BfR

Risiken erkennen – Gesundheit schützen

Brush Painting – Human Exposure
A study with Wood Preservatives

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Outline of the talk

- Aim and design of the ExpoVal study
- Results of the study
- Comparison with ConsExpo (model based approach)
- Conclusion and discussion

The ExpoVal study: Human exposure to wood preservatives

Performed in 2003 – 2008 (two experimental parts)

Initiated by BMLFUW (Austria) and BfR (Germany)
(E. Plattner, W. Lingk, H. Reifenstein, D. Westphal)

Experimental design by Steffen Uhlig (quodata)

Experiments performed at MPA Brandenburg

Mainly dermal, also some inhalation measurements.

Next step: Make results available for expo assessment

Aim and design of the study

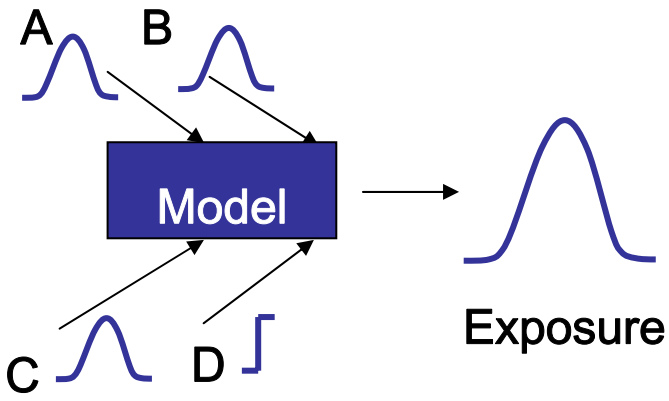
Aim: Find distribution of human exposure
when painting wood preservatives
(i.e. outdoor-painting ?)

Problem: Many influencing factors – valid data representing the exposure has to take into account all possible realisations of factors.

Design: Small sample size required
→ exposure model with relevant factors
and probabilistic assessment

Probabilistic exposure assessment

From the exposure model
the exposure percentiles can be derived.



For an assessment under restricted conditions, single factors can be set on one level
(e.g. worst case scenario).

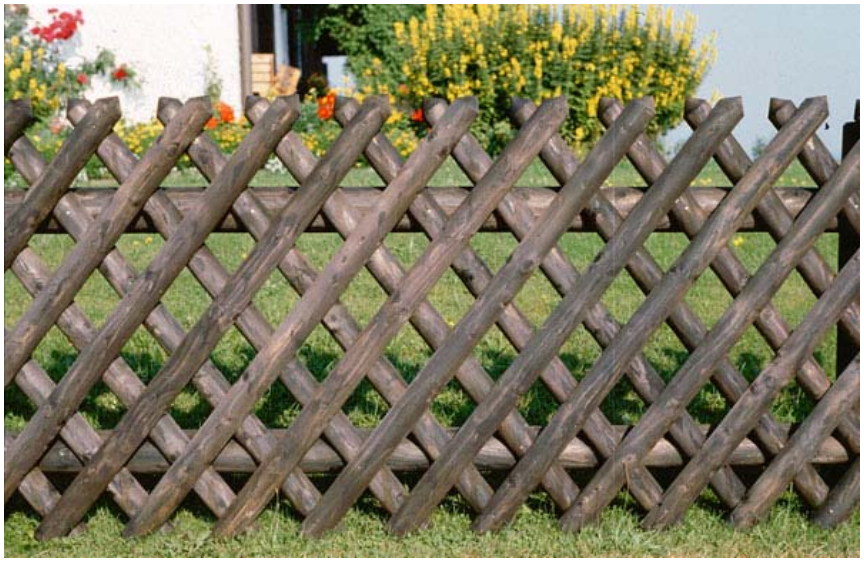
Factors investigated

Person's fix properties: sex, height, BMI, experience

Person's variable properties: speediness, fatigue, consumption, motivation

Circumstances: wind, fence type (trellis vs. lattice)

Material: brush (bristle) length, base, type, active substance



Statistical model

Factorial design to minimize sample size
while allowing many factors.

X Fixed effects: sex, height, BMI, experience,
wind, speediness, fence type, brush len, base, type, fatigue,
consumption, probjob.

U Random effects: series, person.

Y Dermal exposure of face, corpus, arms, hands, legs, feet.

$$\log Y = X \beta + U Z + \varepsilon, \qquad \varepsilon, Z1, Z2 \text{ norm. distr.}$$

Results of the study

No influence of person's fix properties:

sex, height, BMI, experience

Some influence of person's variable properties and of material:

speediness, fatigue, consumption, motivation

brush (bristle) length, base, type

special: brush * fence

Strong influence of circumstances:

wind, fence type

No influence of active substance

Summary of measurements

Distribution of exposure in µg per m^2 fence and 1% a.s.

	mean	median	min	max	GM	GSD
face	9	4	0	117	4	3.3
arms	57	20	1	670	22	4.1
corpus	28	10	1	318	11	4.2
legs	47	17	1	553	16	4.7
hands	772	187	12	6638	212	5.2
feet	50	16	1	499	20	4.1

Results of probabilistic assessment (worst-case as example)

Outcome of probabilistic model with worst-case scenario (trellis fence, wind, long brush, person tired and not motivated; consumption modelled by lognormal distribution)

Exposure in µg per m^2 fence and 1% a.s.

Type	**primer**		**glaze**	
Base	**spirit**	**water**	**spirit**	**water**
75 %	3 600	3 700	3 800	3 800
90 %	7 500	7 700	7 800	6 300
95 %	12 000	12 400	12 800	8 900
99 %	29 800	31 300	31 200	18 400

Comparison with ConsExpo

Problem at the moment: exposure is modelled per treated area, not per time.

ConsExpo Paint Products Fact Sheet:

2.3 Brush/roller painting, solvent rich paint

2.5 Brush/roller painting, waterborne paint

(1 – 1.25 kg product for 10 m^2 in 2 hours)

Constant rate model, contact rate 30 mg/min

→ exposure = 30 mg/min * 120 min * 1% = 36 mg

exposure in µg per m^2 fence and 1% a.s.: 3 600 µg

Methodological difference to ConsExpo

	ConsExpo	ExpoVal
model	mechanistic	empirical
range of application	wide (all purpose)	restricted
parameters	have a meaning	are model estimates
understanding	fully understood	structural
quality of prediction	mixed	best

Conclusion

- Study demonstrates a clever method for determining a distribution (get much information with low effort)
- No dependence on active substance (non-volatile...)
- Describes outdoor-painting (dermal expo)
- The 75th percentile of worst-case scenario is comparable to ConsExpo 50th percentile when using the Fact Sheet scenario.
- It is easy to obtain more specific information of high quality
  - special scenario (other than worst-case)
  - special percentile
  - with confidence interval
- As close to “reality” as possible

Discussion: How to proceed?

Now there are several options to proceed.

What is an optimal choice?

For dermal exposure assessment of outdoor painting, use

- ☐ Table with percentiles for worst-case scenario (see above)
- ☐ Tables with percentiles for a handful of scenarios
- ☐ A computer-based tool giving the distribution for any scenario specified
- ☐ ConsExpo
- ☐ Other

General question of which percentile and which confidence limit to use (e.g. 90% confidence limit of 75th percentile)

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Thank you for your attention

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