

Treatment and expression of uncertainty in risk assessment : Introduction to the issue

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Uncertainties and risk assessment : a large number of works and reports...

- Recent publications on the characterization of uncertainties
 - International Programme on Chemical Safety, IPCS, *Uncertainty and Data Quality in Exposure Assessment*, Genève, WHO, 2008
 - NRC, *Science and Decisions : Advancing Risk Assessment* , 2009
 - EFSA, Opinion of the Scientific Committee related to Uncertainties in Dietary Exposure Assessment, 2007
 - Etc.
- Objectives
 - To better clarify the modes of uncertainty
 - To characterize uncertainties during the course of expertise
 - To allow scientific projections

Uncertainty : what are we talking about?

- **Broad definition**
 - Uncertainty not only characterized by lack of knowledge
- **Several classes**
 - **Epistemological uncertainties**
 - Related to lack of knowledge
 - Methodological uncertainties
 - Theoretical uncertainties
 - **Political and regulatory uncertainties**

Uncertainty : what are we talking about?

- Uncertainties related to ambiguity, complexity, ignorance or lack of data
- Deep uncertainties, not quantifiable or statistically describable
 - relevant studies not published (e.g. in case of negative results)
 - values, implicitly or explicitly expressed, that influence the choices in the research design etc.
 - Etc.
- More readily quantifiable uncertainties
 - Measurement, sampling etc.

Uncertainty / variability

Variability

- between species
- gender-related
- age-related

- health inequalities

- conditions of exposure
- behavioral variability
- Etc.

Uncertainty and risk assessment : current state of practice

- Lack of attention to uncertainty at pre-assessment phase
- More attention given to the more readily quantifiable variables
- Different types of uncertainty not adequately differentiated in risk assessment reports
 - Guidance inconsistently applied
- Minority views rarely reported
 - Missed opportunities to share methods between disciplines

Uncertainty and risk assessment : current state of practice

- Uncertainty, communication and risk management
 - Difficulty in communicating uncertainties and their impact on the need for action
 - Ambiguity about level of knowledge :
Receptivity and flexibility / information on uncertainty and knowledge

How to deal with uncertainty?

Various trends with respect to uncertainty

(Van der Sluijs JP, Water Science and technology, 2005;
Ravetz and Strand, 2005)

- Exorcism
 - To reduce uncertainties
 - To exorcise “junk science”
« rectify false concepts in order to establish scientific validation »
- Adaptation → to quantify
 - Bayesian analysis etc.
 - Hypothesis, scenario

How to deal with uncertainty?

- Assimilation
 - To give up our search for a single unquestionable truth
 - To aim for the transparency of the various positions

- ➔ Ambiguity of risks
 - Incertitude surrounding facts
 - Controversial values
 - Political, economic stakes
 - etc.

How to deal with uncertainty?

- Evidence-based approach
 - To eliminate uncertainty
 - To aim at a high degree of accuracy
- Precautionary-based risk assessment
 - To incorporate and learn from uncertainty

Grandjean P, *Annu. Rev. Public Health* (2004)
- Quantification
 - Variability → probabilistic analysis / safety factors
 - Epistemic uncertainties → quantification and prevention: safety factors

How to deal with uncertainty?

- To clarify the various dimensions of uncertainty
 - Technical : accuracy/ inaccuracy
 - Methodological : reliability
 - Epistemological : ignorance
 - Societal : social robustness

Judgments of experts

- Hypothesis/presumptions about mechanisms of action
 - Relevance of data obtained with not standardized methods
 - Interpretation of conflicting data
 - Quality of studies
 - Critical effect selected
 - Interpretation of causality
- ➔ **Multidisciplinary expertise**
- Comparison of various models of uncertainty management
 - Various visions of the elements of certainty and uncertainty

Areas for improvement

- Systematic identification and evaluation
- Uncertainty analysis
 - Proportionate to the needs of the problem
- Evaluation of uncertainty relevant to other aspects of overall process
 - Socio-economic analysis etc.
- Review
 - Availability, review

Areas for improvement

- To be more explicit about variability and its effect on risk and uncertainty
- Inclusion/exclusion of data
 - Transparency, justification
- Review
 - Independent committees or experts
 - External parties

Areas for improvement

- Better communication
→ Decision-making
- To indicate the impact of the uncertainty on the assessment of risk
- Information on the types, sources and reducibility of uncertainties etc.
- Need for harmonized guidance on approaches for communicating uncertainty etc.

Conclusion

- Culture change
 - Risk assessors, risk managers
- Interactions between parties
 - Experts, managers, stakeholders etc.

“Knowledge is an unending adventure at the edge of uncertainty” (Jacob Bronowski)

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