

## Probabilistic exposure assessment of patulin in apple juice for preschool children in Flanders

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## Patulin

- *Penicillium expansum*
- Apples and apple-based products
- Toxicity

↓ Bacteria  
↓ Animal cells and tissues

TDI: 0.4 µg/kg bw/day



## Influence of organic farming on patulin?

2 possible impacts

↓  
Reduced use of fungicides

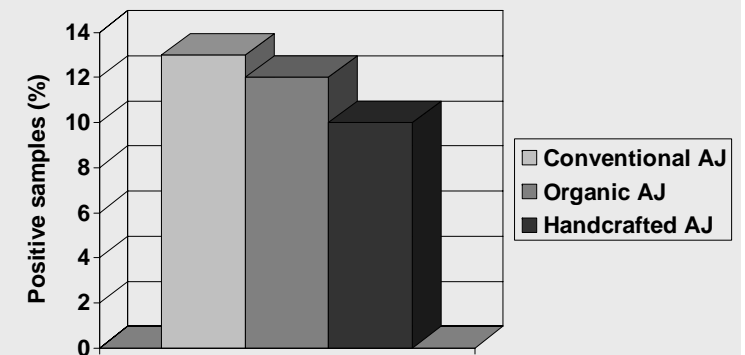
↓  
More mould growth

↓  
Reduced use of insecticides

↓  
More insect damage

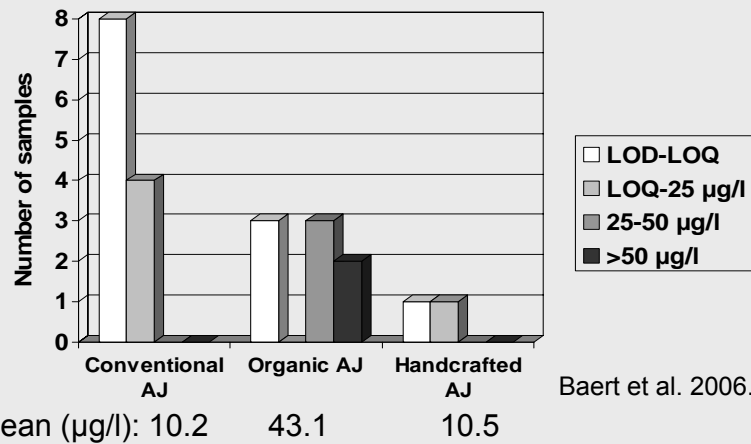
↓  
More fungal invasion

## Occurrence of patulin in apple juice (AJ) in Belgium



Baert et al. 2006.

## Patulin levels in contaminated samples



Baert et al. 2006.

Mean (µg/l): 10.2      43.1      10.5

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## Objectives

- Evaluate influence of patulin levels on public health

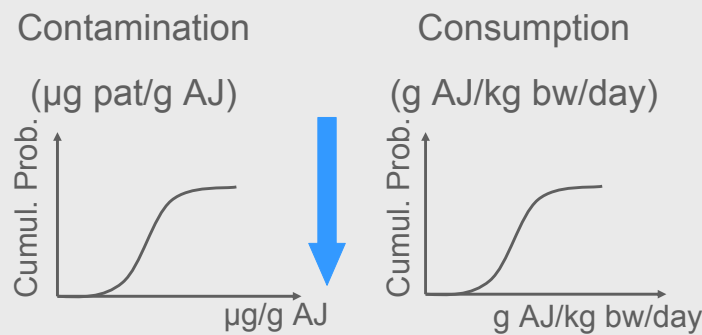


Focus: small children and apple juice

- Evaluation of lowering regulatory limit

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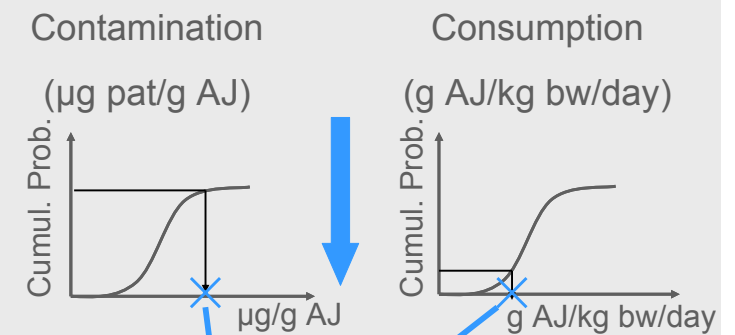
## Exposure assessment



Contamination x Consumption = Intake

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## Exposure assessment - Probabilistic

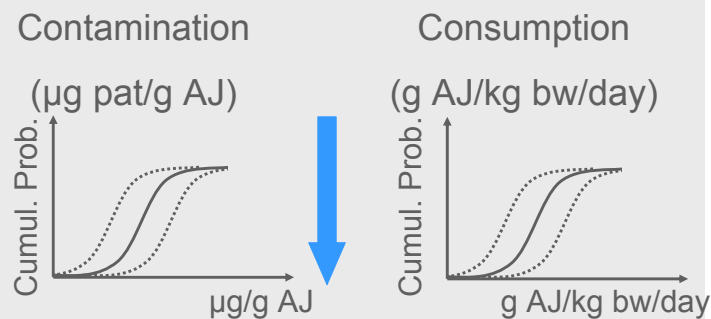


Contamination x Consumption = Intake

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$X_1, X_2, X_3, X_4, X_5, \dots$

## Exposure assessment - Probabilistic

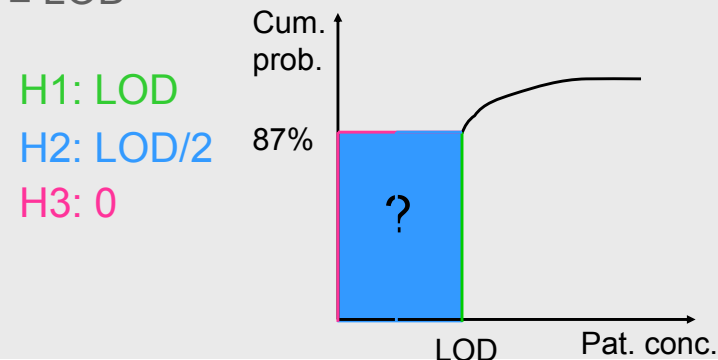


Contamination x Consumption = Intake

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## Values below LOD?

Between 10 and 13% of the data  $\geq$  LOD  $\rightarrow$



H1: LOD  
H2: LOD/2  
H3: 0

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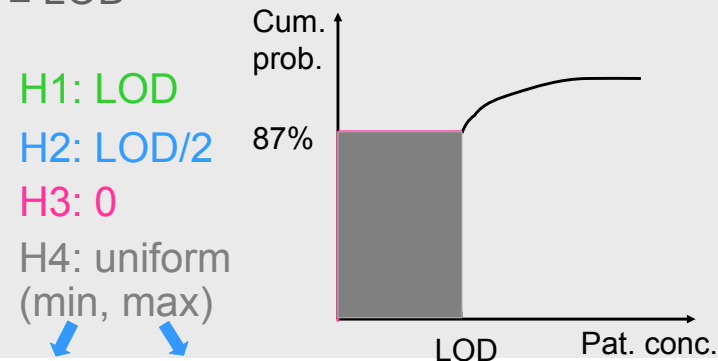
## Values below the LOD? - exposure ( $\mu\text{g}/\text{kg bw}/\text{day}$ ) for organic apple juice

	LOD	LOD/2	0
P50*	0	0	0
P90	0.085	0.043	0
P97.5	0.216	0.125	0
P99	0.408	0.341	0.316
P99.5	0.601	0.617	0.627
P99.9	1.449	1.443	1.445

\*50<sup>th</sup> percentile TDI: 0.4  $\mu\text{g}/\text{kg bw}/\text{day}$

## Values below LOD?

Between 10 and 13% of the data  $\geq$  LOD  $\rightarrow$



H1: LOD  
H2: LOD/2  
H3: 0  
H4: uniform (min, max)

Uniform (0, LOD)    Uniform (0, LOD)

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## Values below the LOD? - exposure ( $\mu\text{g}/\text{kg}$ bw/day) for organic apple juice

	LOD/2	Uniform
P50*	0 [0-0]**	0 [0-0]
P90	0.043 [0.039-0.047]	0.039 [0.014-0.069]
P97.5	0.125 [0.096-0.197]	0.135 [0.053-0.229]
P99	0.341 [0.155-0.782]	0.350 [0.143-0.822]
P99.5	0.617 [0.213-1.442]	0.615 [0.249-1.472]
P99.9	1.443 [0.506-3.246]	1.471 [0.526-3.066]

\* 50<sup>th</sup> percentile    \*\* [90% confidence interval]



## Assessment of patulin exposure ( $\mu\text{g}/\text{kg}$ bw/day)

	Organic AJ	Convent. AJ	Handcraft. AJ
P83*	0 [0-0]**	0 [0-0]	0 [0-0]
P97.5	0.135 [0.053-0.229]	0.095 [0.057-0.133]	0.102 [0.047-0.151]
P99	0.350 [0.143-0.822]	0.156 [0.106-0.206]	0.150 [0.084-0.229]
P99.5	0.615 [0.249-1.472]	0.202 [0.141-0.287]	0.195 [0.109-0.290]
P99.9	1.471 [0.526-3.066]	0.328 [0.210-0.548]	0.298 [0.156-0.460]

\*83<sup>th</sup> percentile    \*\* [90% confidence interval]



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## Probability to exceed the TDI

Organic AJ	Convent. AJ	Handcraft. AJ
0.9% [0.3-1.8%]*	0.1% [0-0.3%]	0% [0-0.2%]

\* [90% confidence interval]



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## Risk management measure: Lowering the regulatory limit

### European legislation Nr. 1425/2003

- ▶ fruit juices and fruit nectar:  $50 \mu\text{g kg}^{-1}$
- ▶ future: new evaluation



Effect on exposure when current limit would be followed

Effect on exposure when limit would be  $25 \mu\text{g kg}^{-1}$



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## Lowering the regulatory limit: patulin exposure ( $\mu\text{g}/\text{kg}$ bw/day) for organic apple juice

	Current sit.	<50 $\mu\text{g}/\text{kg}$	<25 $\mu\text{g}/\text{kg}$
P50*	0 [0-0]**	0 [0-0]	0 [0-0]
P97.5	0.135 [0.053-0.229]	0.118 [0.045-0.186]	0.099 [0.036-0.157]
P99	0.350 [0.143-0.822]	0.226 [0.107-0.443]	0.154 [0.066-0.222]
P99.5	0.615 [0.249-1.472]	0.379 [0.173-0.647]	0.196 [0.100-0.303]
P99.9	1.471 [0.526-3.066]	0.682 [0.320-1.402]	0.309 [0.171-0.491]

\* 50<sup>th</sup> percentile    \*\* [90% confidence interval]



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## Lowering the regulatory limit: Probability to exceed the TDI

Current sit.	<50 $\mu\text{g}/\text{kg}$	<25 $\mu\text{g}/\text{kg}$
0.9% [0.3-1.8%]*	0.5% [0.1-1.2%]	0% [0-0.3%]

\* [90% confidence interval]



Due to high apple juice consumption: up to 1.2l/day



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## Conclusion

- A proper treatment of data <LOD is not be underestimated
- A uniform distribution with uncertain bounds can be used to handle data <LOD
- Children consuming organic AJ: 0.9% [0.3-1.8%] exceed TDI
- ↓ regulatory limit to 25  $\mu\text{g}/\text{kg}$ : 0% [0-0.3%] exceed TDI



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