

For our Environment

Umwelt 
Bundesamt

WG3 – Meeting

assessing the burden of risk factors

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Agenda – WG3 – Risk Factors “break-out-session”

- Recap of the last break-out-session in Brussels
 - Summary of the aims, action points and deliverables for WG3
 - Update on current status of planned publications
- Introductory presentation on “Comparative Risk Assessment (CRA) – the ideas behind”
- Identification / discussion of topics for training school
- Identification / discussion of needs for training materials
- Discussion about necessary tools for different programs (e.g. R, STATA, Excel)
- Further planning
- Discussion and wrap-up

Tasks of the WG3 according the MoU

1. Map existing activities in the COST region
2. Reach out to international initiatives in the concerned area of inquiry (Aol)
3. Develop specific applications in the concerned Aol
4. Develop methodological advances in the concerned Aol
5. Interact with transversal activities
6. Promote the use of BoD in the concerned Aol

→ Aol in our case are the risk factors

Recap of the “break-out-session” in Brussels

- 21 participants joined the WG3-Session
 - 12 with experience in BoD
 - 9 without experience in BoD
- Agreement on CRA-Concept as the framework for the underlying work in WG3
- First challenges defined by the participants
 - Estimating the combined effects of risk factors
 - Considering social determinants of health
 - Exposure assessment in general
 - Handling missing data
 - Missing information in studies due to incomplete reporting

Current state

- Map existing activities in the COST region
 - Task is centrally located in the COST-Action
 - Risk factors are included in the mapping exercise
- Reach out to international initiatives in the concerned area of inquiry (AoI)
 - Ongoing – reaching out to more researches envisaged
 - Suggestion: Gathering a list of initiatives via Google-Doc

Current state

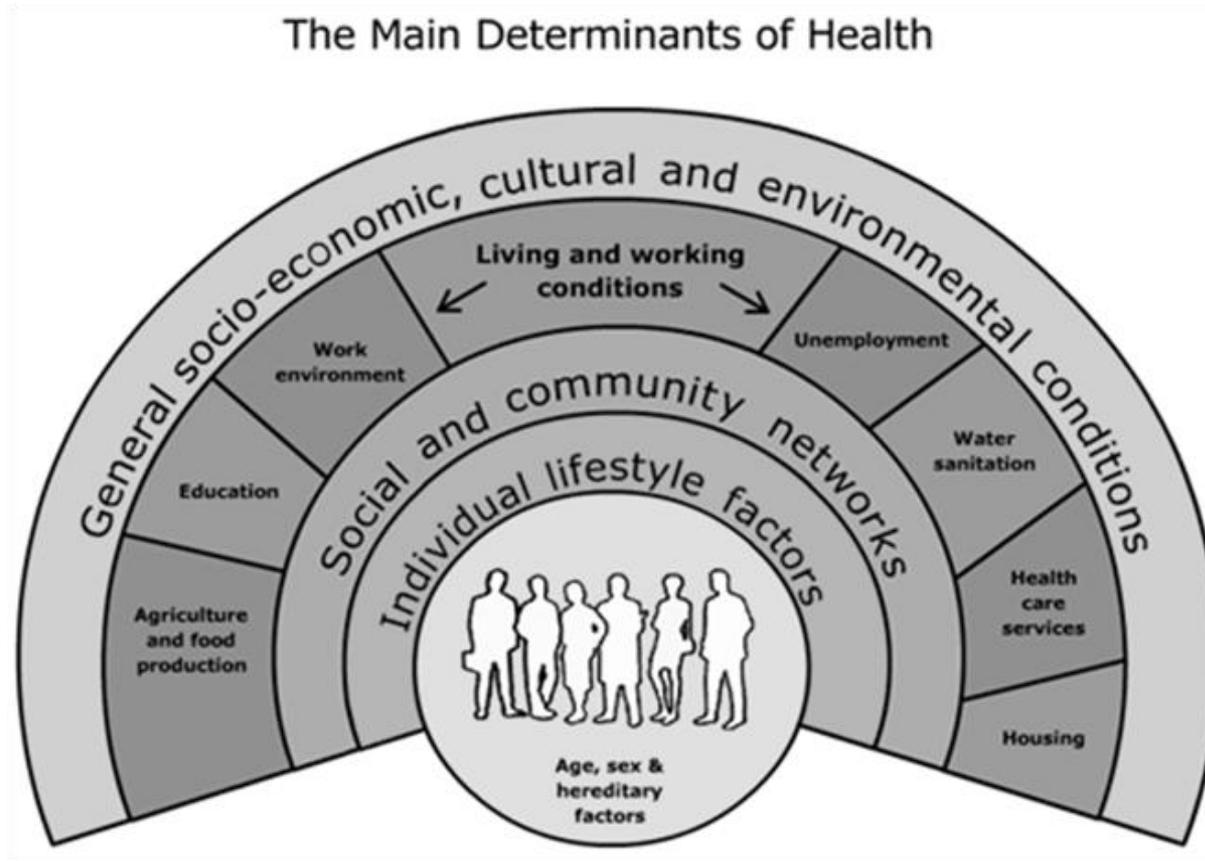
- Develop specific applications in the concerned Aol
 - Step-by-step guidance document for CRA (incl. practical examples)
 - Scripts for selected software programs (e.g. R)
 - Training materials for training school on CRA
 - Defining a reference list with basic literature on CRA
- Develop methodological advances in the concerned Aol
 - Scientific paper to identify potential challenges
 - Suggestions for more challenges welcome
 - This can also be e.g. a position paper of the COST-WG3

TASK:

- Write down challenges you encountered when using CRA
- Which topics would you be interested when having a training school?
- Which tools might help you during your work?

What are the important risk factors? The ideas behind the CRA-Concept

(Population) Health Determinants



Cave: There are plenty of interactions between the health determinants. Effects of single determinants are not easily extracted.

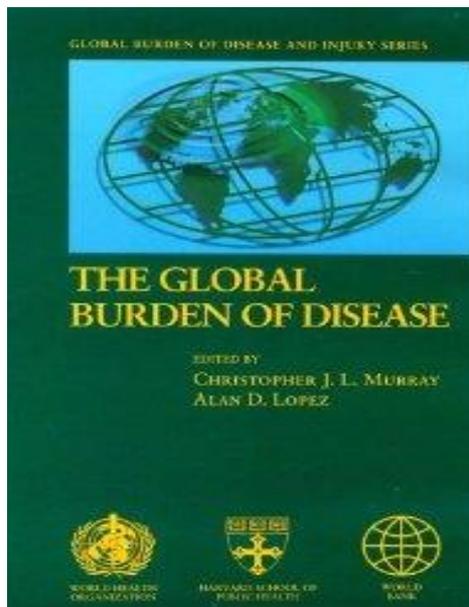
(Dahlgren und Whitehead 1991)

Comparative Risk Assessment (CRA)

- Quantifying disease burden is important to present the current population health status
- Identification of risk factors which are major drivers of disease burden to uncover potential measures
- Attributing disease burden to risk factors is the essential step to take
- Comparative Risk Assessment as a part of the GBD study aims at standardized assessments of risk factor effects on population health

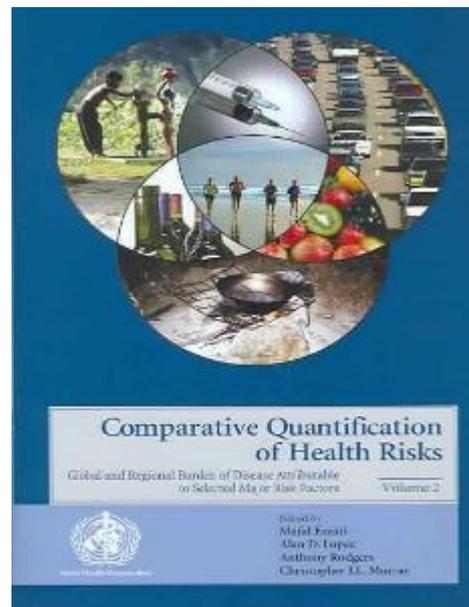
Comparative Risk Assessment (CRA) – first estimates

WHO, World Bank,
Harvard School of
Public Health 1996



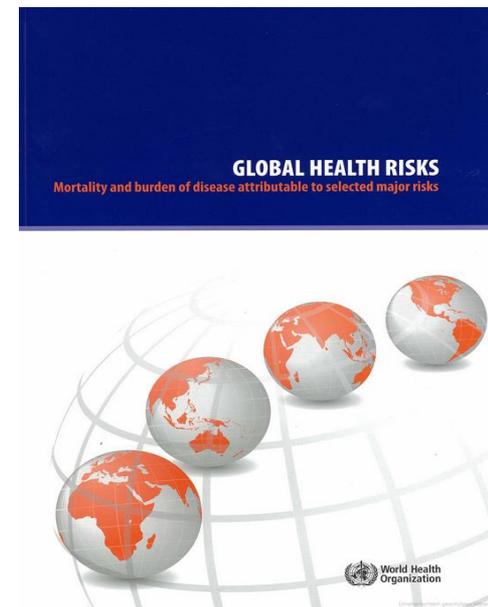
- 10 risk factors
- Baseline year 1990

WHO 2004



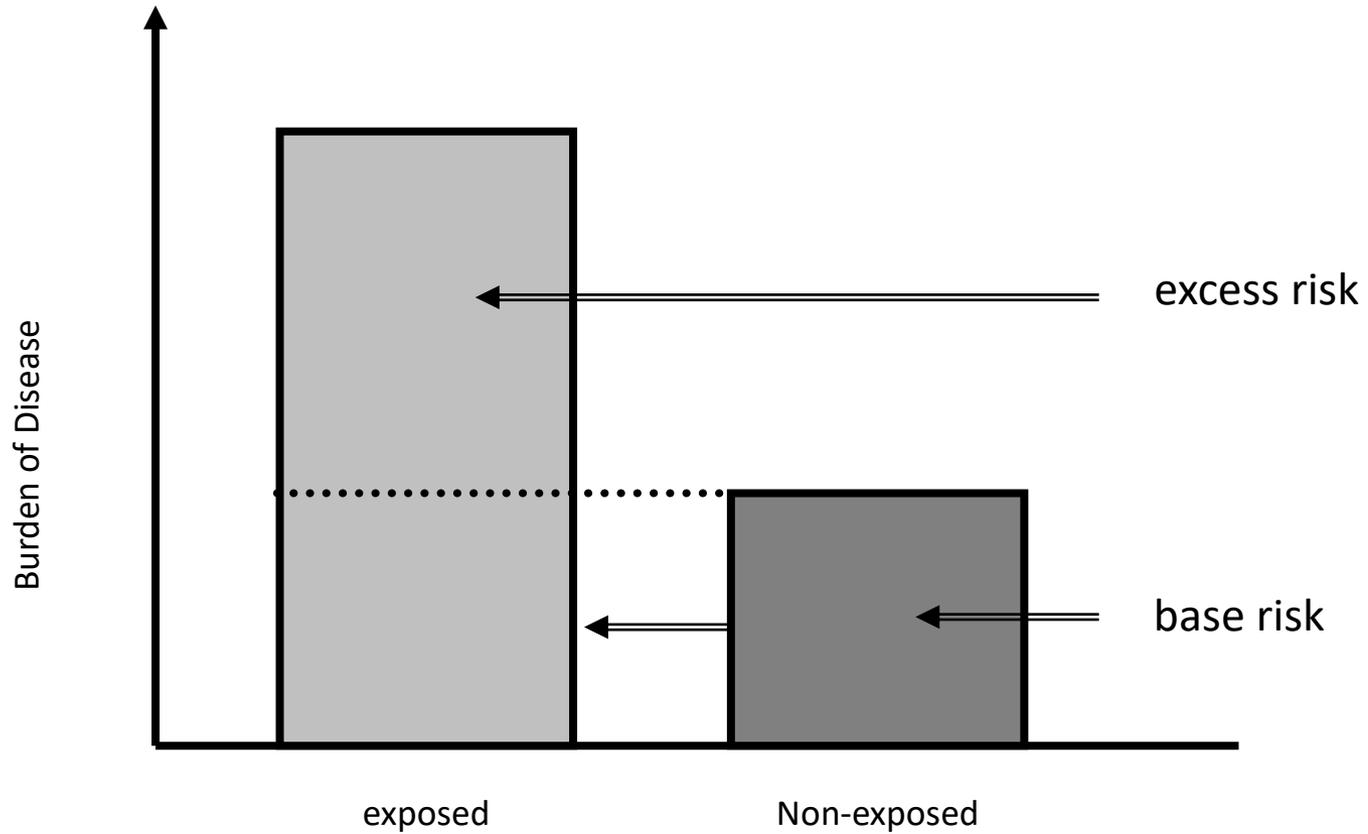
- 26 risk factors
- Baseline year 2000

WHO 2009



- 24 risk factors
- Baseline year 2004

Comparative Risk Assessment in particular I



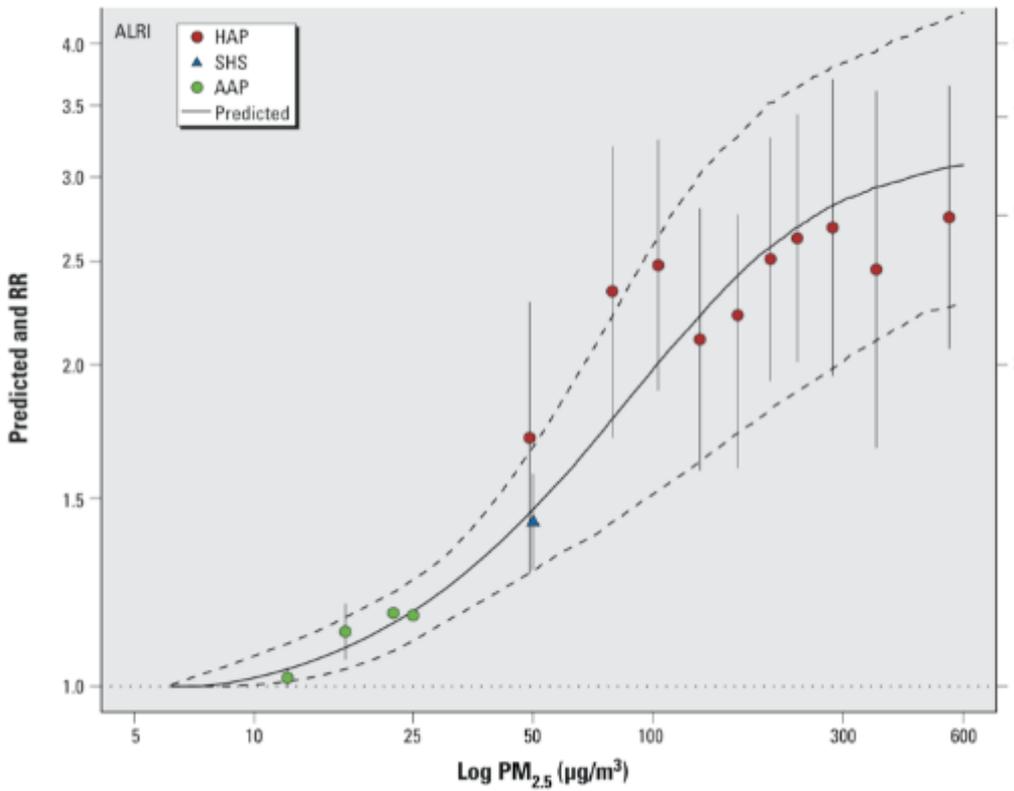
Comparative Risk Assessment in particular II – The Population Attributable Fraction

“The PAF is the **proportion** by which the **outcome** would be **reduced** in a given population and in a given year if the **exposure** to a risk factor in the past were **reduced** to the counterfactual level of the **TMREL**.

The PAF for **each individual risk–outcome–pair** is estimated independently and incorporates all burden for the outcome that is attributable to the risk, whether directly or indirectly.”

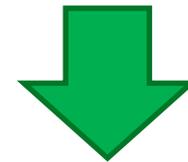
Comparative Risk Assessment in particular III

Integrated Response Function for ALRI



Exposure Alternative

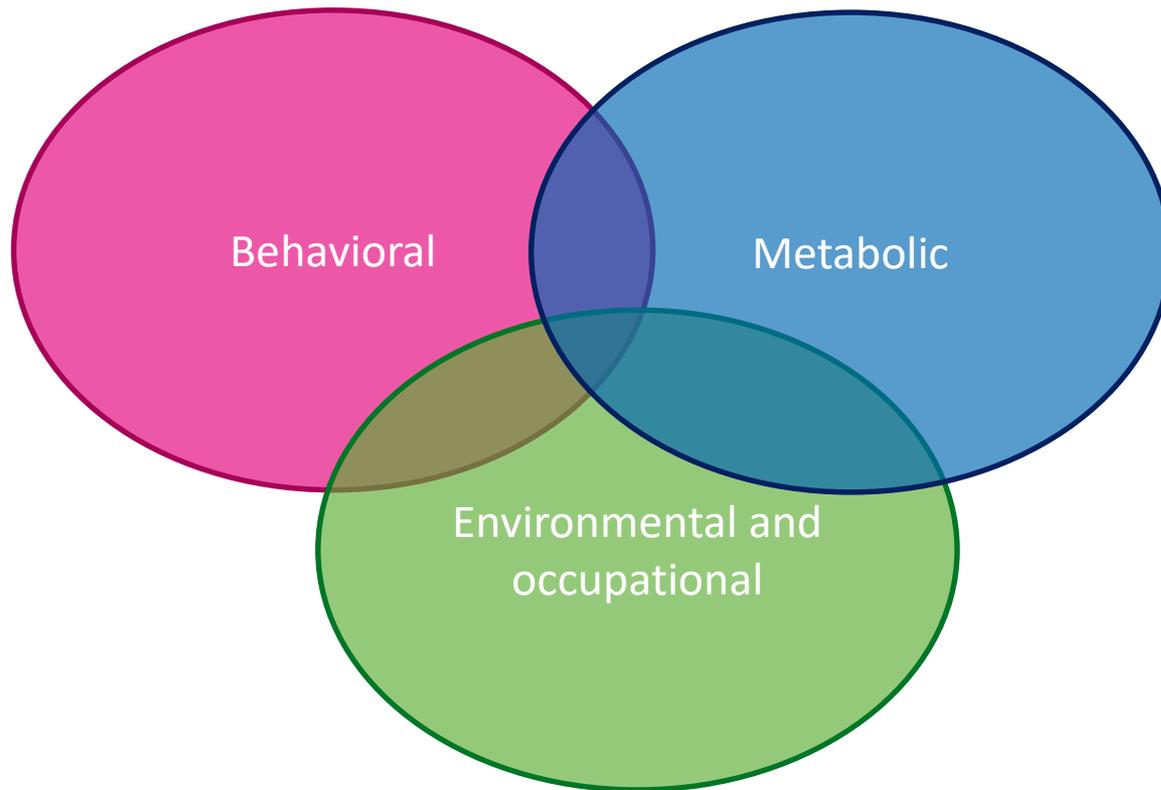
$$PAF = \frac{\sum P_i RR_i - \sum P_i' RR_i}{\sum P_i RR_i}$$



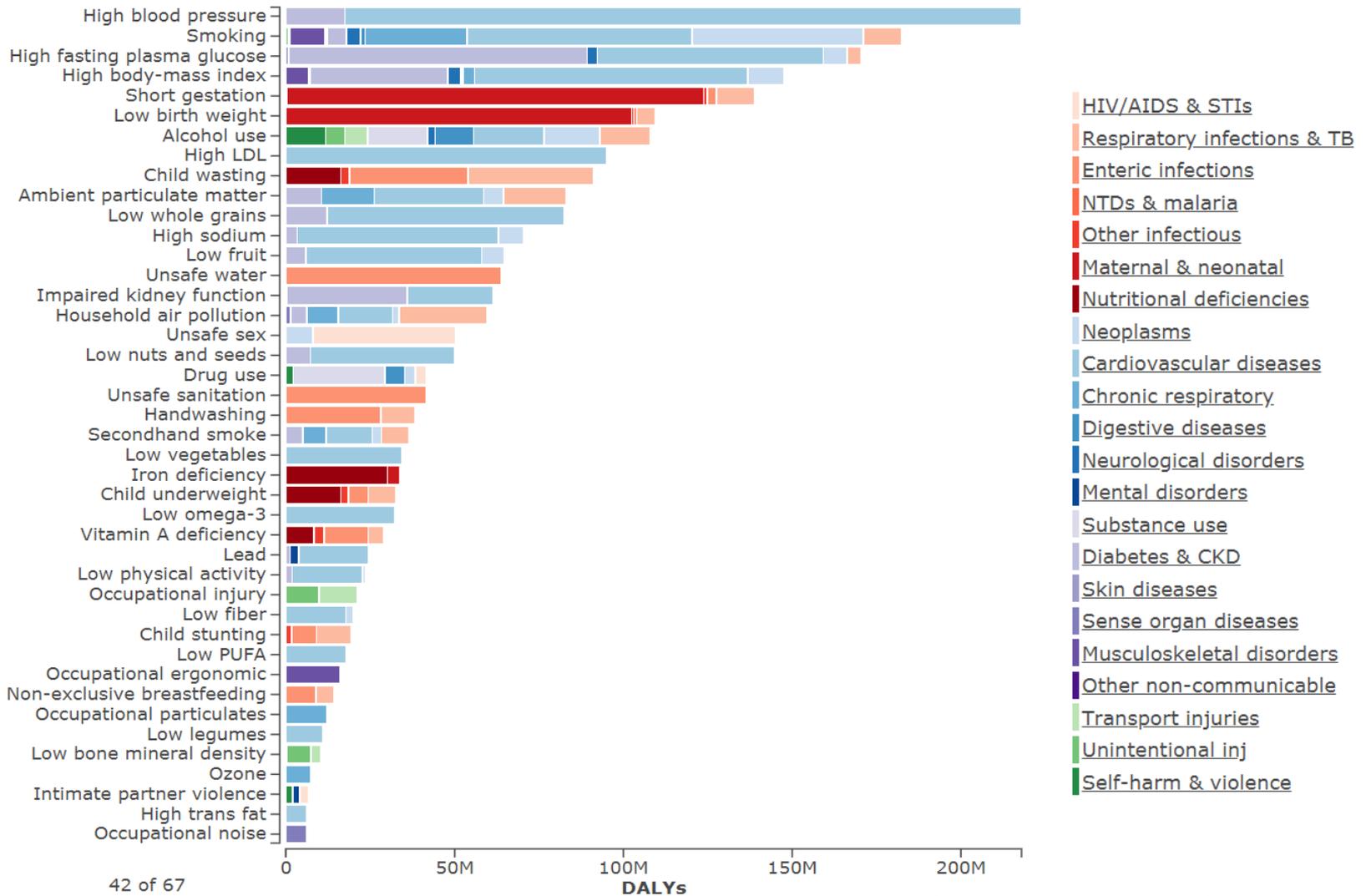
Exposure Alternative

$$PAF = \frac{\sum P_i RR_i - 1}{\sum P_i RR_i}$$

CRA – Risk groups according to the GBD-Study



Selected results – IHME (2017) – global DALYs attributable to selected risk factors



Comparative Risk Assessment (CRA)

- Four components / steps can be identified when using CRA



Definition of the exposure



Exposure assessment /
distribution of the risk factor within the population



Identification of risk outcome pairs



Identification / Quantification of the association between the risk
and the outcome (e.g. relative risk)

Comparative Risk Assessment (CRA)



Definition of the exposure

Definition of the exposure

- Operationalization of exposure is a critical step
- Suitable data at necessary resolution required
- Complexity dependent on selected risk factor
- Different definitions available for risk factors
 - No clear gold standard available

Definition of the exposure - challenges

- Definitions of exposure may vary
 - IHME provides a definition of risk factors
 - Definition of Risk Factors for CRA on a European level?
- Finding the relevant level of detail for the risk factor
 - e. g. spatial resolution
- Decision about the levels of exposure
 - binary, categorical, continuous

Comparative Risk Assessment (CRA)



Definition of the exposure

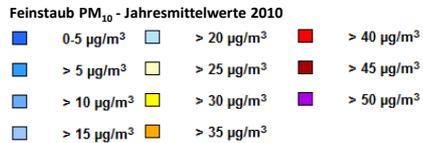
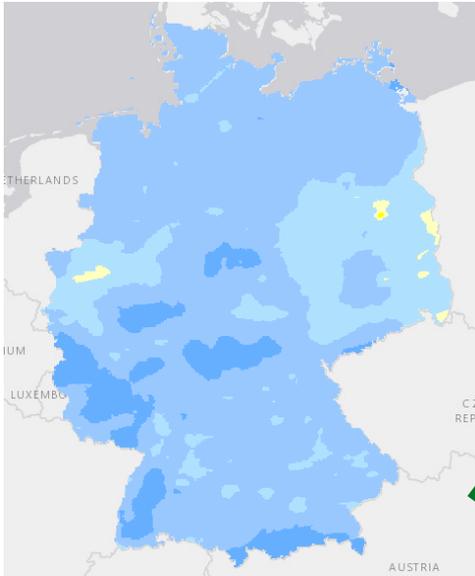


Exposure assessment /
distribution of the risk factor within the population

Exposure assessment

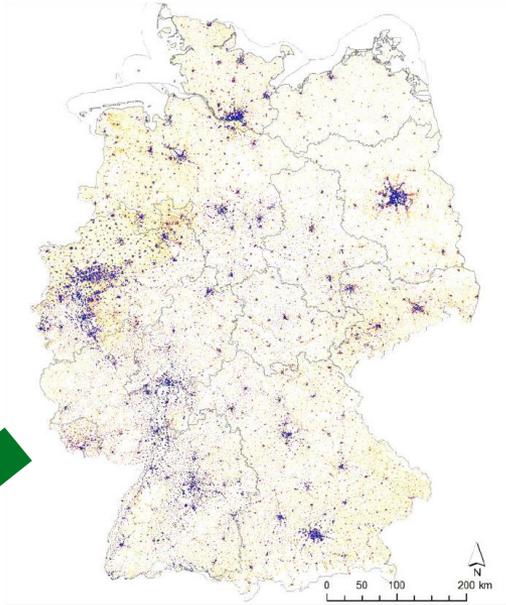
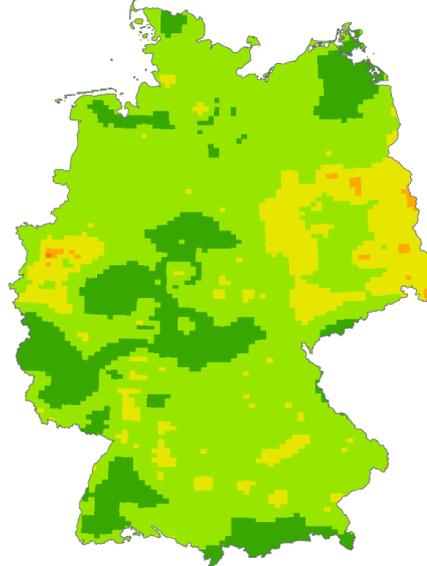
- Aim is to assess the prevalence of a risk factor in the population
- Different types of exposure assessments available
 - Population representative surveys
 - Human Biomonitoring Data
 - Measurement data
 - Modelling data
- Identifying the best proxies for the selected risk factors

Exposure assessment



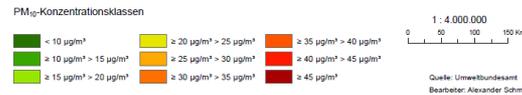
2 km x 2 km
Particulate Matter

1 km x 1 km
Pop-weighted exposure to PM



Einwohnerdichten für 2011 in EW/(250*250 m²)
High : 4204.15
Low : 0

250 m x 250 m
Population density



Exposure assessment - challenges

- Availability of population representative survey data
 - Mostly gathered from population samples
 - Each extrapolation adds to uncertainty
- Measurement accuracy
 - Availability of measurement stations (e.g. air pollution)
 - Bias when using self-reported data (e.g. smoking behavior)
- Exposure assessment needs to fit with exposure definition
 - Using cross-walking techniques?
- Defining the counterfactual value
 - GBD uses global Theoretical Minimum Risk Exposure Level (TMREL)
 - Minimum exposure or threshold (where RR is 1)?

Comparative Risk Assessment (CRA)



Definition of the exposure



Exposure assessment /
distribution of the risk factor within the population



Identification of risk outcome pairs

Identification of risk-outcome-pairs

- in GBD: Inclusion of „risk-outcome-pairs“ only when World Cancer Research Fund (WCRF) for convincing or probable Evidence are met
- „convincing evidence consists of biologically plausible associations between exposure and disease established from multiple epidemiological studies in different populations”
- “probable evidence is similarly based on epidemiological studies with consistent associations between exposure and disease, but for which shortcomings in the evidence exist, such as insufficient trials (or prospective observational studies) available”
- consider RCT, cohort studies, case-control-studies

Identification of risk-outcome-pairs - challenges

- Defining a set of criteria for causality
 - Bradford-Hill criteria as a guidance?
- Varying evidence for risk-outcome-pairs
 - Comparability of risk-factors
- How to deal with risk factors with lower evidence?
 - Environmental noise?

Comparative Risk Assessment (CRA)



Definition of the exposure



Exposure assessment /
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Identification of risk outcome pairs



Identification / Quantification of the association between the risk
and the outcome (e.g. relative risk)

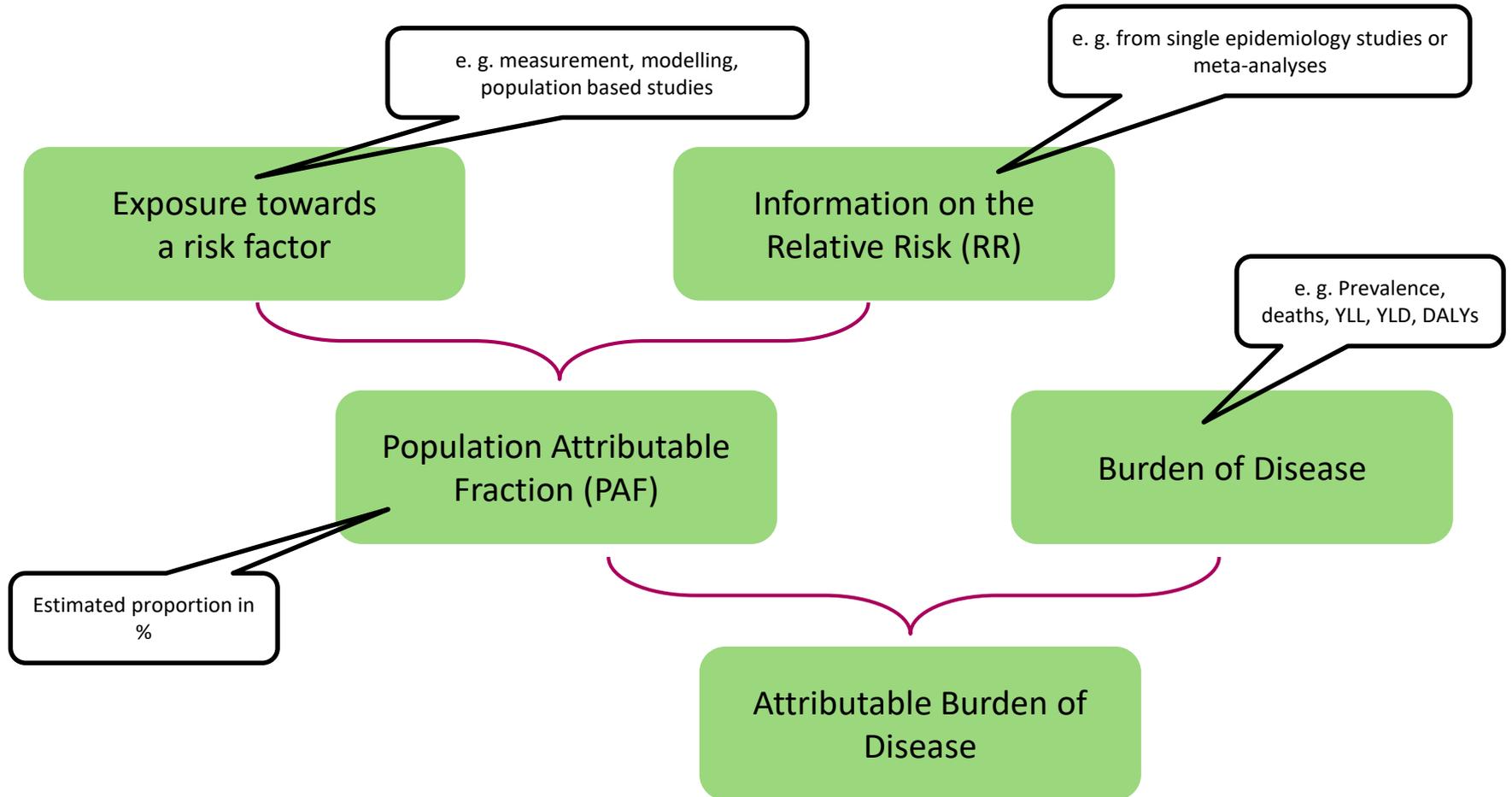
Identification / Quantification of the association between risk and outcome (e.g. relative risk; RR)

- RR a necessary prerequisite for estimating attributable burden
 - Population Attributable Fraction as the key component
- Published and unpublished meta-analyses provide relative risks (RR) for each risk-outcome-pair
 - partly stratified by age and sex

Identification / Quantification of the association between risk and outcome (e.g. RR) - challenges

- RR estimated for single risks
 - How to consider the combined effects of risk factors?
 - Additive, multiplicative, complicated interactions?
 - How to deal with over-attribution?
- Questions about the generalizability of effects over populations
 - RR are not available for all countries
- single RR are used for mortality and morbidity
 - over- underestimation of effects
- Inadequate reporting of epidemiologic studies limits the use of the results for CRA

Pathway of a Comparative Risk Assessment



Discussion – CRA challenges

- What challenges have you encountered when using CRA?
 - In general?
 - Specific for risk factors?
- How did you solve the challenges?

Discussion - training school

- General training school on CRA or specific schools for groups of risk factors?
- Hands on training needed?
- Specific case-studies on different risk factors?
- Poster session
 - Presenting and discussing work-in-progress
 - Pre-application with specific examples / challenges

Discussion - training materials

- Would you prefer generic or risk-specific guides?
- What kind of materials would you prefer in general?

Discussion – CRA-tools

- Map the existing tools as a start
 - What tools do you use for the different steps CRA?

Discussion – Any other business

- ???