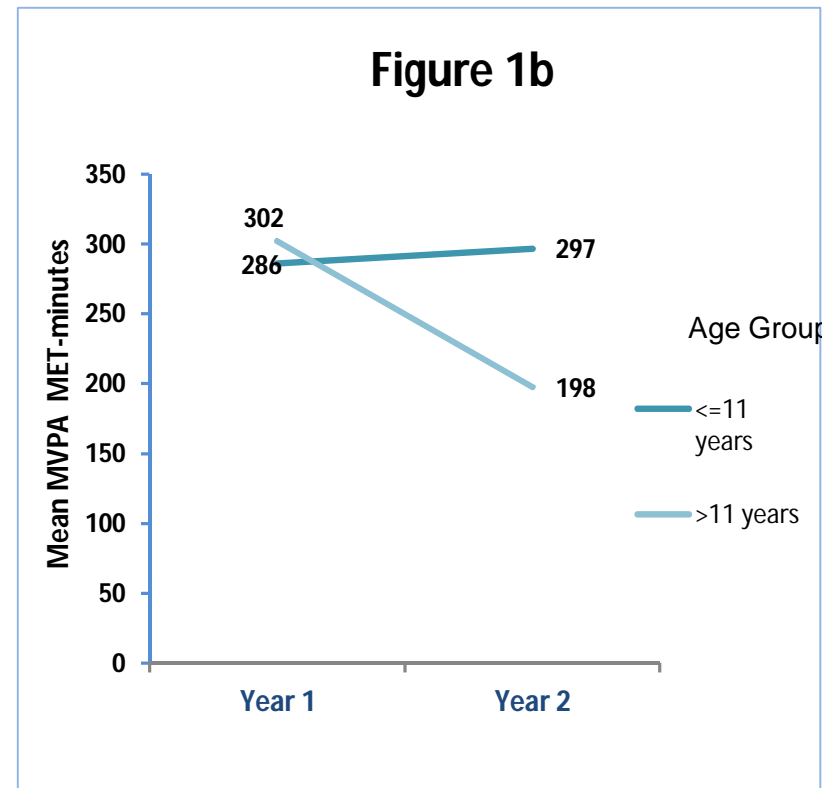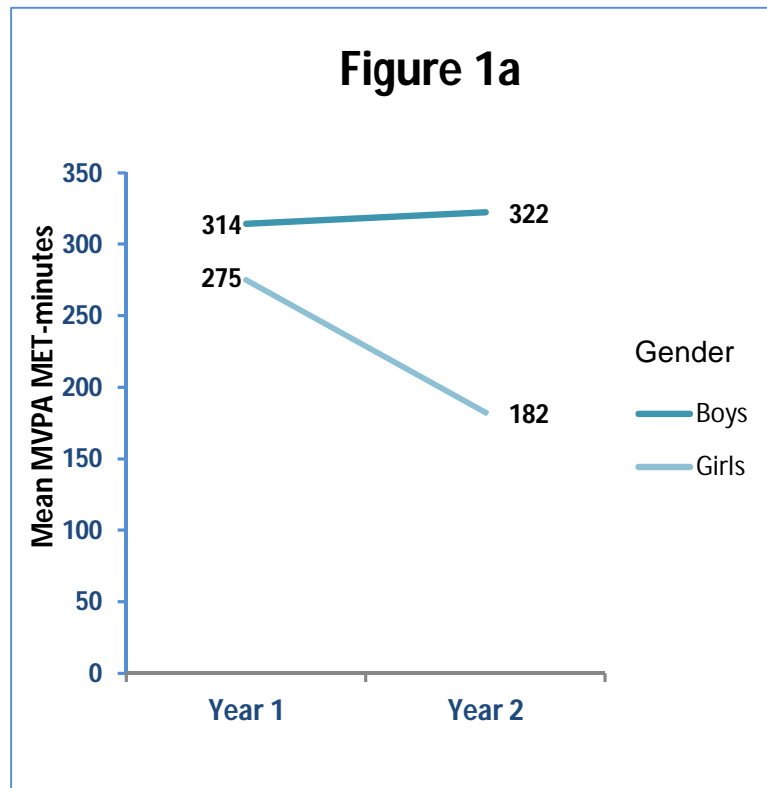
- **DOMAINS**
  - Occupational
  - Household
  - Transport
  - Leisure

Associations between moderate-to-vigorous physical activity (MVPA) and obesity in 6,548 9-11 year old children from 12 study sites around the world. Odds ratios are expressed per 25 minutes of daily MVPA adjusted for sex. Error bars represent 95% confidence intervals.

A) Moderate-to-Vigorous Physical Activity

PAQ: MODERATE TO VIGOROUS PA (MVPA) IN CHILDREN IN INDIA

Figure 1a — Mean MVPA MET-minutes by Gender (Boys, Girls) over Year 1 and Year 2: Boys 314 → 322; Girls 275 → 182.

Figure 1b — Mean MVPA MET-minutes by Age Group (<=11 years, >11 years) over Year 1 and Year 2: <=11 years 286 → 297; >11 years 302 → 198.

- *Ref: Swaminathan S, Selvam S, Thomas T, Kurpad AV, Vaz M. Longitudinal trends in physical activity patterns in selected urban South Indian school children. Indian J Med Res. 2011: 134: 174-180.*

# What the data tell (and do not tell)

Defining what is required

- Defining deficiency (we usually can't)
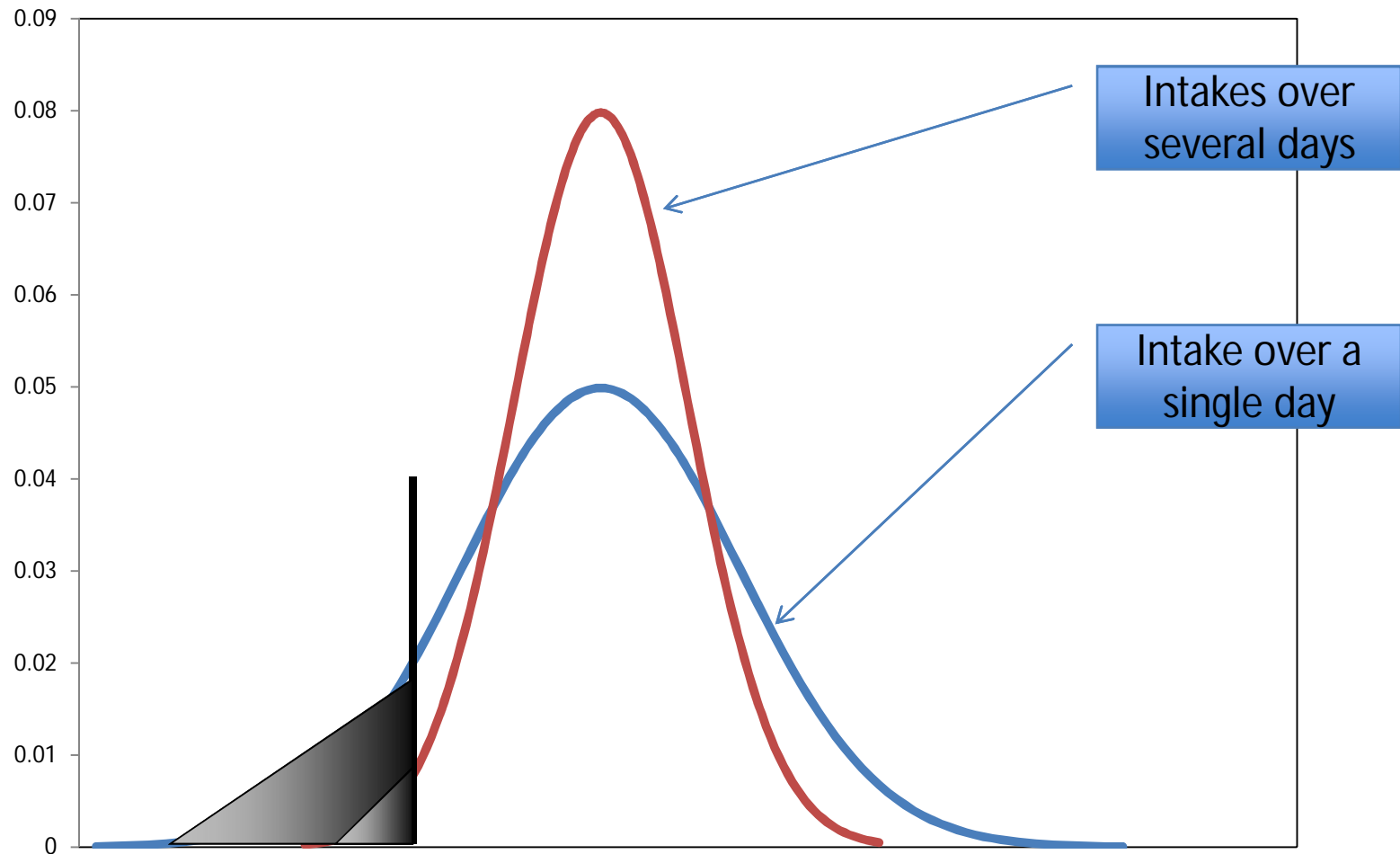
- Defining risk (of NCD)

We don't define deficiency or excess:
we define risk

- Compare Intake to Nutrient requirements
- Epidemiology
  - Figure out how much of a food people eat
  - Figure out risk of outcomes

If we only know intakes of a population "prevalence or risk of deficiency"
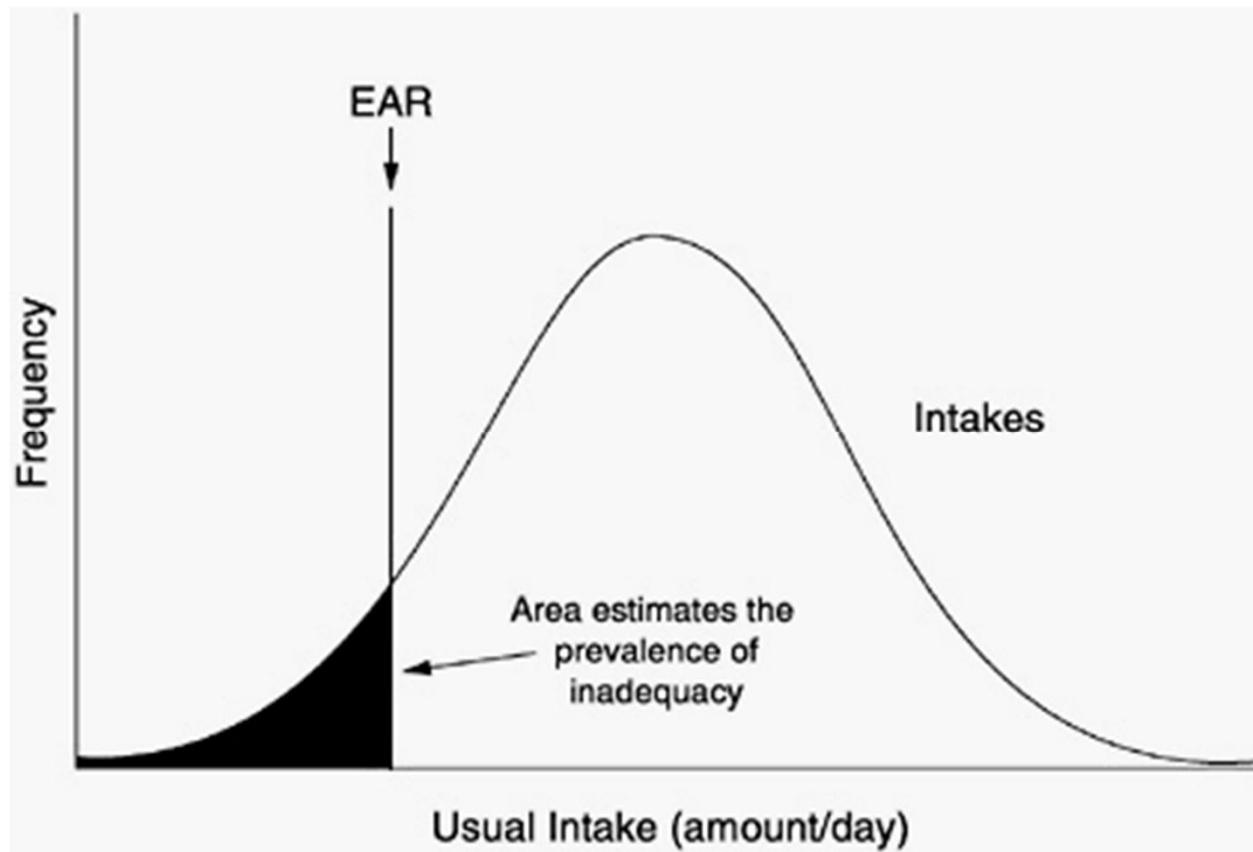
# Need to refine intakes to smaller SD

Prevalence of Body Mass Index Lower Than 16 Among Women in Low- and Middle-Income Countr

Fahad Razak, MD, MSc; Daniel J. Corsi, PhD; Arthur S. Slutsky, MD, MASc; Anura Kurpad, MD, PhD;
Lisa Berkman, PhD; Andreas Laupacis, MD, MSc; S. V. Subramanian, PhD

Country	Year of Most Recent Survey	Survey Sample Size	No. With BMI <16
India	2005	91248	4454
Bangladesh	2011	14709	538
Madagascar	2008	5910	192
Timor-Leste	2009	8904	256
Senegal	2010	3957	101
Sierra Leone	2008	2693	57
Pakistan	2012	3969	57
Ethiopia	2011	11150	375
Nepal	2011	4559	64
Democratic Republic of the Congo	2007	3308	59
Chad	2004	2618	49
Namibia	2006	6917	112
Burundi	2010	2993	35
Cambodia	2010	6960	97
Burkina Faso	2010	6059	69
Kenya	2008	6050	79
Guyana	2009	3601	38
Niger	2012	3646	46
Mali	2006	9774	94
Guinea	2012	3231	36
Nigeria	2008	23066	259
Maldives	2009	5078	54
Haiti	2012	6639	56
Zambia	2007	4848	40
Uganda	2011	1835	11
Liberia	2007	4991	29
Uzbekistan	1996	3182	20
South Africa	1998	4264	32
Benin	2006	12284	69
Malawi	2010	5317	24
Tanzania	2010	7044	49
Ghana	2008	3497	19
Cameroon	2011	5422	32
Tajikistan	2012	7007	40
Côte d'Ivoire	2011	3399	16
Mozambique	2011	9490	43
Lesotho	2009	2851	11
Congo	2012	4028	26
Kazakhstan	1999	1883	6
Rwanda	2010	4945	15
Dominican Rep	1996	5821	25
Guatemala	1998	2173	7
Azerbaijan	2006	6461	15
Morocco	2003	12713	37
São Tomé and Príncipe	2008	1723	5
Zimbabwe	2010	6313	20
Nicaragua	2001	9058	20
Gabon	2012	3858	13
Moldova	2005	5709	12
Kyrgyz Republic	1997	2871	5
Armenia	2005	5058	10
Colombia	2010	35622	63
Honduras	2011	16290	27
Jordan	2012	6350	11
Albania	2008	5858	4
Peru	2012	18419	6
Egypt	2008	14411	4
Swaziland	2006	3412	2
Bolivia	2008	12301	3

Weighted Prevalence, %
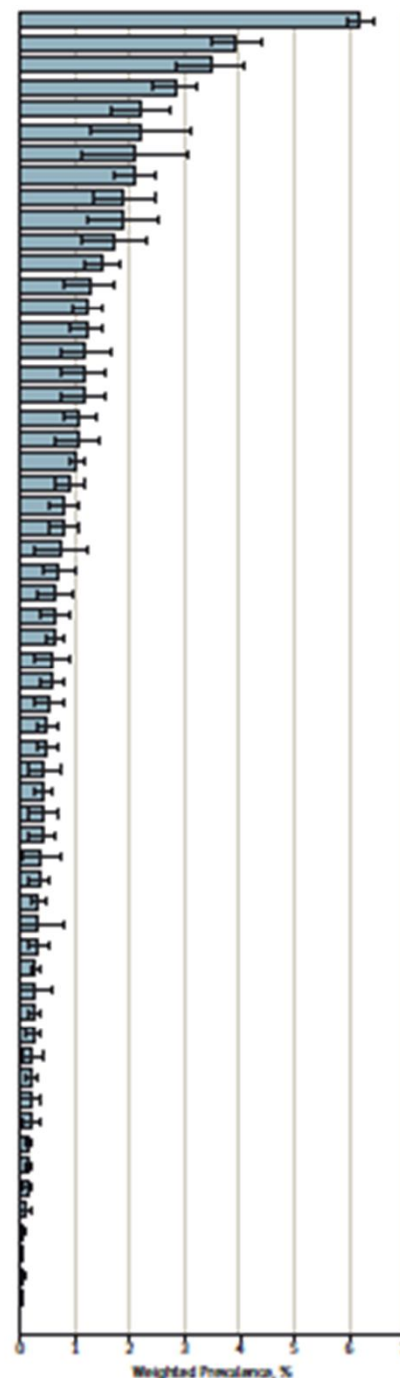
The data tell us "risk of deficiency"
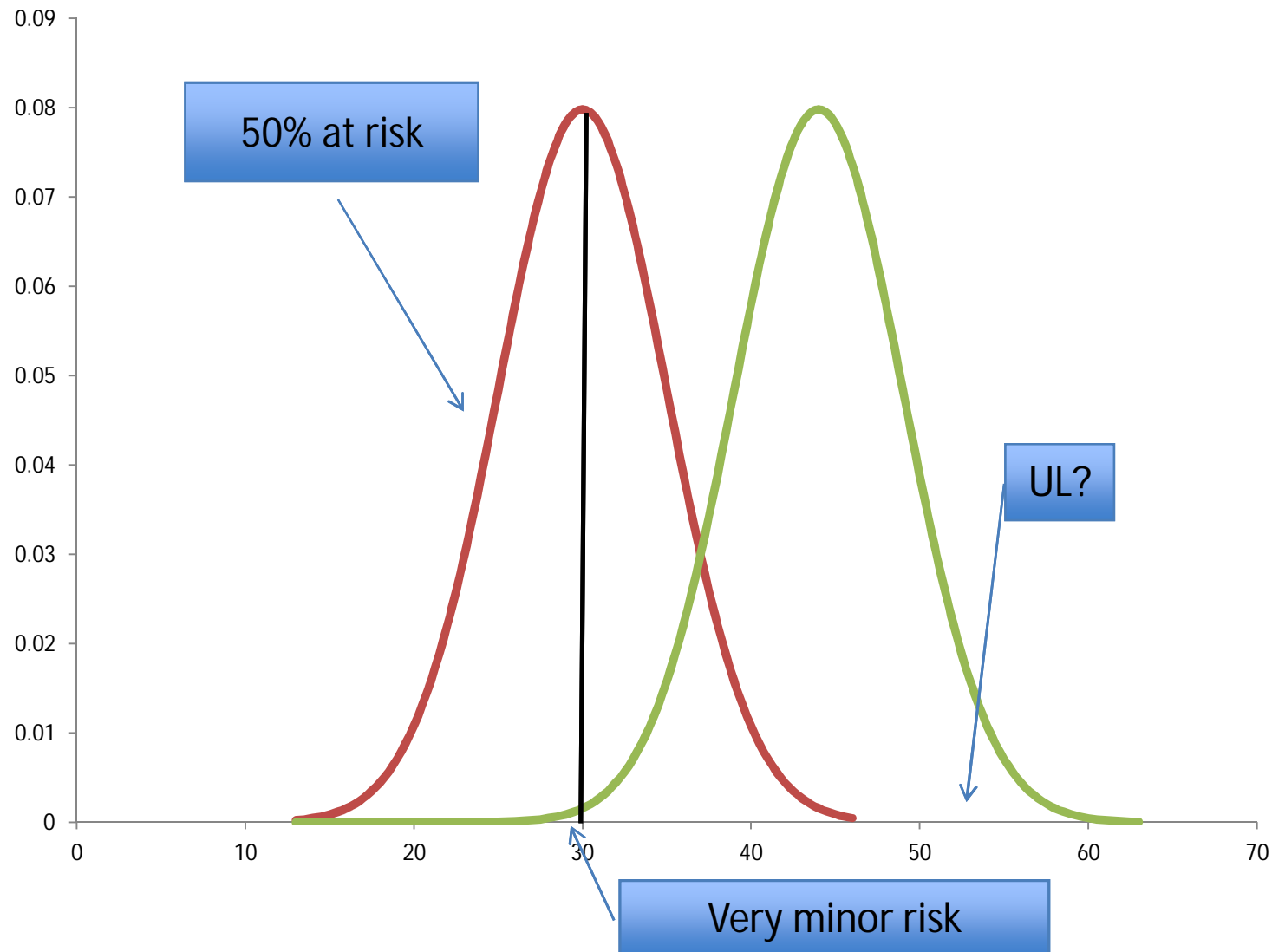
The data do not tell us who is deficient

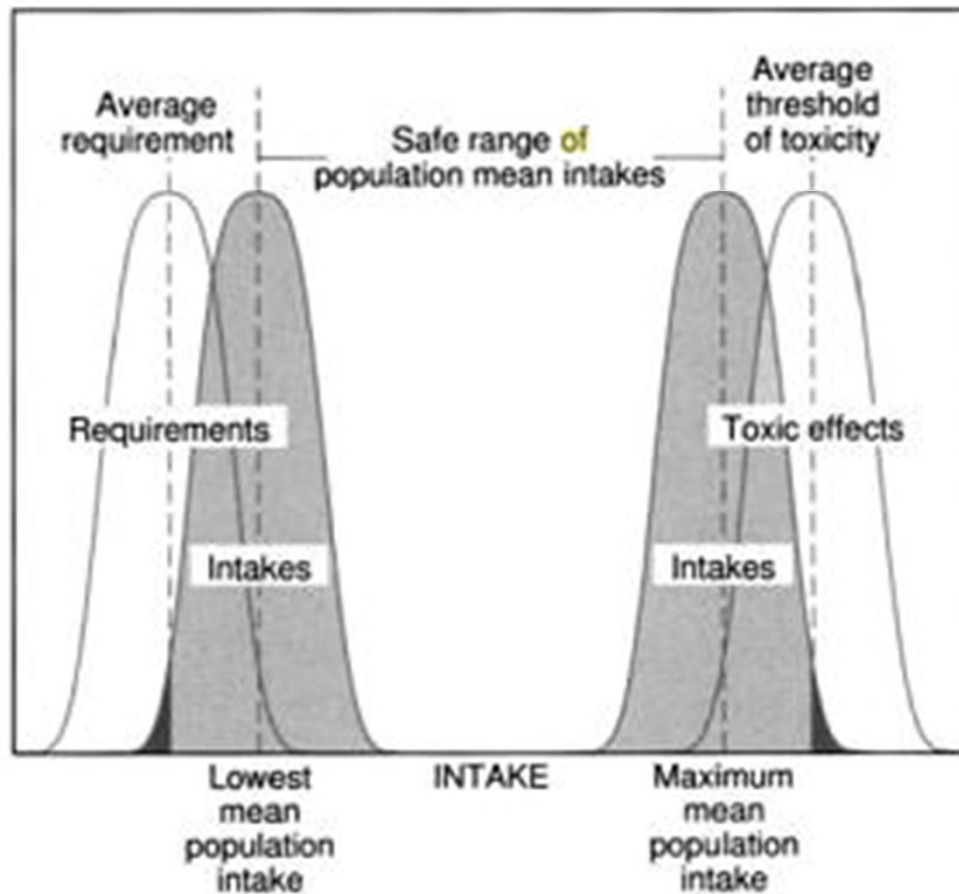The data do not tell us precision

The data tell us what to consider next…
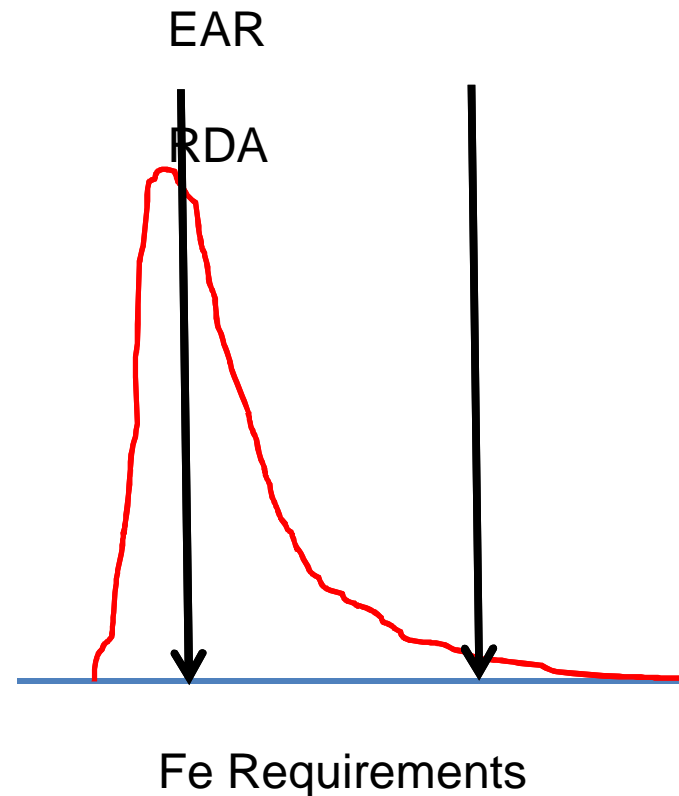
If diets are risk prone or deficient…
Fortify?

Target intake: shifting the bell shaped curve

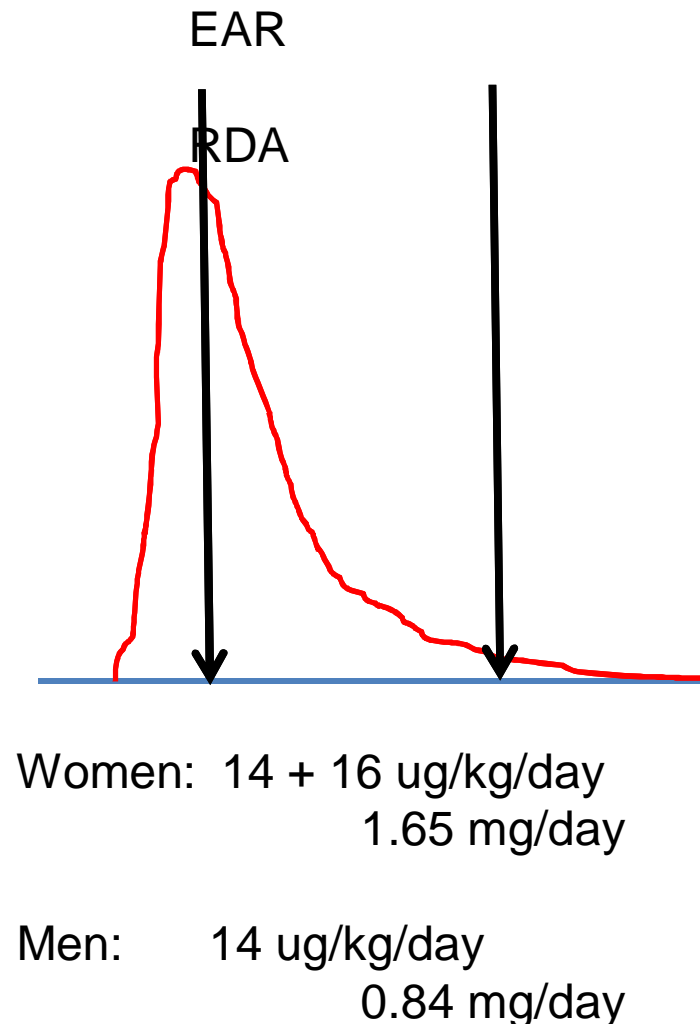50% at risk

UL?

Very minor risk

Defining a "Safe Range" of intakes

- Factorial approach
- Add up requirements
  - Daily Losses (Skin/intestine)
  - Menstrual losses
- If the Average Loss (50th Percentile) is added for each, then sum = EAR
- Put in bioavailability term
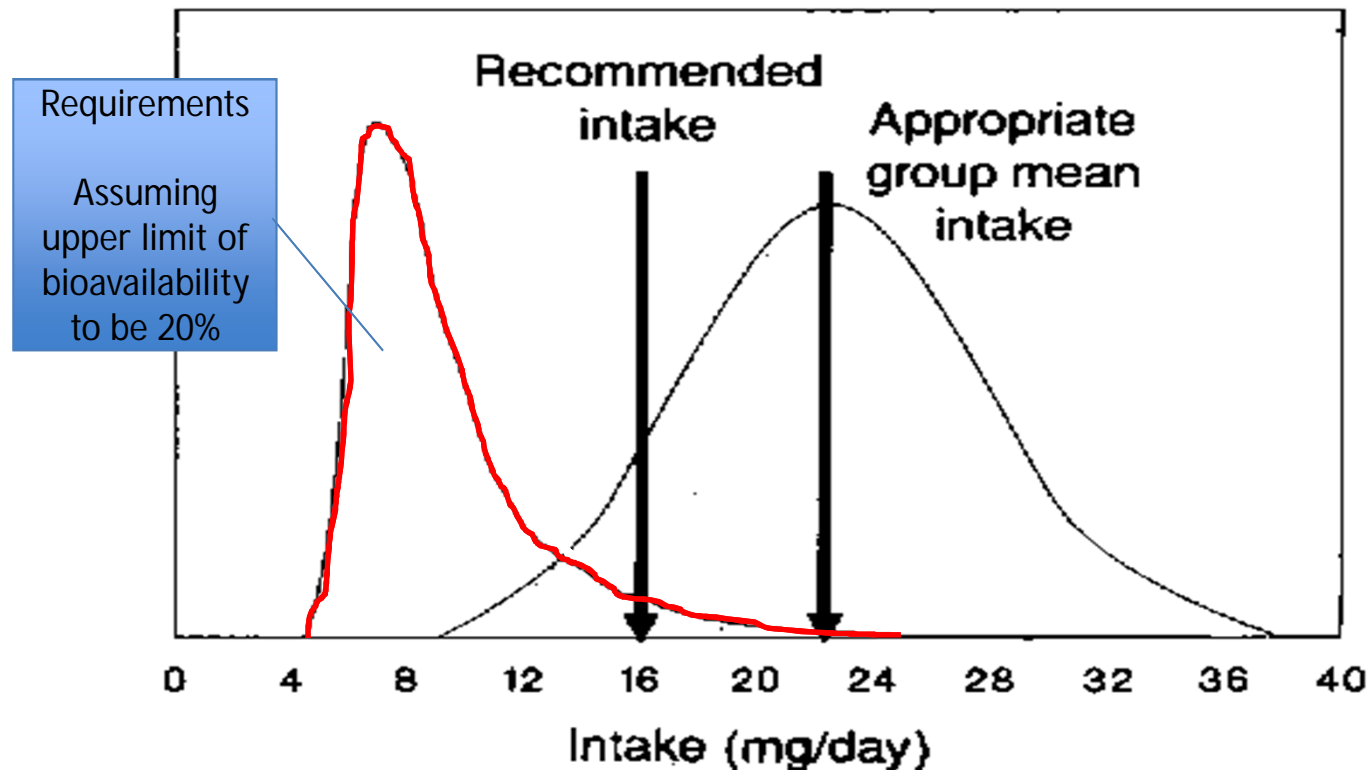
EAR

RDA

Fe Requirements

- Factorial approach
- Add up requirements
  - Daily Losses (Skin/intestine)
  - Menstrual losses
- If the Average Loss (50th Percentile) is added for each, then sum = EAR
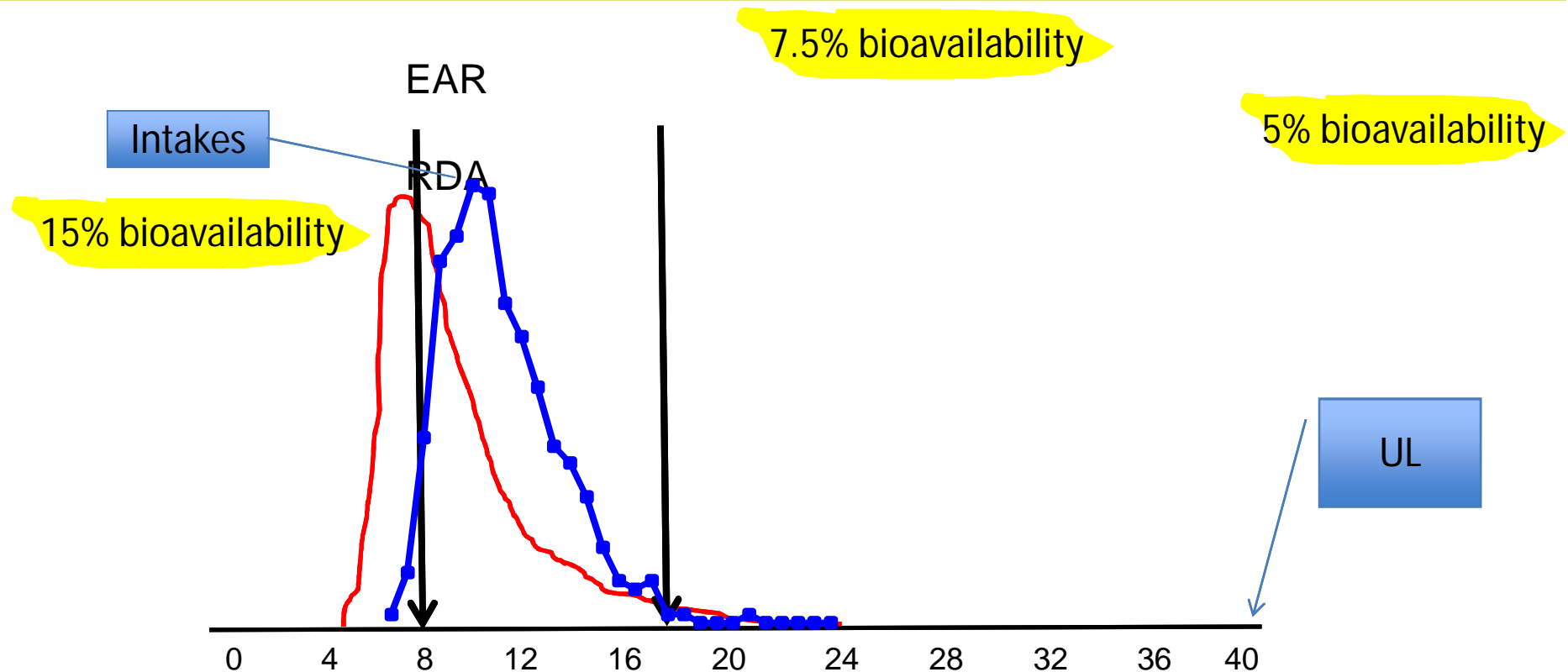- ~~Put in bioavailability term~~

EAR

RDA

Women: 14 + 16 ug/kg/day
                1.65 mg/day

Men: 14 ug/kg/day
                0.84 mg/day

Derivation, interpretation and application in evolutionary perspective
Iron intakes are skewed: G.H. Beaton, FAO, 1991

Requirements

Assuming upper limit of bioavailability to be 20%

Recommended intake

Appropriate group mean intake

Intake (mg/day)

urce: Requirements based on FAO/WHO, 1988

Iron requirement, intake and bioavailability

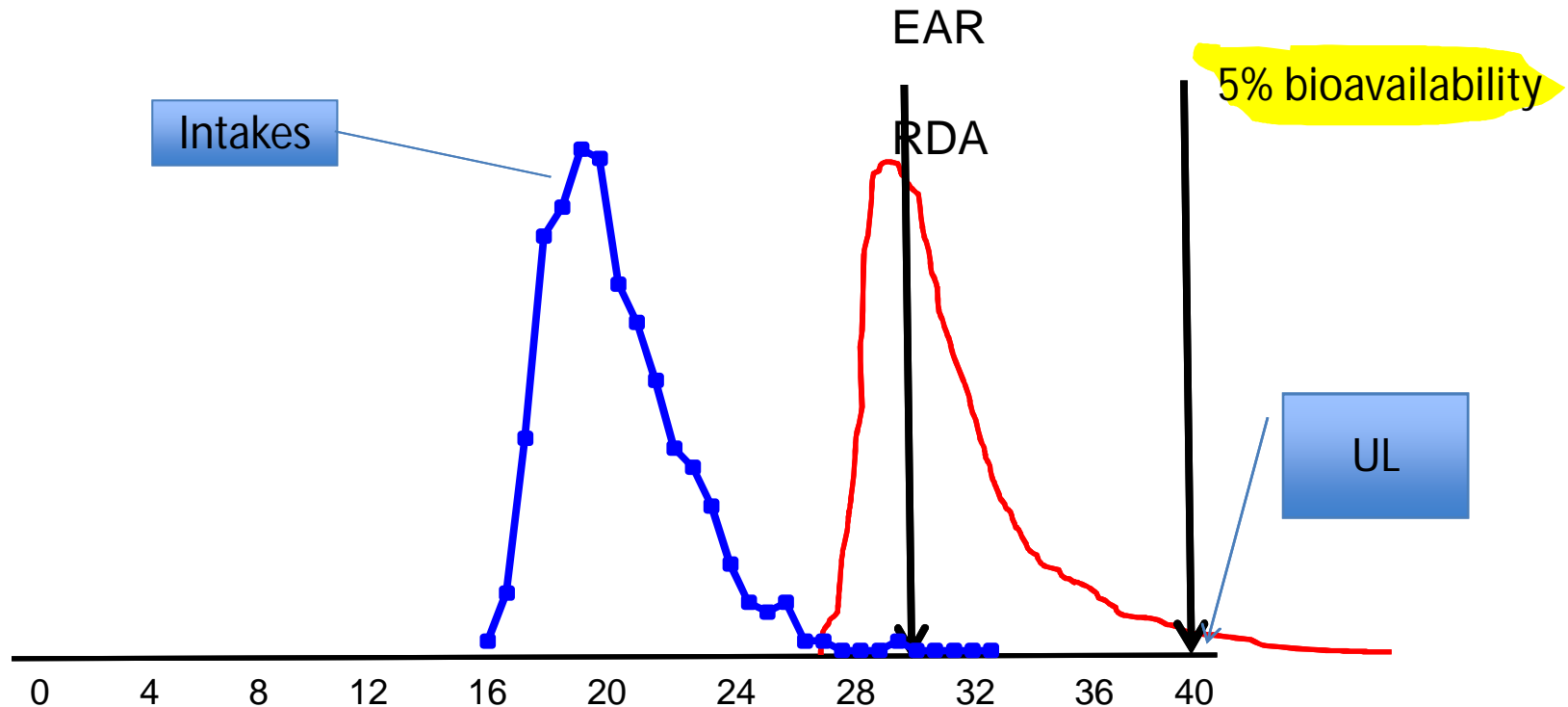
Requirements shift to the right because of inhibitory diet

IRON – RISK OF DEFICIENCY

Age group (years)	Iron (per day)			Iron + 10 mg fortificant (per day)	
	EAR (mg)	Intake (mg)	Risk of deficiency (%)	Intake (mg)	Risk of deficiency (%)
1-3	9.0	5.7	74	15.7	9.4
4-6	13.0	8.6	76	18.6	18.3
7- 9	16.0	10.2	79	20.2	27.9
10 -12 boys	21.0	12.0	84	22	45.8
10 – 12 girls	27.0	11.5	97	21.5	74.6
13 – 15 boys*	32.0	13.3	99	23.3	84.4
13 – 15 girls*	27.0	13.0	95	23	67.9
16 – 17 boys	28.0	16.4	87	26.4	56.2
16 – 17 girls	26.0	13.5	93	23.5	61.7

Using NNMB, 2006 rural dietary intake data

Derivation, interpretation and application in evolutionary perspective
Iron intakes are skewed: G.H. Beaton, FAO, 1991

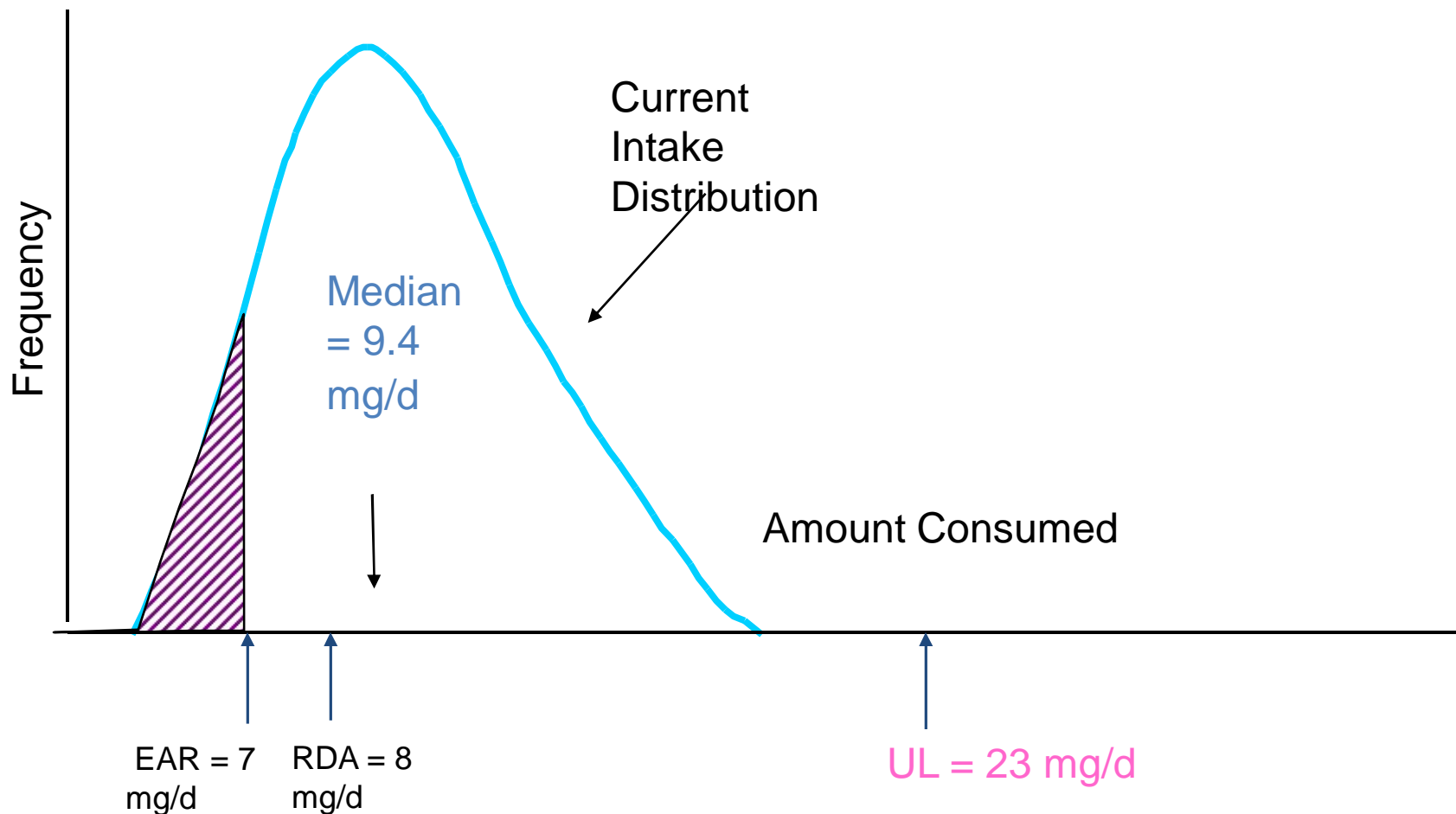Requirements shift to the right because of inhibitory diet
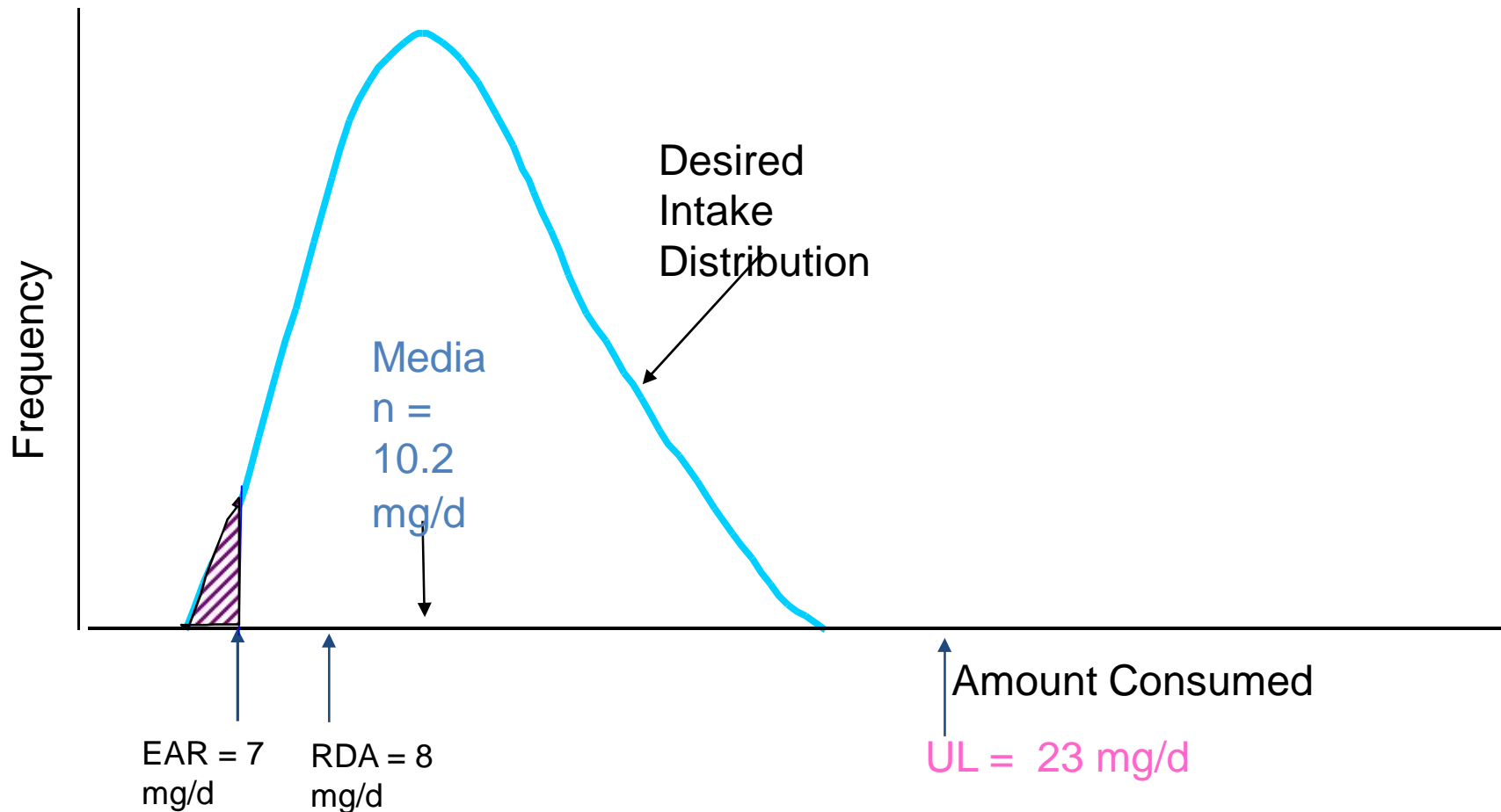
NPNL women, sedentary
NNMB, 2011-2012, Rural

State	Energy Kcal/day	Iron mg/day	Iron Density mg/1000 Kcal	Fortified % Risk of >UL	Cereal source
Kerala	1350	9	7	0.3	Rice
Tamil Nadu	1675	8.5	5	0.2	Rice
Karnataka	1875	11.5	6	1.4	Rice/Millets
Andhra Pradesh	1600	7	4	0	Rice
Maharashtra	1400	11.5	8	1.4	Rice/Wheat
Gujarat	1840	17	9	9.1	Wheat/Rice/Millets
Madhya Pradesh	1825	18.5	10	12.3	Wheat/Rice/Millets
Orissa	2000	13.5	7	3.4	Rice
West Bengal	1400	11	8	1.1	Rice
Uttar Pradesh	1800	16.5	9	8.1	Wheat/Rice

Courtesy: Dr Suzanne Murphy

Current zinc intake distribution, girls 9-13:
15% prevalence of inadequacy

Frequency

Current
Intake
Distribution

Median
= 9.4
mg/d

Amount Consumed

EAR = 7
mg/d

RDA = 8
mg/d

UL = 23 mg/d

Desired zinc intake distribution, girls 9-13:
3% prevalence of inadequacy

Frequency

Desired
Intake
Distribution

Median = 10.2 mg/d

Amount Consumed

EAR = 7 mg/d

RDA = 8 mg/d

UL = 23 mg/d

The data tell us average intakes

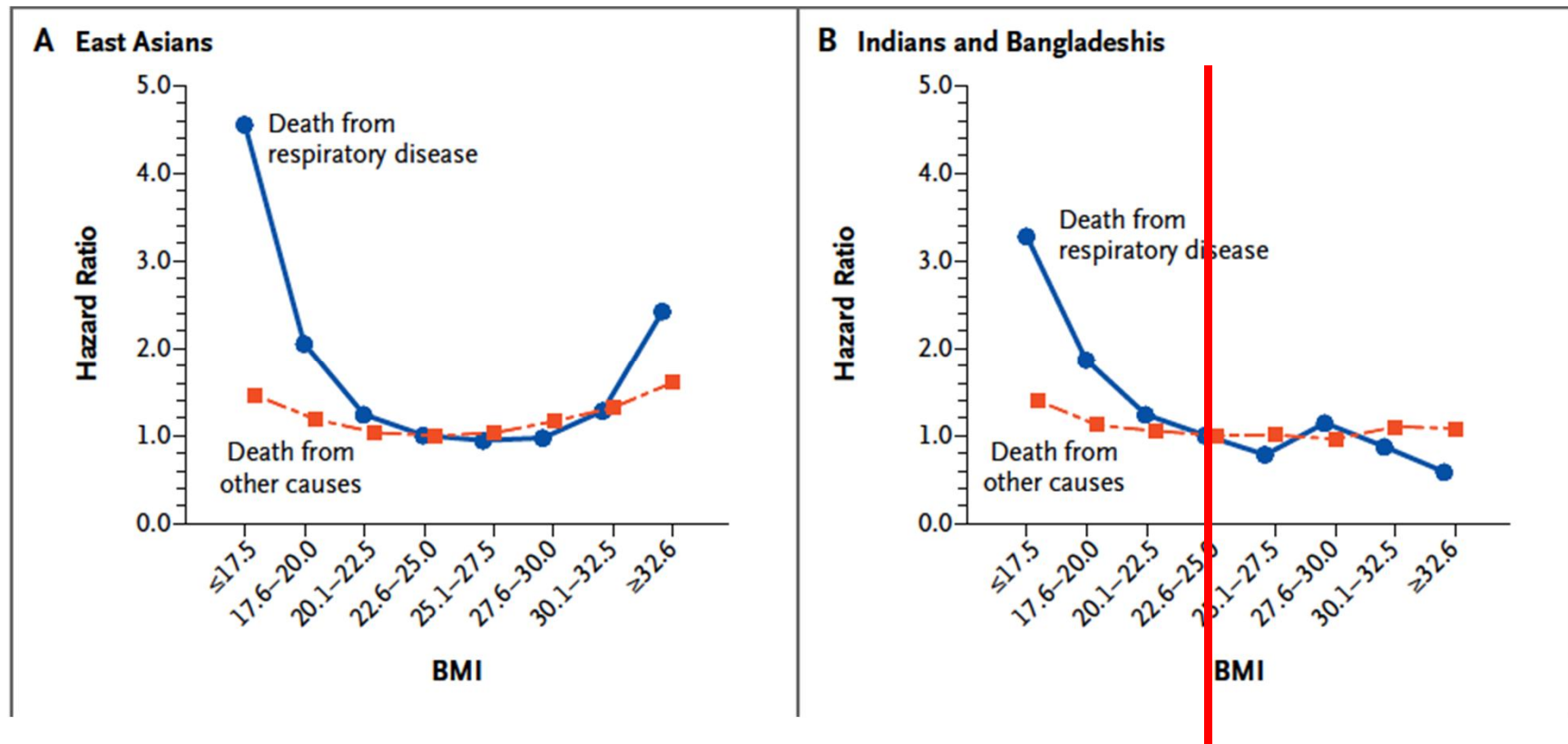The data do not tell us nutritional status

Nutritional status

- Several ways to tell someone that they are eating wrong
  - Anthropometry
  - Biomarkers

- We use population data for individual cut-offs
- Victims of the bell shaped curve, and really need personalized approaches

Association between Body-Mass Index and Risk of Death in More Than 1 Million Asians

Food and Nutrition in India:
Facts and Interpretations

ANGUS DEATON, JEAN DRÈZE

One, there is strong evidence (not only from the NSS but also from NNMB surveys) of a sustained decline in per capita calorie consumption during the last 25 years or so. According to NSS data,

Two, the decline of per capita consumption is not limited to calories. It also applies to proteins and many other nutrients, the major exception being fat consumption, which has increased

India. There are serious gaps in India's nutrition statistics, and even the most basic nutrition trends are far from clear. The NNMB

mainly on state-level indicators. Effective action in this field requires regular and reliable large-scale surveys that would make it possible to monitor the nutrition situation at the district level at intervals of, say, two to three years at most. Revamping the Dis-

Another useful option would be to "link" these surveys with NSS surveys from time-to-time, making it possible to combine detailed nutrition data with household expenditure data.

What next?

- Conceptual framework
  - Exposure-outcomes; biomarkers, other exposures, household or individual?
- Methodological framework
  - How much can be done?
  - How to validate at every stage?
  - Developing databases; biobanks
- Statistical framework
  - Sampling frame
  - Power
- Quality framework
  - Rigour, rigour, rigour