tds ▶ exposure

WP7
Variation and Trends: Understanding Data for Better Assessment

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Stakeholder Meeting

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BfR
Risiken erkennen – Gesundheit schützen

SEVENTH FRAMEWORK PROGRAMME

EFSA/ FAO/ WHO, 2009 - Variation

"There are, however, some cases where the TDS approach is unsuitable:

- *to calculate exposure for populations with dietary habits not differentiated by the TDS food list;*
- *to calculate **high dietary exposure levels specifically arising from high contamination** or to*
- ***estimate acute dietary exposure**, given that pooled samples provide only mean concentration*
- *…"*

EFSA/ FAO/ WHO, 2009 – Matching occurrence and consumption

“If food consumption data are available for different regions and/or seasons, it has ***to be decided if the consumption and occurrence data should be averaged to a year-round national mean value*** *before calculating the dietary exposure,* ***or matched at seasonal and/or regional level before being averaged****. All the choices made for calculations should be clearly explained.“*

EFSA/ FAO/ WHO, 2009 - Trends

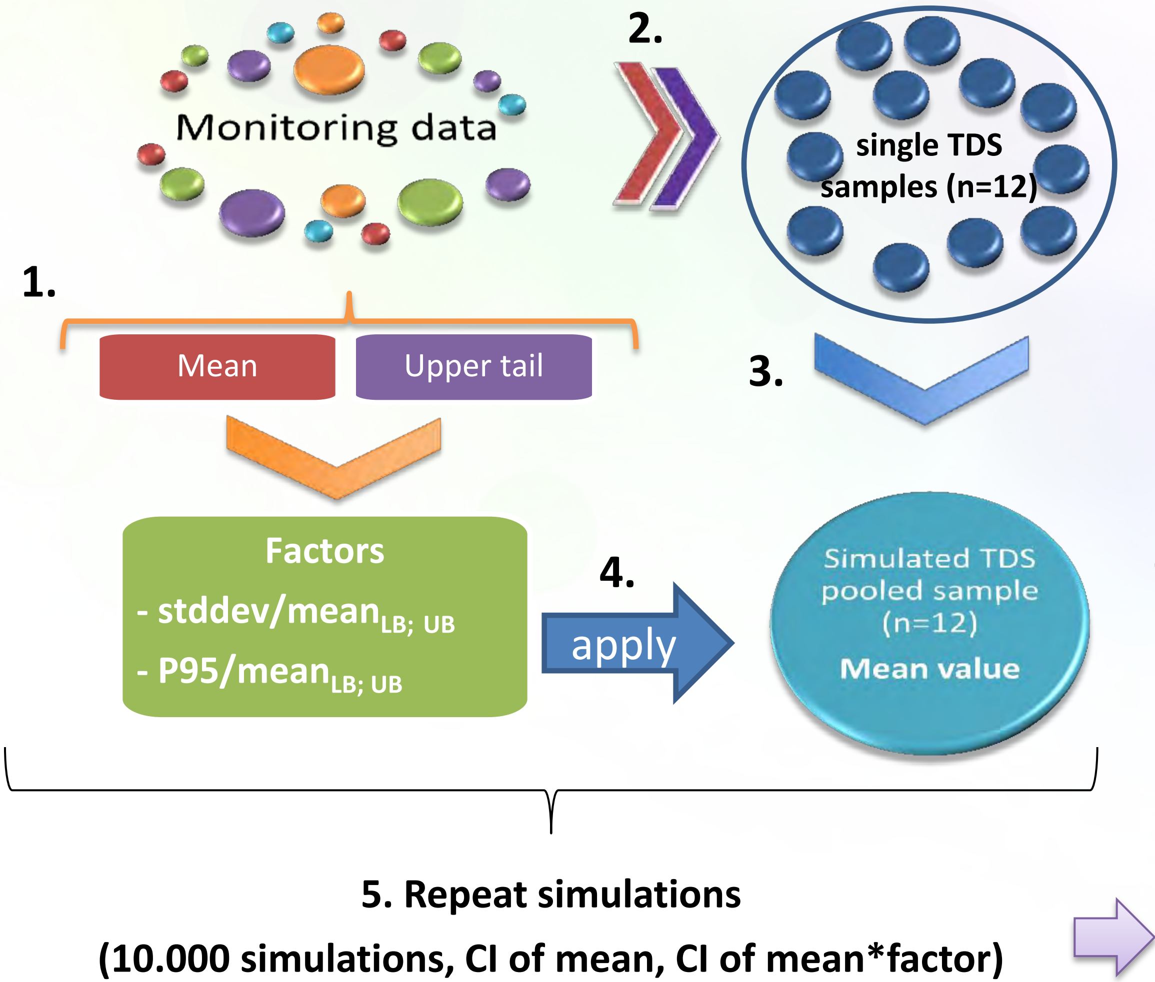
"Using pooled samples of individual food items means that the analytical data generated represent averages of concentration data. ***Therefore, TDS results*** *are best suited for calculating chronic exposure to food chemical substances and* ***may allow the analysis of trends*** *where the sample size is sufficiently representative."*

Variation in concentration data

Idea

- **Extrapolation from mean to high percentiles using secondary data**
- **Factors tested**
  - **stddev/mean**
  - **P95/mean**
  - **P95/median**
- **First conclusions:**
  - **P95/median does not work well → excluded from simulations**
  - **Lower Bound (LB) approach to deal with non-detects is more conservative than Upper Bound (UB) approach**
  - **Outliers can cause problems but should not be excluded only due to statistical criteria and without further evidence**
  - **Procedures will hardly work in case of multi-modal distributions, so it has to be checked in advance whether distribution is uni-modal**

Simulations based on monitoring data (DE)



1. Analysis of food monitoring data (stddev, mean, percentiles etc.) and calculation of factors (stddev/mean; P95/mean)
2. Simulation of a TDS-sample from monitoring data of selected food groups
3. Calculate mean of simulated TDS-sample
4. Apply factors for respective food group
5. Repeat simulations

6. Compare to simulated CIs of mean, P90, P95, P99, max of respective food group from analysed food monitoring data

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Aims Task 7.2.4

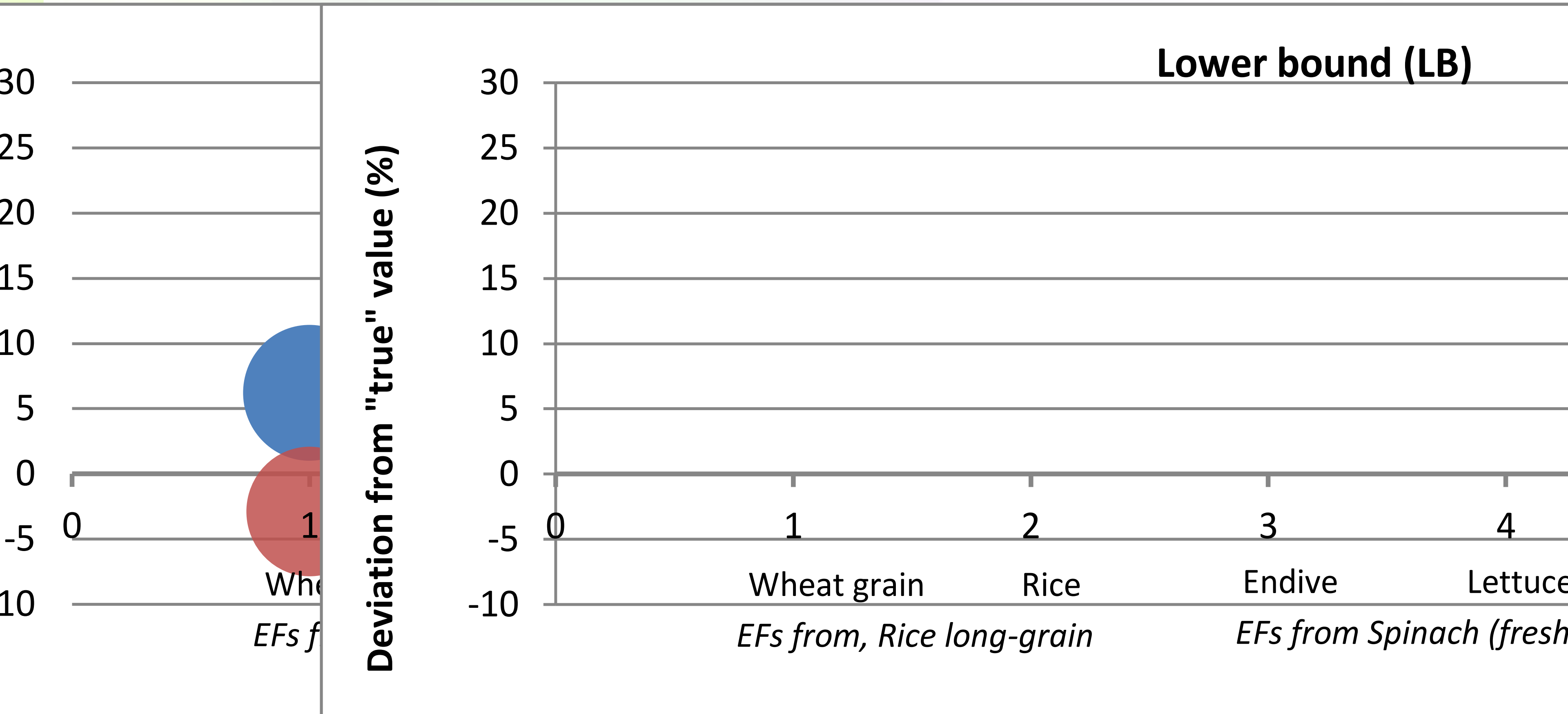
- Extrapolation to high percentiles
  - Impact of non-detects (NDs) when deriving EFs
  - Impact of sample size when deriving EFs
  - Impact of distributions (unimodal, bimodal, extreme values)
- Extrapolation between similar foods
- Extrapolation between different years

Preliminary findings

Scenario/ Factor	Av. Deviation (%)	Av. 95% CI range	Av. Deviation (%)	Av. 95% CI range
	LB		UB	
Unimodal distributions				
SD/mean	8	0,17	9	0,15
P95/mean	3	0,15	3	0,14
Bimodal distributions				
SD/mean	38	0,56	27	0,51
P95/mean	10	0,52	7	0,46
Extreme values				
SD/mean	11	0,2	10	0,18
P95/mean	5	0,14	5	0,13
between foods				
SD/mean	13	1,19	14	1,28
P95/mean	2	1,31	6	1,96
between years				
SD/mean	20	3,16	25	1,77
P95/mean	10	1,52	8	1,41

Table: Average deviation (%) from “true” P95 and average 95% CI range over all considered foods for each scenario for the element copper (German food monitoring).

Example for extrapolation between similar food groups



Performance of extrapolation between similar foods. Estimates based on lower bound (
s.

Some conclusions

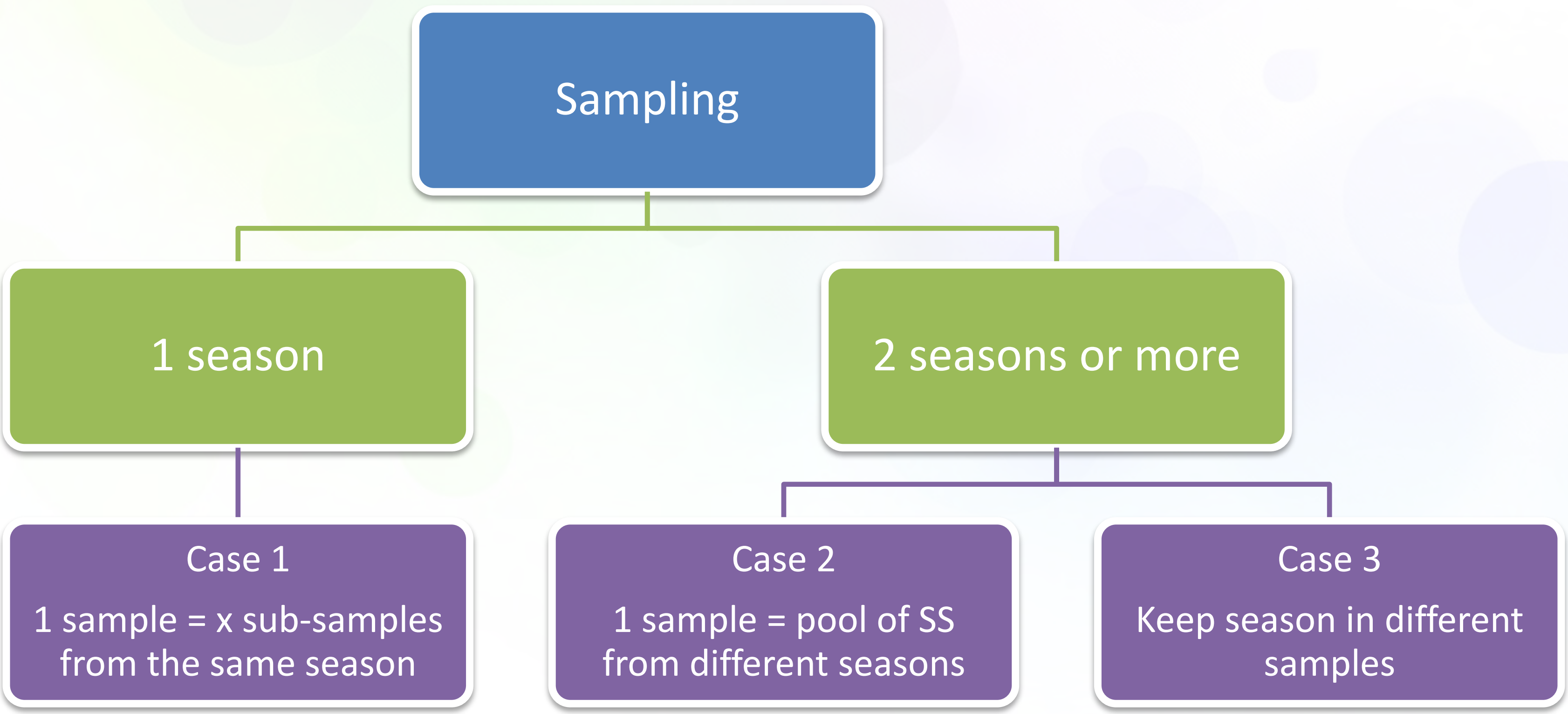
- LN approximations look OK in most cases

- For low ND%, all factors similar
- Increasing ND% leads to differences
- F_P95MeanUB factor performs reasonably well throughout

- Between food & year, simple extrapolations work fine in the examples

Matching occurrence and consumption data

Influence of seasonality in TDS sampling



Data and approach

- **Use the French TDS data**: Consumption and contamination data; “Cold season” (Oct to March) vs. “warm season” (April to Sept). Check that populations are comparable between seasons
- **Chemicals selected**: Cu and Mn (pilot studies), As , PCDD/Fs, DL-PCB, PCDD/Fs+DL-PCBs, sum 6 iPCBs, DON and OTA
- **Different scenarios**: Calculate exposure with and without taking into account season and compare to assess the impact of seasonality

Scenario 1: Global impact of season on exposure	$Cons_C \times Conc_C = Expo_C$
	$Cons_W \times Conc_W = Expo_W$

Results: Adults in Scenario 1 with UB hypothesis

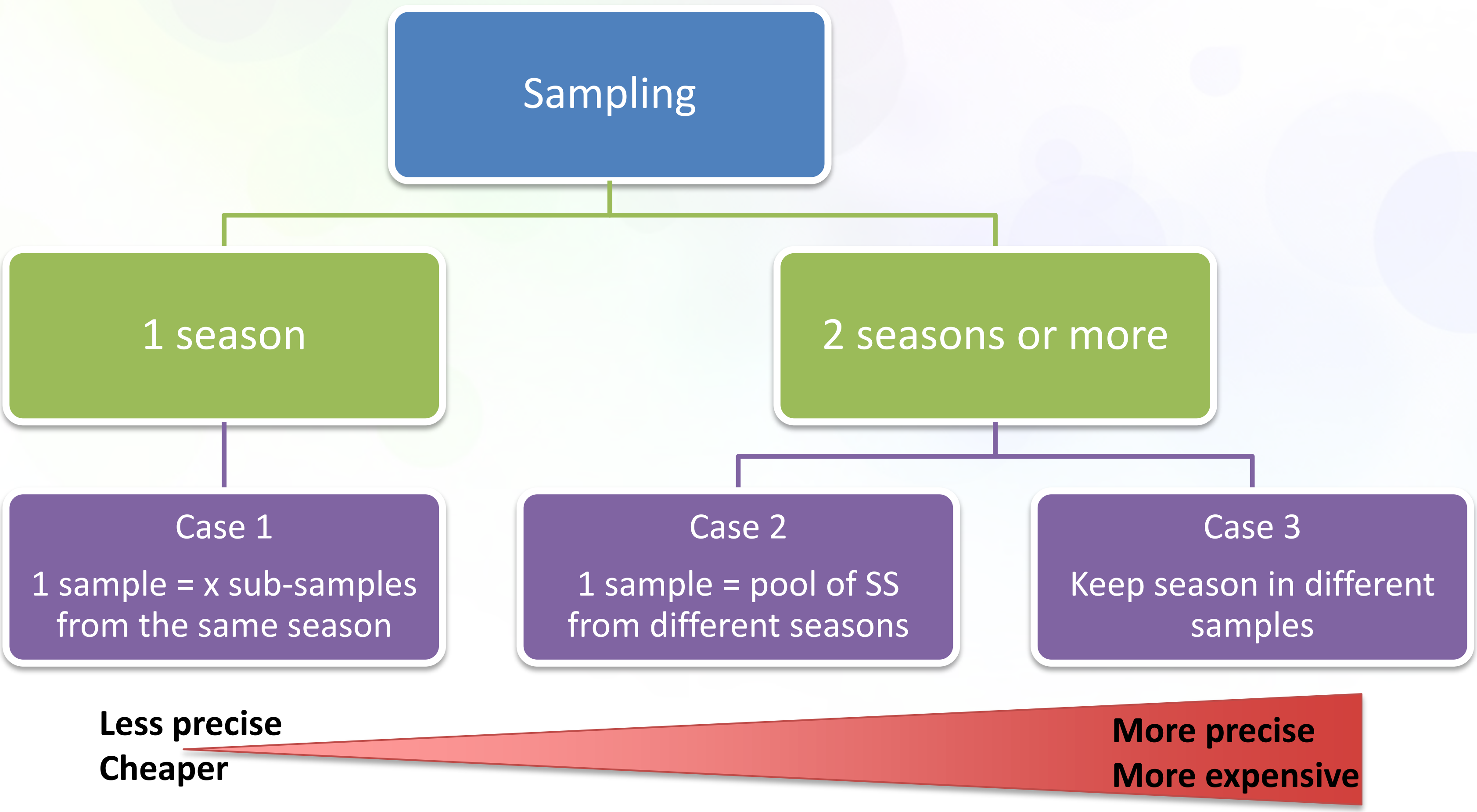
	Cold season		Warm season		Anova
Substances	Mean	p95	Mean	p95	p
Cu (µg/kg bw/day)	30.5	68.3	26.1	51.6	**<0.0001**
Mn (µg/kg bw/day)	32.0	53.8	31.3	49.8	0.25
OTA (ng/kg bw/day)	1.63	2.67	2.14	3.62	**<0.0001**

In blue: highest exposure; P = p-value for the test of mean comparison between cold (C) and warm (W) seasons

Scenario 1 (closest to reality):

significant differences in exposures and not always the same season → seasonality has to be taken into account

Influence of seasonality in TDS sampling



Trends

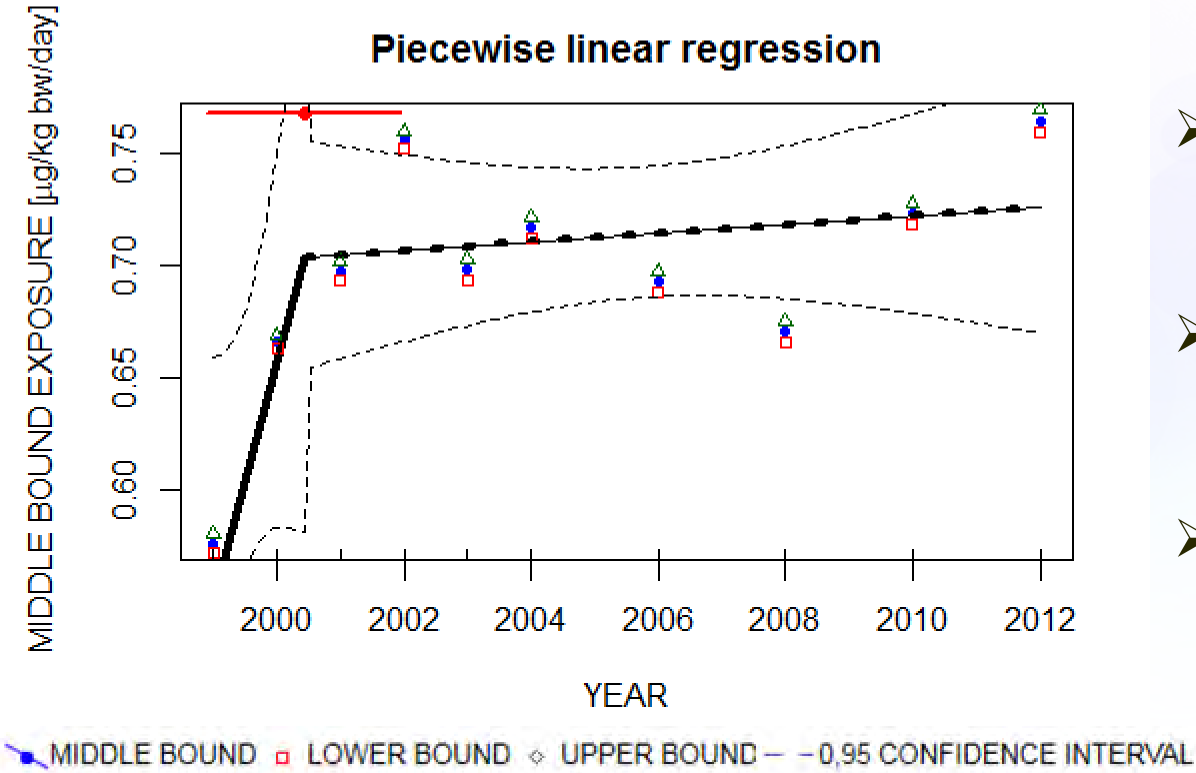
Methods

1. **Normality of data** tested:
   - graphically using normal P-plot
   - Kolmogorov-Smirnov test
     - Normality of the data confirmed for all studied compounds (Pb, Al, Se)
2. **Replacement of outliers**
   - For lead, an outlier (resulting value from the year 2000) **replaced by the average value of the other years**
3. **Linear regression** → calculation of model
4. **Residual analysis** to detect whether estimated model fits well on the analyzed data
   - For Pb and Al, residuals fulfilled all assumptions

     → **Multiple regression analysis**
   - For Se, residuals did not fulfill assumptions for multiple regression analysis

     → **Piecewise linear regression with break-point**

Temporal trend in Se dietary exposure for average person (4-90 years) in the CZ



- The model shows increasing trend with break-point
- Estimated model explains **72 % of the variability** in the data
- model estimated by multiple linear regression **only 30 %**

Remaining uncertainties

Task 7.5.1: Qualitative uncertainty description: **Proceeding**

1. Defining objectives of the TDS
2. Establishing a food list (incl. pooling)
3. Creation of sampling plan/shopping list
4. Collecting of selected foods
5. Kitchen preparation & homogenization
6. Analysis of pooled samples
7. Exposure assessment
8. Interpretation of TDS results

i. **Description** of food collection, packaging and transport to cooking facility

ii. **Uncertainty analysis** food collection

STEP	*ASSOCIATED UNCERTAINTY*	*TYPE OF UNCERTAINTY*
4	• Incorrect labeling and documentation	*Scenario uncertainty*
	• Strategy of random sampling and alternative purchase	*Sample Uncertainty*
	• Wrong storage/transport conditions …	*Scenario uncertainty*

iii. **Example from German TDS pilot (WP9)** how foods were collected and which uncertainties have been encountered.

Summary

- Extrapolation from secondary data like food monitoring is possible
- In those specific cases also high dietary exposure levels arising from high contamination and acute dietary exposure can be assessed by TDS
- When seasonal samples are available it should be matched to seasonal consumption instead averaging over whole year
- Statistical methods for trend analyses proposed for TDS

Many thanks!

To the team of WP7

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And to you, for your attention!