NATIONAL INSTITUTE FOR HEALTH AND WELFARE

Expert contributions: exposure-response functions (ERFs) in estimating health impacts

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Dose-response vs. exposure-response

- In pharmacology and toxicology, dose-response describes the relation between the dose (given to the study subject) and the effect
  - e.g. dioxin induced enzyme induction

- In environmental health, the exact dose is often not known, instead, e.g. the ambient concentration of a pollutant is measured. Sometimes the "exposure" may even not be a substance. Therefore a wider term exposure response is used.
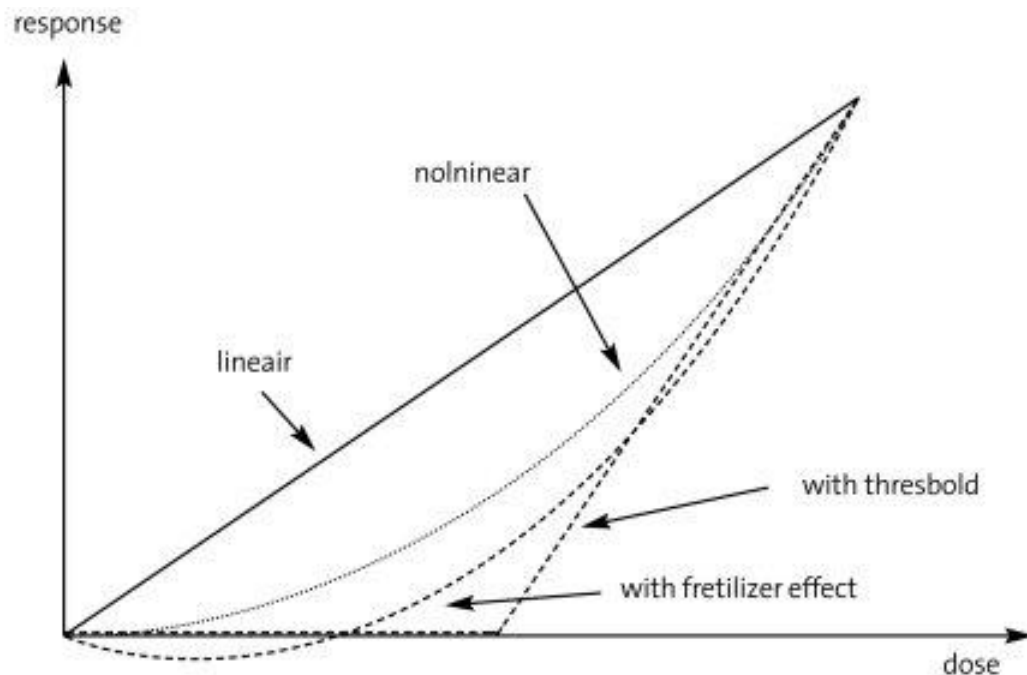
Exposure response functions, basic shapes

Figure 3:
Possible behavior of dose-response functions at low doses.
If P is the lowest dose where a nonzero impact has been observed, the extrapolation to lower doses is uncertain but values higher than linear are unlikely.

Source: Veolia Institute: Report n°4: How Much to Spend for the Protection of Health and Environment

Odds ratio (OR)

- OR is a measure of association between an exposure and an outcome/response (e.g. disease)

- It represents

  the odds that an outcome will occur given a particular exposure, compared to

  the odds of the outcome occurring in the absence of that exposure.

- OR is a basic concept in epidemiology

- More information on odds ratios e.g. Szumilas. Explaining Odds Ratios. *J Can Acad Child Adolesc Psychiatry,* 19:3, August 2010

Calculating OR

Outcome status

Exposure status		+	-
	+	a	b
	-	c	d

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

a = Number of exposed cases
b = Number of exposed non-cases
c = Number of unexposed cases
d = Number of unexposed non-cases

Interpretation of OR

- OR = 1 Exposure does not affect odds of outcome
- OR > 1 Exposure is associated with higher odds of outcome
- OR < 1 Exposure associated with lower odds of outcome

Confidence intervals (CI)

- 95 % confidence interval is used to estimate the precision of the OR

- A large CI indicates a low level of precision of the OR

- A small CI indicates a higher precision of the OR

- CI does not report statistical significance but in practice is used as a proxy for it

Statistical significance, *p*-value

- **Statistical significance** describes the likelihood of obtaining a given result by chance.

- Usually, a result with *p*-value < 0.05 is considered statistically significant.

- Statistical significance and substantive, or practical, significance are not the same thing.

Homework 8: ERFs for indoor environment quality factors (IEQs)

- Select one article from the list below Homework 8 on page http://en.opasnet.org/w/Decision_analysis_and_risk_management_2013/Homework

- Every pair should have a different article. Write your username after the article you have selected in Homework 8 (Homework page).

- Go to http://en.opasnet.org/w/Indoor_environment_quality_(IEQ)_factors

- Write your **username** and **whole reference** (name, authors etc. of the article) into Rationale section. Use RefTaq functionality in the latter.

- **Add one row** into IEQ table and write again **reference in short form** (e.g. Matthews et al. 2002) into Description/Reference –box.

- Identify exposure, response, OR and other parameters from your selected article and fill the row you made with this information.

- If OR and CI:s are given, write them in form OR (lower CI-upper CI), for example 1.8 (1.6-2.2)

- Feel free to create more rows if your article has more than one exposure-response function

- Into "rationale" section below the IEQ table, write your estimate of the **precision** and **plausibility** of the OR. You can find an example e.g. on page http://en.opasnet.org/w/Concentration-response_to_PM2.5, there Rationale – Uncertainties.

- If two pairs get estimates for the same exposure-response function, you should consider how to combine them, i.e. what is the single common estimate for this specific exposure-response function.

IEQ table, some instructions

http://en.opasnet.org/w/Indoor_environment_quality_(IEQ)_factors

- Exposure
- Response
- Response metric; do not care about this
- Exposure route
- Exposure unit
- ERF parameter
  - usually OR givenin articles
  - in some cases might be risk ratio (RR)
- ERF in form 1.8 (1.6-2.2)
- Significance; do not care about this
- Description/Reference