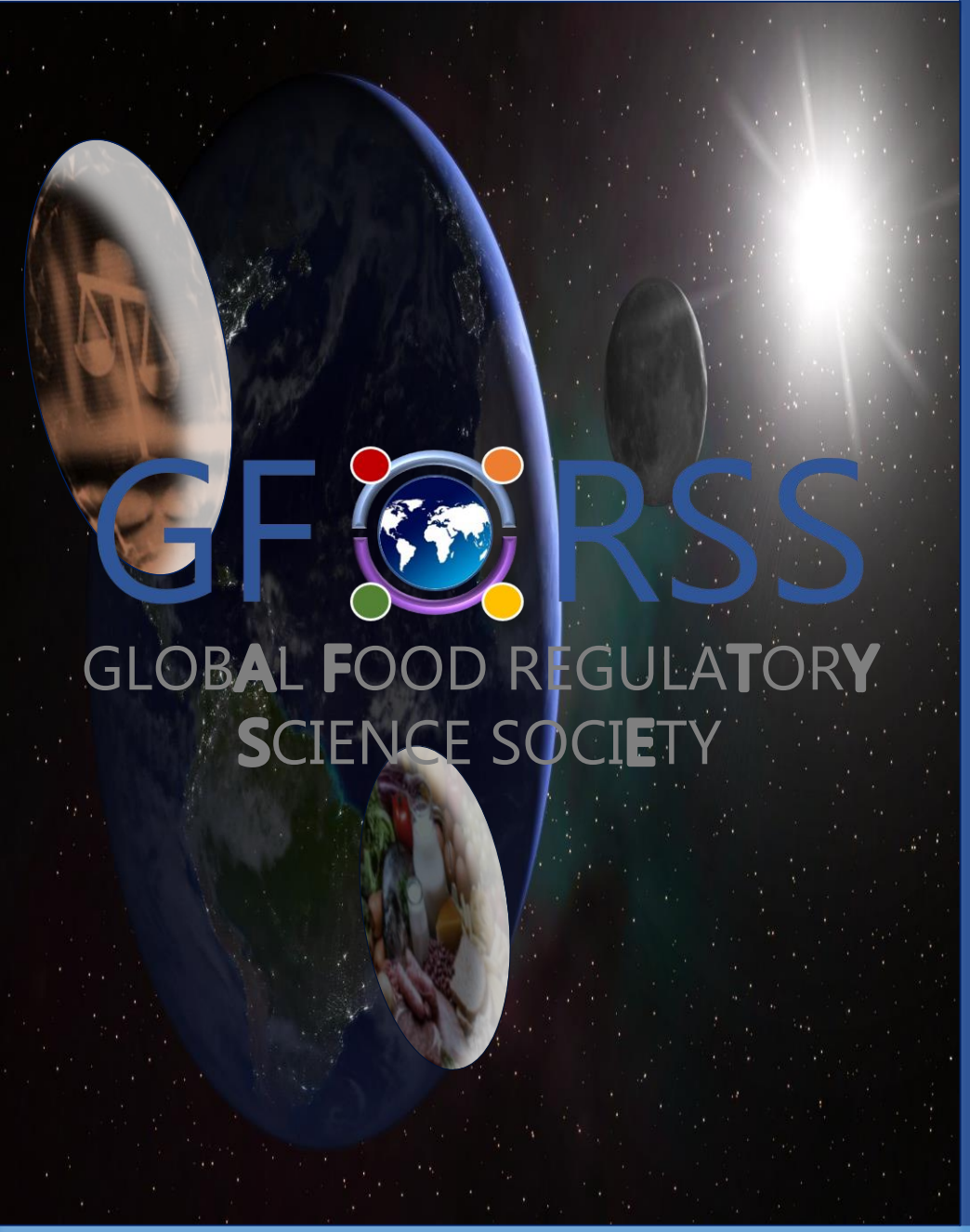


Extraction and Management of Occurrence Data

Day 2 – 27 February, 2023

9:00 – 9:45

Dr. Silvia Dominguez| *Global Food Regulatory Science Society (GFoRSS)*

Chemical risk assessment

Exposure to contaminant from dietary source(s) is compared to reference “safe” value to assess risk

$$Estimated\ daily\ intake\ of\ contaminant = \frac{Daily\ food\ intake\ x\ Concentration\ in\ food}{Body\ weight}$$

- ❑EDI (*ng/kg bw per day)*
- ❑Daily food intake (*kg/day)*
- ❑Concentration in food (*ng/kg)* → measured or extracted from database / literature
- ❑Body weight (*kg)*

Study selection = “mini database”

- ❑Define selection criteria: contaminant, food, country, years….
- ❑Not necessarily straightforward (we’ll do an exercise)
- ❑Extract ALL possible information from the selected studies
- ❑Ex. adapted from Rahmani et al (2018)

The prevalence of aflatoxin M1 in milk of Middle East region: A systematic review, meta-analysis and probabilistic health risk assessment

Table 1
The main characteristic of included studies.

Country	Year	Sample size	Positive	Prevalence (%)	Method of detection	Mean (ng/kg)	SD[a]	SE[b]	Range	LOD (ng/kg)[c]	LOQ (ng/kg)[d]	Reference
Iran	2013	320	320	100 (320/320)	ELISA[e]	121	14.98	0.84	40–242			(Sadeghi et al., 2013)
Iran	2002	64	53	83 (64/53)	ELISA	207	130.41	16.30	69–387			(Kamkar, 2002)
Iran	2005	90	90	100 (90/90)	ELISA	60.17	54.00	5.69	7.31–141.2	5		(Mokhtarian and Mohsenzadeh, 2005)
Iran	2005	111	84	76 (111/84)	TLC[f]	60	23.00	2.18	15–280	1		(Kamkar, 2005)
Iran	2013	60	44	73 (60/44)	ELISA	55	30.25	3.91	17–390	3		(Kamkar et al., 2014)
Iran	2006	624	624	100 (624/624)	RIDASCREEN	112	70.56	2.82	NM[g]			(Alborzi et al., 2006)
Iran	2008	319	319	100 (319/319)	HPLC[h]	56.4	13.68	0.77	NM	5		(Tajkarimi et al., 2008b)
Iran	2012	100	100	100 (100/100)	HPLC	2.7	1.87	0.19	0.45–9.76			(Behfar et al., 2012)

Data preparation = Excel file

- From each study, for exposure assessment, we need:
  - **Number of samples tested**
  - **Mean**
  - **Standard deviation** (or RSD)
  - Range [min, max]
  - LOD / LOQ values
  - Number of samples <LOD / LOQ (“non detects”)
  - Number of samples between LOD and LOQ (if applicable)

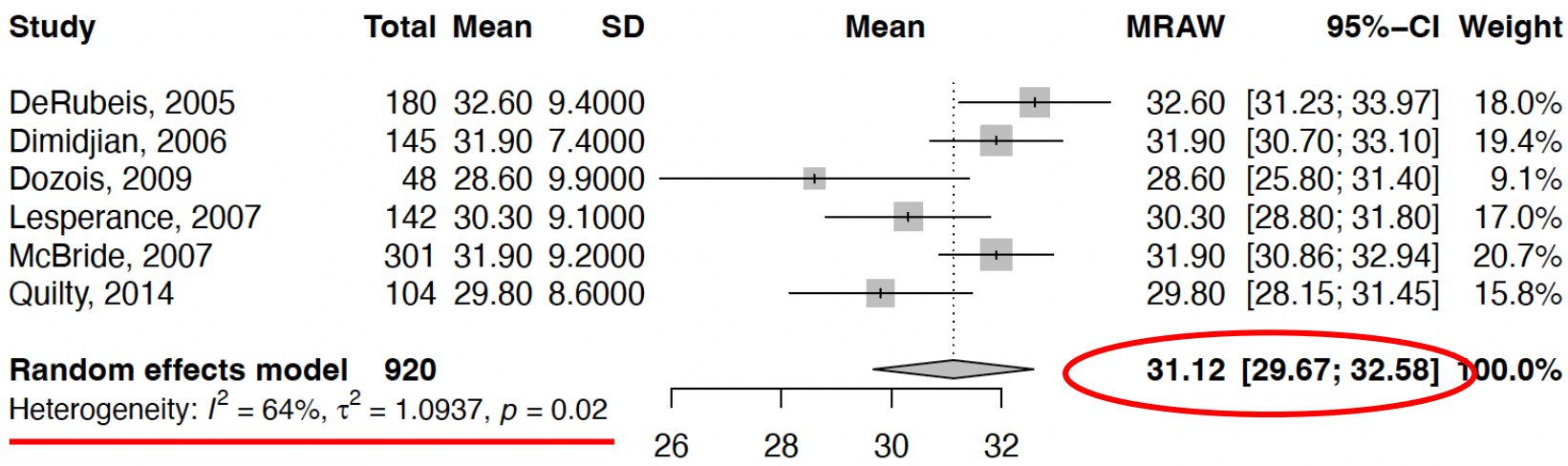
- Will most likely result in additional data exclusions

Meta-analysis

- Can we pool data from different studies together?
  - Treat it as one single data set
- Check heterogeneity (most likely)
- Use Random Effects Model to estimate pooled values
  - “meta” package in R
  - Concentration
  - Prevalence

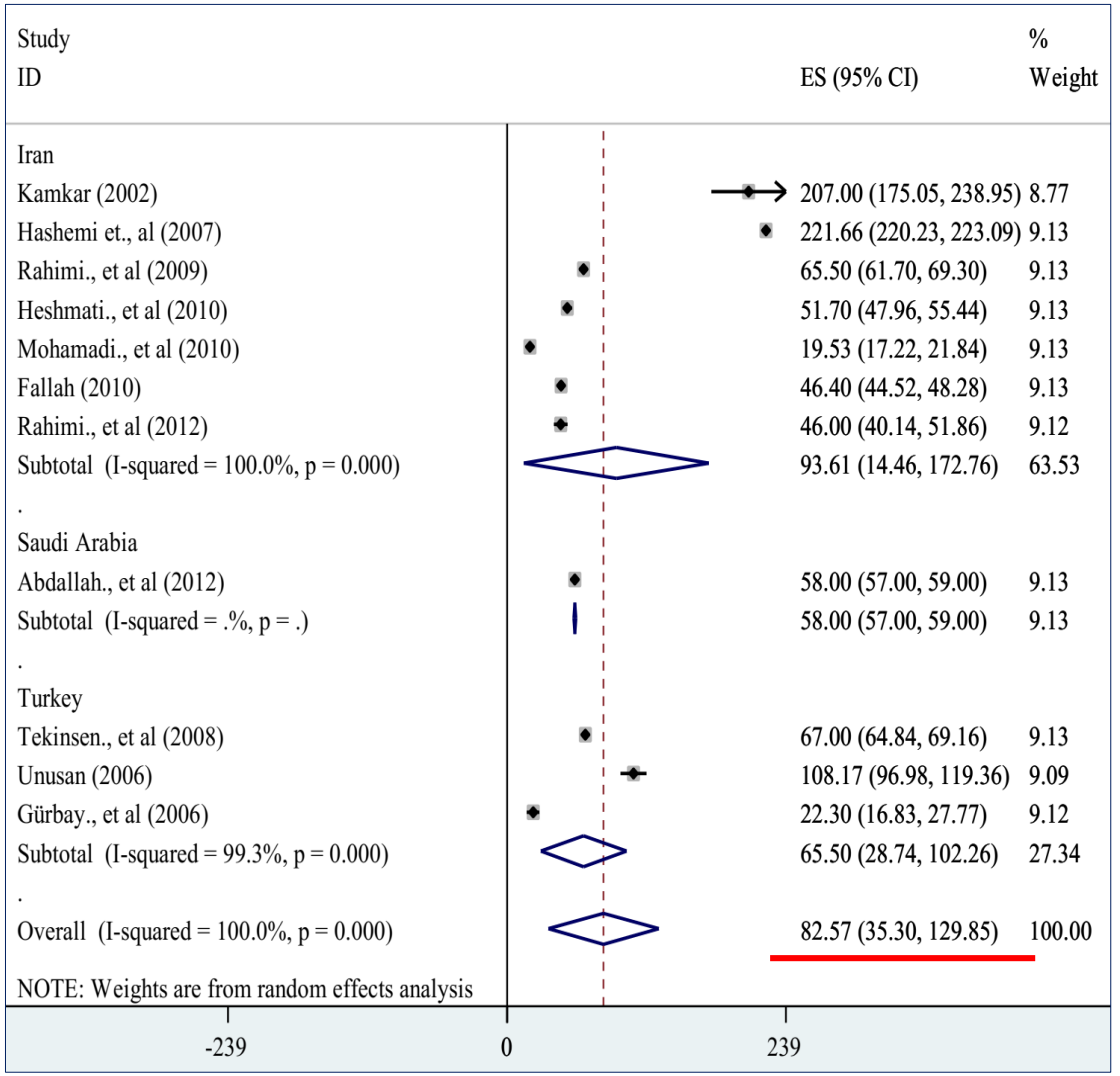
Meta-analysis outputs

- Easy to produce for studies with n, mean and SD
- Forest plot: forest.meta()
- Full analysis: metamean() / metaprop()
- Ex. using data from R database



Ex. Rahmani et al (2018)

Concentration of AFM1 in UHT milk in countries in the Middle East

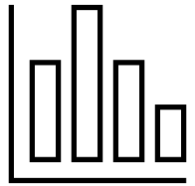


Data pooling

- ❑ Could do it for Egypt for several mycotoxin / food combinations
- ❑ Gives us a point value (e.g., pooled mean, pooled prevalence)
- ❑ Useful for deterministic exposure assessment, but not sufficient for probabilistic
  - Probabilistic includes variability; inputs and outputs = distributions

Probabilistic exposure assessment

- Need **raw** data to generate a distribution
  - ALL data points
  - Unlikely to be published
  - Would need to generate in the lab (targeted study) or have access to monitoring data

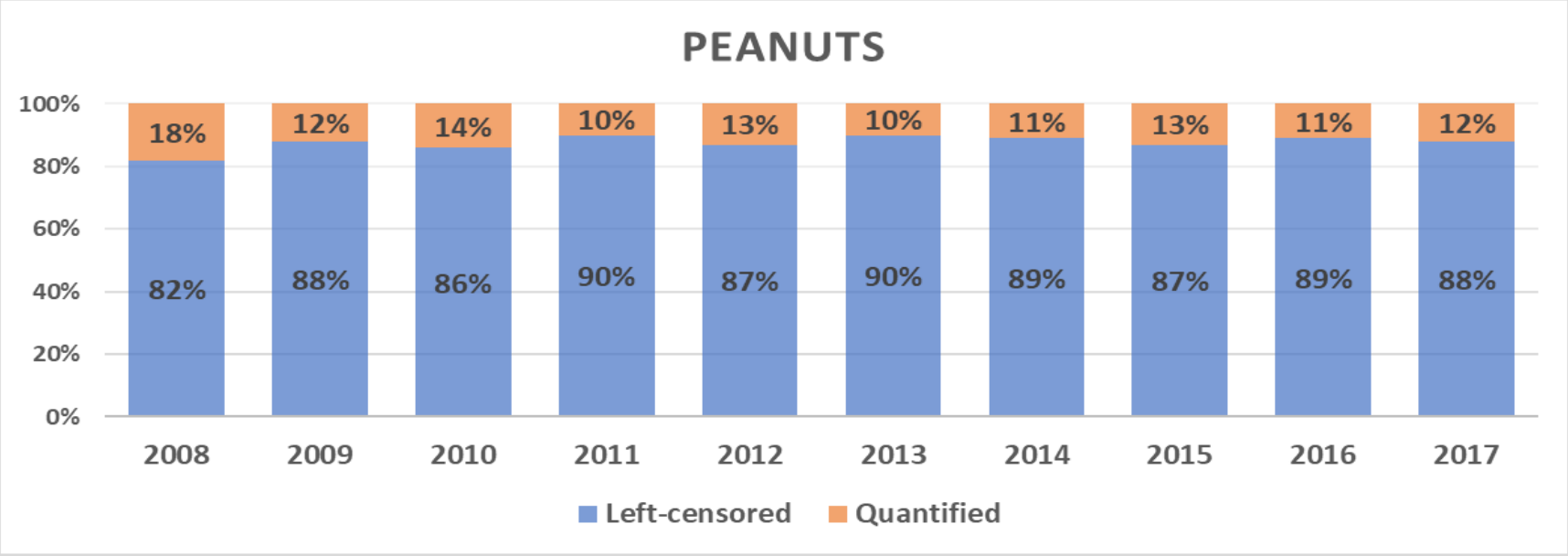


- Or, if we have [min, mean, max] we could do a triangular distribution

- But not sufficient for a full parametric model (e.g., LogNormal, Gamma, Weibull)

Left-censored data (“non detects”)

- Usually, for contaminants, a lot of data **points <LOD/LOQ**
- What to do with these values? Are they real 0s?
- Ex. EFSA (2020) aflatoxins risk assessment



Left-censored data ("non detects")

First option: **substitution**

- ❑ Recommended by WHO/IPCS (2009) for chemicals likely to be present
- ❑ Used in EFSA (2020)

Proportion of results <LOD	**Simple estimate of mean**	**Estimation of statistical mean, median, standard deviation**
None, all quantified	true mean	
≤ 60% non-quantified	using LOD/2 for all results less than LOD[a]	Use methods in (Vlachonikolis and Marriott, 1995; Hecht and Honikel, 1995) and/or graphical methods[b,c]
> 60 but ≤ 80% non-quantified and with at least 25 results quantified.	Produce two estimates using 0 and LOD for all the results less than LOD[a,d]	Use methods in (Vlachonikolis and Marriott, 1995; Hecht and Honikel, 1995) and/or graphical methods[b,c]. Use with caution if total number of measurements is <100.
> 80% non-quantified, or if > 60% but ≤80% non-quantified and with <25 results quantified	Produce two estimates using 0 and LOD for all the results less than LOD[a,c]	None practicable

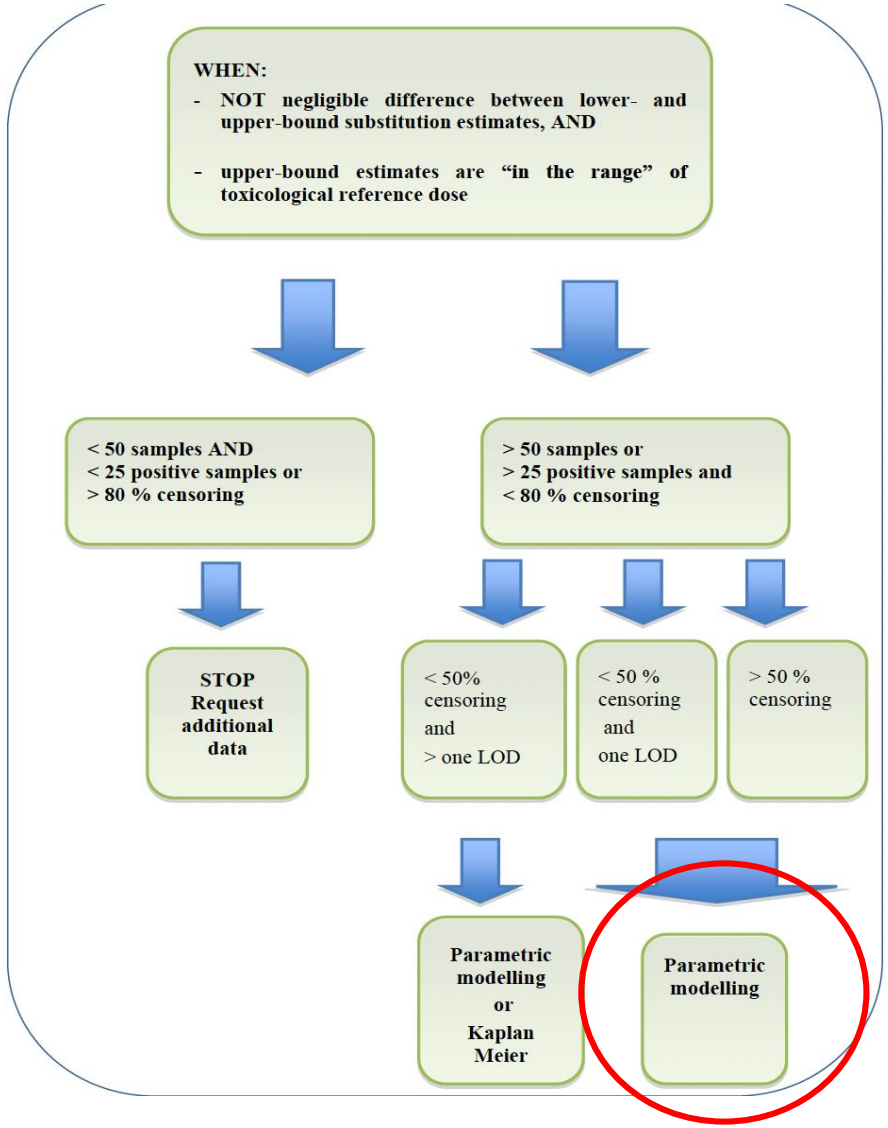
GEMS/Food-Euro (1995)

LB = use 0s

UB = substitute with LOD

EFSA (2010) guidelines

- If mean with / without substitution not different, then substitute 0s with LOD (= UB)
  - Fit data to a not-censored distribution (parametric model)
- Otherwise, see flow chart
  - Fit data to a distribution (parametric model)
  - Not censored (LB and UB)
  - Censored (LOD as left censored)
- But again, we need raw data to do this (e.g., from monitoring, like EFSA 2020 aflatoxins assessment)



Semi-probabilistic exposure assessment

- ❑ Simulate 3 scenarios [min, mean, max] OR
- ❑ Build a triangular distribution with [min, mean, max]

Mean

- Meta-analysis of studies from database or online, OR
- $Pooled\ mean = \frac{N1.M1+N2.M2+Nn.Mn}{N1+N2+Nn}$

Min (LOD?) / Max (highest observed value?)

- ❑ OR, select one single study and use their [min, mean, max]


thank you
merci
gracias
danke
謝謝
ngiyabonga
teşekkür ederim
dank je
obrigado
dziękuję
bedankt
go raibh maith agat
sukriya
kop khun krap
terima kasih
dakujem
arigatô
mochchakkeram
tapadh leat
спасибо
Баярлалаа
рахмат
faafetai lava
vinaka
спасибі
blagodaram
misaotra
matondo
paldies
grazzi
mahalo
kiitos
dankie
dhanyavad
nanni
nandri
bayarlalaa
gràçie
hvala
maururu
köszönöm
akun
dankon
ačiū
хвала
asante
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dhanyavadagalu
takk
shukriya
mercé
мерси
trugarez
kam sah hamnida
rahmat
তোমাকে ধন্যবাদ
감사합니다
xièxie
ευχαριστώ