APPROACHES FOR ESTIMATING PROBABILITY OF CAUSATION FOR COMPENSATION PURPOSES

Hajo Zeeb

Leibniz Institute for Prevention Research and Epidemiology – BIPS, Bremen, Germany

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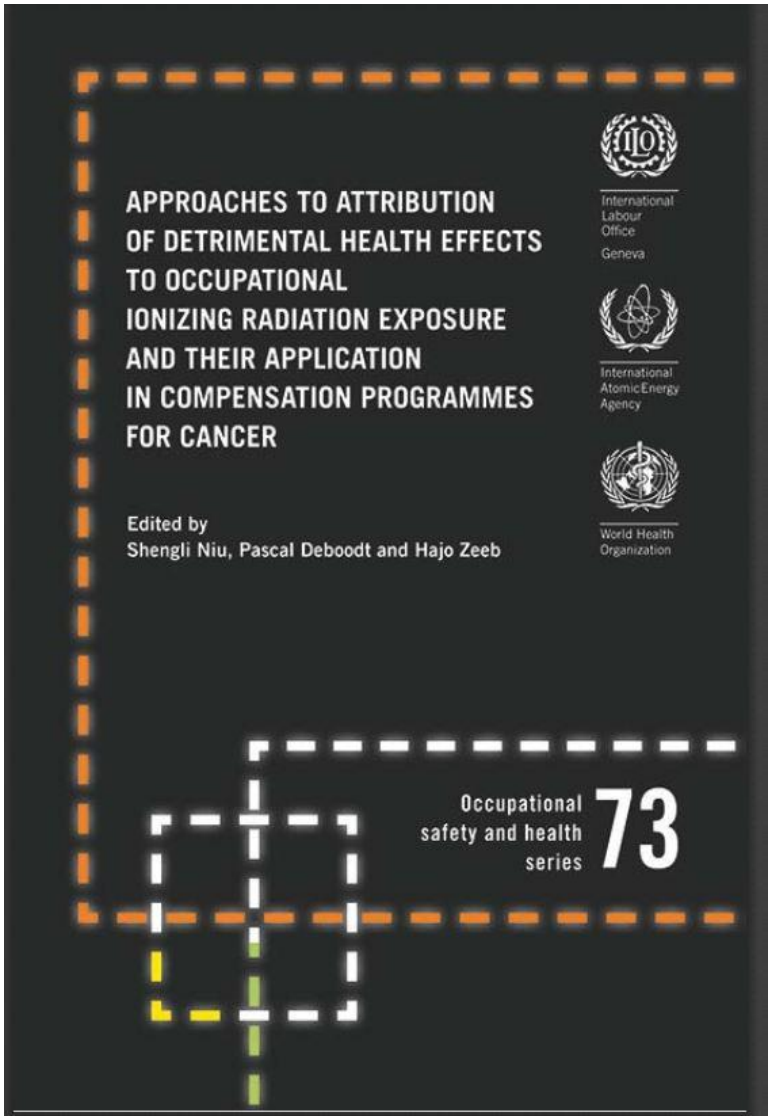
Overview

- Background – tasks from earlier conferences
- Probability of causation
- Basic approaches
- Complexities and uncertainties
- Software
- Outlook
  - Application in different compensation frameworks

Background

- Occupational exposure to ionizing radiation may result in cancer among workers
- Exposure-disease relation not directly observable or deducible
- Countries use different approaches to decide on compensation of workers in case of alleged occupational causation
- 2002 International Conference on Occupational Radiation Protection: guidance needed !
- Working group produced document co-sponsored by ILO, IAEA and WHO (2010)


APPROACHES TO ATTRIBUTION OF DETRIMENTAL HEALTH EFFECTS TO OCCUPATIONAL IONIZING RADIATION EXPOSURE AND THEIR APPLICATION IN COMPENSATION PROGRAMMES FOR CANCER
Edited by
Shengli Niu, Pascal Deboodt and Hajo Zeeb
International Labour Office
Geneva
International Atomic Energy Agency
World Health Organization
Occupational safety and health series
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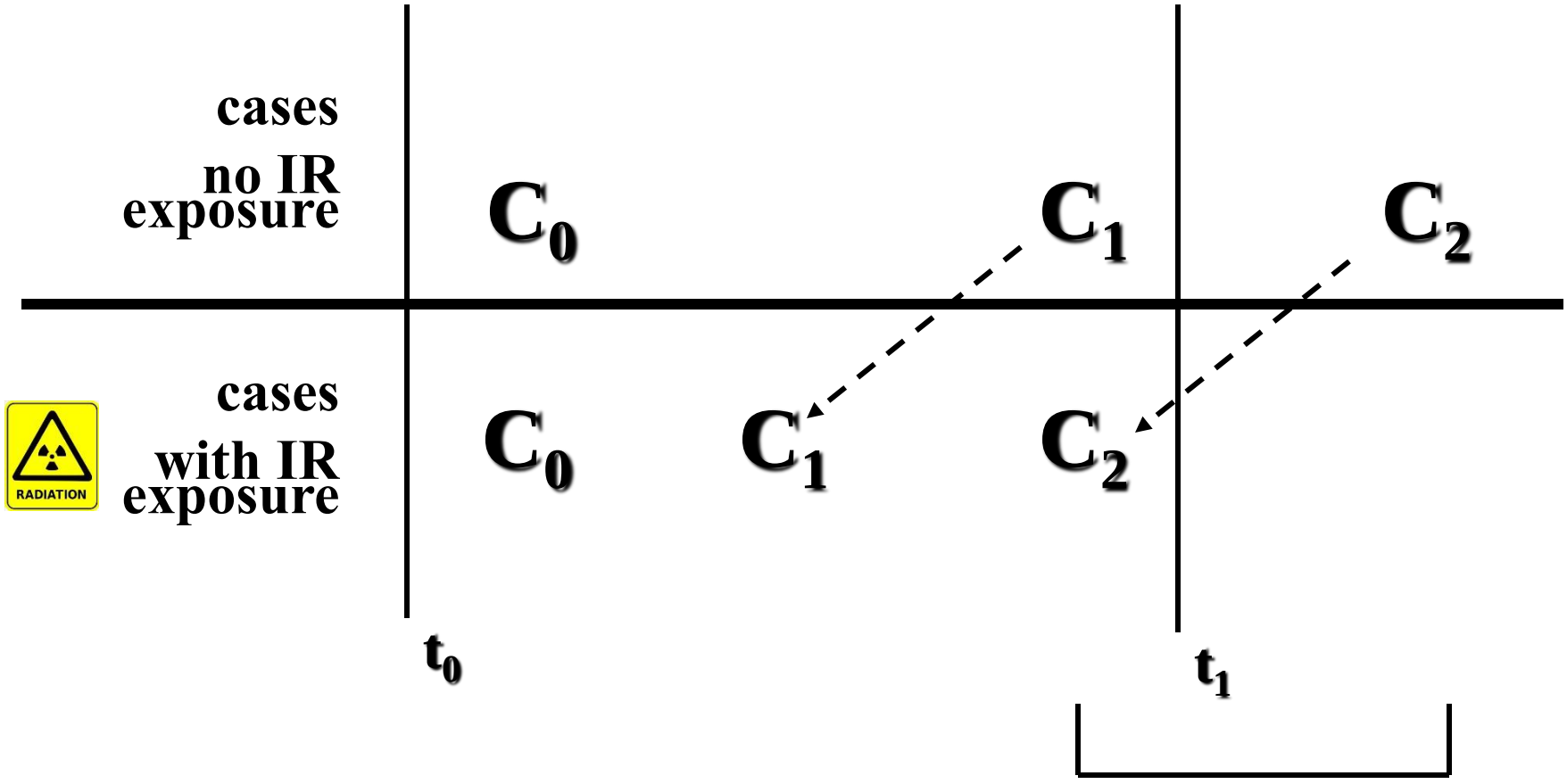
Probability of Causation

- A diagnosed disease (say: cancer) cannot unequivocally be attributed to a – specific – cause
  - Did occupational ionizing radiation cause this cancer ?
  - How likely is it that ionizing radiation contributed to the development of this cancer ?
- Approaches needed to assess the causal situation
  - Inference from population data to the individual case
- Epidemiology (science): attribution / etiology
  - Includes different epidemiologic measures
- Jurisdiction: probability of causation
  - Can be estimated by etiologic fraction (also called: assigned share)

not 'excess' cases



etiologic fraction = $C_1 + C_2$

Based on Ettinger/Painter 1999

Basic approaches

- no scientific assessment of causation of individual case possible
- Way out: use of population data
- Answering the question: what happens among a larger group of people with same exposure (and co-factor) conditions as known for the individual case ?
- Use an (ideally) unbiased risk estimate from a comparison of exposed versus unexposed persons
  - Note: this is generally pertaining to excess fraction, not etiologic fraction (see previous slides)

Principle

Assigned share based on epidemiological estimate of relative risk (or absolute risk)

- AS = $\frac{RR-1}{RR}$
- AS = $\frac{EAR}{B_{canc}+EAR}$

(B = baseline risk for specific cancer, EAR = Excess absolute risk)

for ERR (e.g. using ERR/unit dose from LSS):

- AS = $\frac{ERR}{1+ERR}$

Example

- Male leukemia case diagnosed at age 68, single exposure of 100 mSv to bone marrow at age 43
- Application of risk model (BEIR, UNSCEAR…) to the specific situation:
- ERR = 0.288
- AS = $\frac{0.288}{1+0.288}$ = 22.4%
- (Missing: uncertainty, e.g. confidence bounds)

Complexities and uncertainties

"Simple" estimation straight forward, blending out sources of uncertainty, e.g.

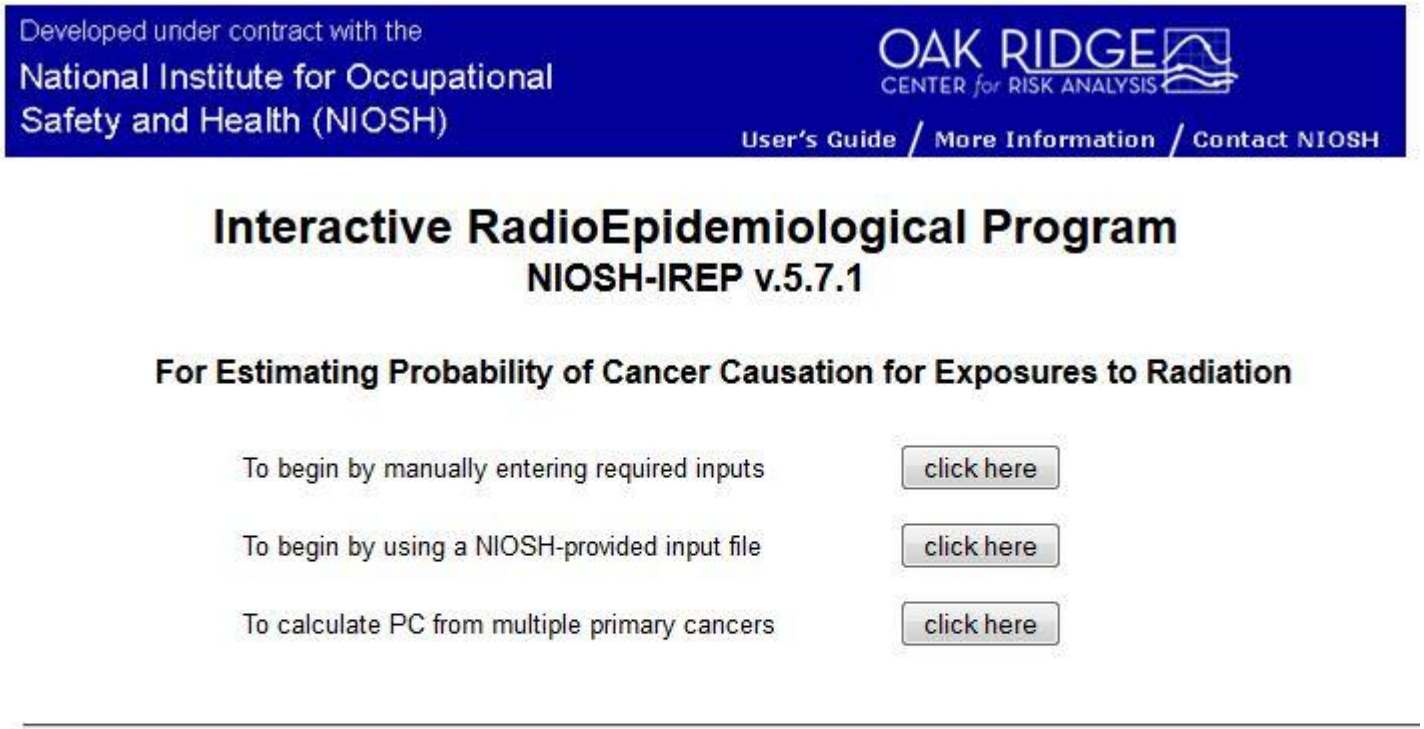
Relating to the case:

- Uncertain dosimetry, disease information,
- information on other factors relevant to risk
- ….

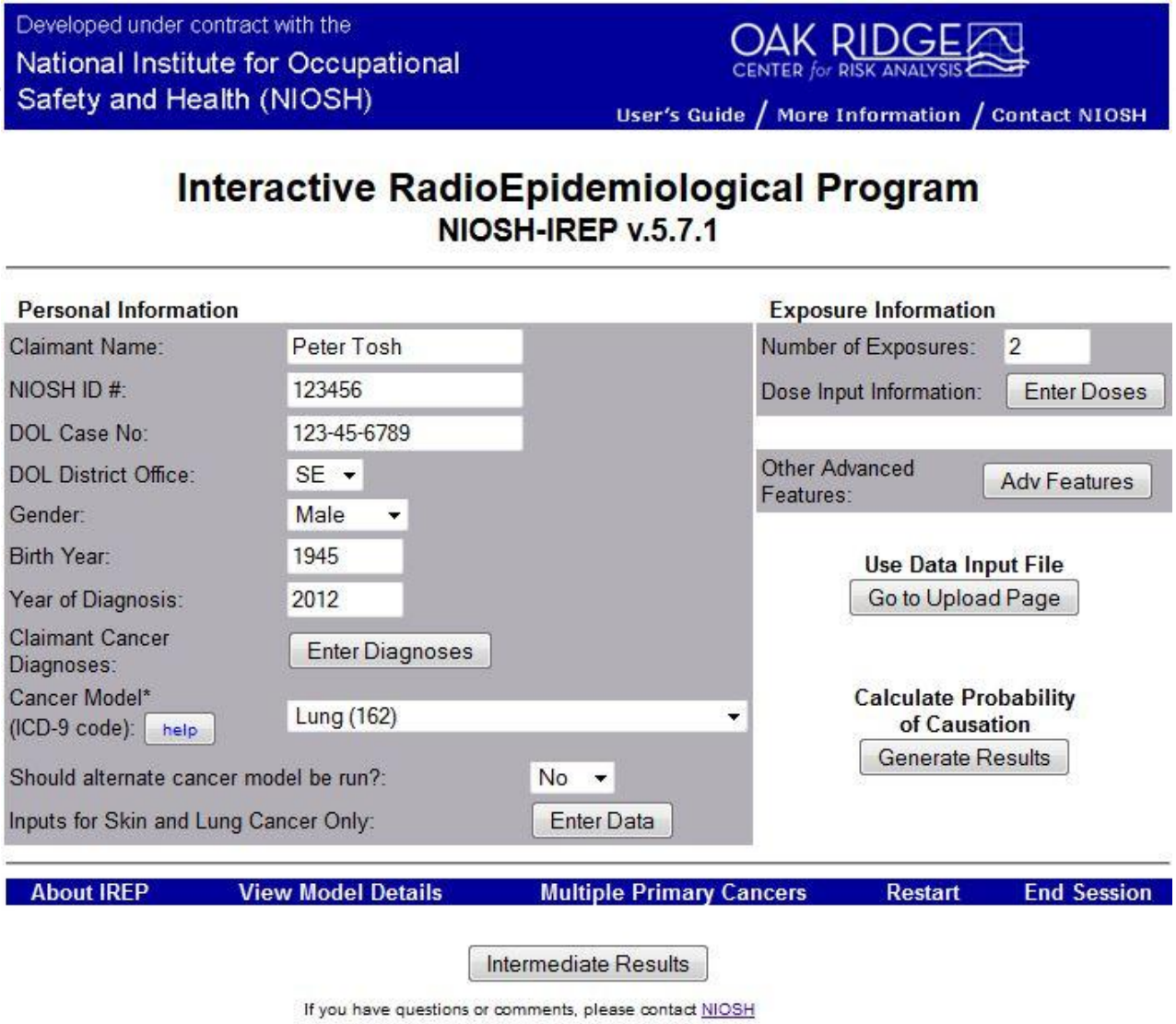
Relating to the models used:

- Shape of dose-response curve
- Use of DDREF, biological effectiveness
- Transport from one population to another
- ….

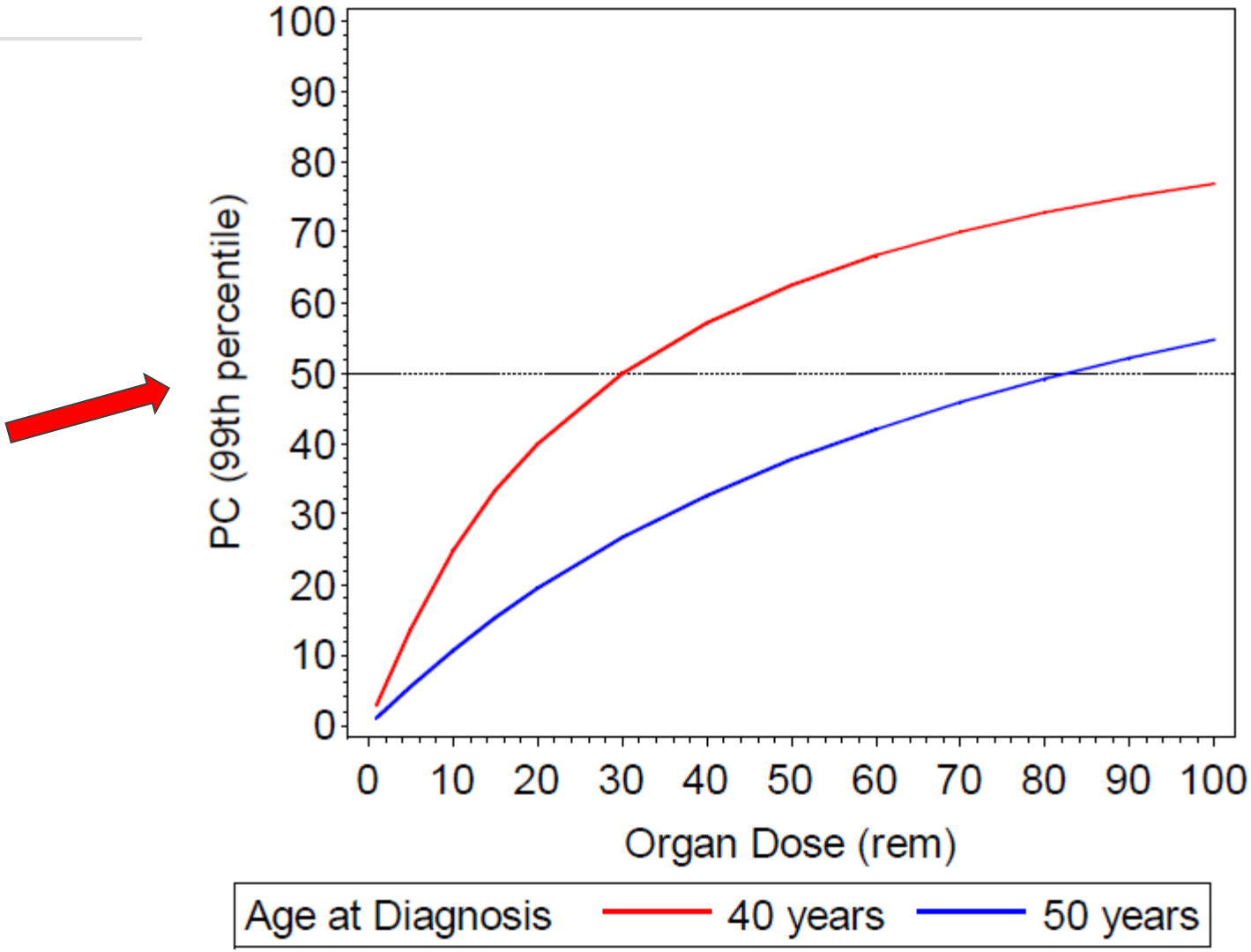
Interactive software – Example IREP



https://www.niosh-irep.com/irep_niosh/


Developed under contract with the
National Institute for Occupational Safety and Health (NIOSH)
OAK RIDGE CENTER for RISK ANALYSIS
User's Guide / More Information / Contact NIOSH
Interactive RadioEpidemiological Program
NIOSH-IREP v.5.7.1
Personal Information
Claimant Name: Peter Tosh
NIOSH ID #: 123456
DOL Case No: 123-45-6789
DOL District Office: SE
Gender: Male
Birth Year: 1945
Year of Diagnosis: 2012
Claimant Cancer Diagnoses: Enter Diagnoses
Cancer Model* (ICD-9 code): help
Lung (162)
Should alternate cancer model be run?: No
Inputs for Skin and Lung Cancer Only: Enter Data
Exposure Information
Number of Exposures: 2
Dose Input Information: Enter Doses
Other Advanced Features: Adv Features
Use Data Input File
Go to Upload Page
Calculate Probability of Causation
Generate Results
About IREP
View Model Details
Multiple Primary Cancers
Restart
End Session
Intermediate Results
If you have questions or comments, please contact NIOSH

Colon Cancer Model
20 years latency



Inputs: Male, One acute exposure, photons E>250keV, Constant distribution

Application in Compensation programmes

- US Energy Employees' Occupational Illness Compensation Program Act of 2000:
  - 99th precentile ≥ 50% PC: claimant eligible for compensation
- UK CSRLD: sliding scale depending on PC value
- Other countries: list-based approach, no PC calculation
- In courts: often the 50% PC (“more likely than not”) used, but differs between countries

Summary

- Causes of individual cancers unknown
- Estimation of share of cancers caused by specific exposures is possible for populations
- From epidemiology: concept of attributability, closely linked to causal models
- Available software incorporates ways to consider uncertainty in input parameters for PC estimation
- Different uses in compensation schemes and legal systems

Thank you

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Contact

Prof. Hajo Zeeb

Leibniz Institute for Prevention Research
and Epidemiology – BIPS
Achterstraße 30
D-28359 Bremen

zeeb@bips.uni-bremen.de

Leibniz Institute
for Prevention Research and
Epidemiology – BIPS GmbH