General introduction to DYNAMO – HIA tool

Wilma Nusselder & Hendriek Boshuizen

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Purpose of this presentation

- Bird-eye view of DYNAMO-HIA
- More information on:
  www.dynamo-hia.eu
- Or email:
  w.nusselder@erasmusmc.nl or
  hendriek.boshuizen@rivm.nl

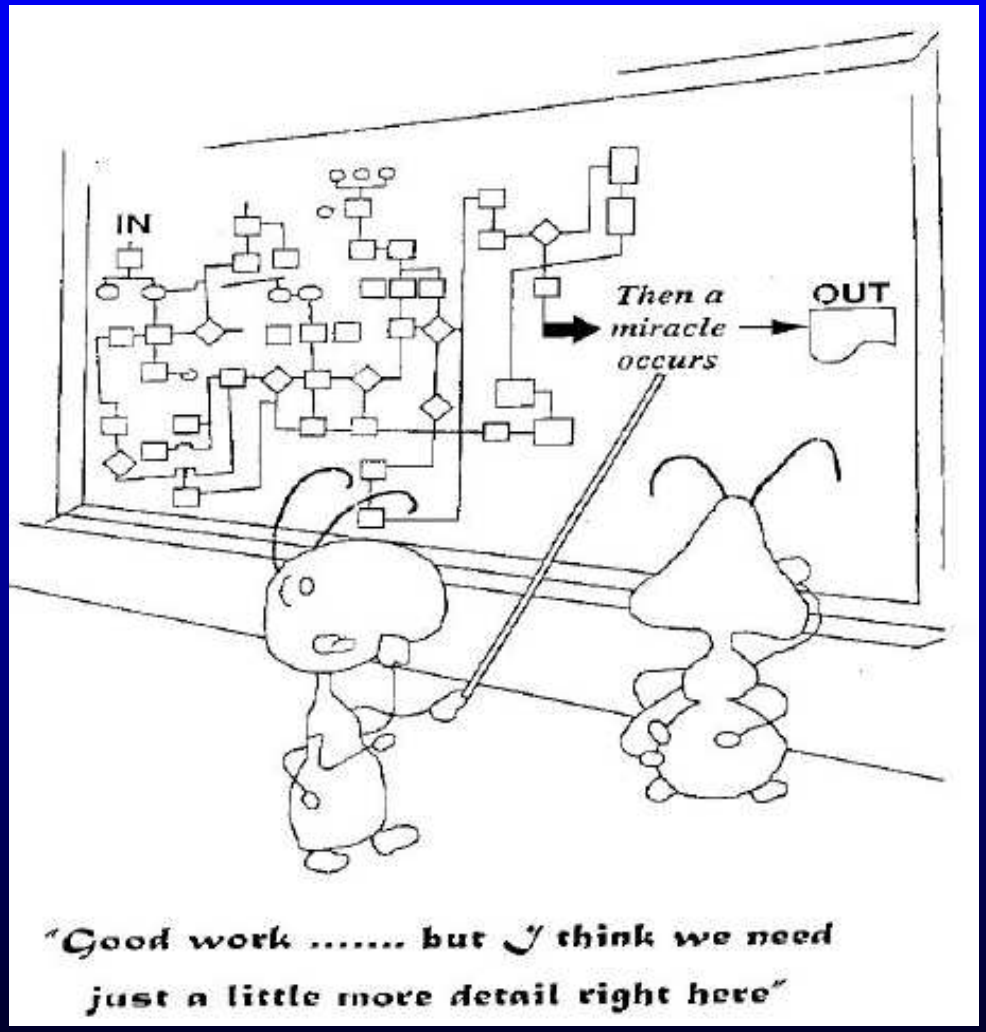
What is the health impact of

Increase price of smoking

Increase excise tax on alcohol

Ban advertising unhealthy foods

Without quantitative tool



DYNAMO-HIA tool

- Is ready-to-use tool to project the effects of changes in risk factor exposure due to policy measure or intervention on disease-specific and summary measures of population health
- Organizes and stores necessary input data
- Syntheses according to standard causal epidemiological pathway
- Projects how changes in risk factor distribution affect disease-specific and summary measures of population health

Scope of DYNAMO-HIA tool

Reference scenario

Description of business as usual situation:
demographic, epidemiological and risk factor exposure

Intervention scenario

Changed risk factor exposure:
changed prevalence and/or changed risk factor transition rates

DYNAMO-HIA

Estimation of change in large set of health outcomes:
comparison reference and intervention scenario

DYNAMO-HIA tool: a look behind the scenes

How does it work behind the scenes

- Standard causal pathway in epidemiology

- Markov modeling framework
  - Explicit risk factor states
  - Disease states: incidence, prevalence, mortality
  - Competing risks are taken into account

- Technical realization
  - Discrete time frame using a multi state model (disease process)
  - Dynamic micro simulation (risk factor)

DYNAMO-HIA tool: no programming, but flexible

Risk factor exposure:

- Categories: never, current, former smokers
- Continuous: mean BMI
- Compound: former smokers by time since quitting

Diseases: 3 types of disease processes

- Chronic disease
- Partly acute fatal disease
- Disease with cured fraction

Transitions between risk factor states:

- Approximation assuming net transitions
- Approximation assuming zero transitions
- User-defined transitions

DYNAMO-HIA tool: one risk factor but can be combination of risk factors

Risk factor exposure:

- Up to 10 categories

Partitioning population along risk factors:

- BMI*smoking
- SES*smoking
- Proximity to hazard source (environmental factors)

DYNAMO-HIA tool: risk factor states, but population level data

Tool starts from population-based data

It uses in calculation:
Incidence of diabetes in 40 year old women with overweight

Often not available

But data need is:

- Incidence of diabetes in 40 year old women
- % overweight for 40 year old women
- RR association between overweight and diabetes

Available & Used in DYNAMO-HIA

DYNAMO HIA

a Dynamic Model for Health Impact Assessment

Large set of output measures

- Future risk factor prevalence by age, sex and year
- Future disease prevalence by age, sex and year
- Future mortality/survival by age, sex and year
- Structure of population by age, sex, diseased vs. non-diseased
- Summary measures of population health
  - Life expectancy
  - Life expectancy with(out) diseases
  - Disability-adjusted Life expectancy
  - DALY

cohort and population

What is needed for quantification with DYNAMO-HIA?

1. Input data

   -> large dataset in the tool

   -> data can be easily added with ready to use macros

2. Expectations about effect of intervention/policy on risk factor exposure (also in future)

   -> USER

3. Computer with DYNAMO tool

   -> tool is free available from www.dynamo-hia.eu

Data needed and included for large set of EU countries

Type of data

- Population numbers
- Newborns (optional)
- Incidence, prevalence and mortality for relevant diseases
- All-cause mortality
- All-cause disability (optional)
- Exposure distribution of risk factors
- RRs linking exposure to health outcomes

General:

- All data by single-year of age (0-95 years) and sex
- Flexibility in choice risk factor exposure, disease type and transitions between risk factor states

Scenarios

- Dynamo compares reference and intervention scenario
- Intervention scenario:
  - Change in current RF prevalence

  AND/OR
  - Change in transitions between RF over the life course
- In addition:
  - Reach: 0-100%
  - Target population: age and gender (next to RF)
  - Duration of the simulation

Applications

1) Liberalization access to alcohol in Sweden

2) Possible health gains and potential health losses through smoking, BMI and alcohol consumption in 11 EU member states

3) Health effects of different types of smoking control based on Dutch case

4) The potential health effects of policies targeting overweight in pre-adulthood in the UK

5) The potential effects of increasing excise duties on alcohol in the EU

More to come: DYNAMO-HIA is still new

Wrapping up: DYNAMO-HIA current situation

Dynamo-HIA is generic tool that:

- simulates a real life population trough time (=dynamic)
- models explicit risk factor states
- has modest data requirements: uses population-level data
- provides large set of outcome measures
- is generally accessible: publicly available + no programming skills
- includes database with data for large number of EU countries on:
  - 3 risk factors: smoking, overweight, alcohol
  - nine diseases: IHD, stroke, diabetes, COPD, 5 cancers
  - demographic situation

Tool can be downloaded

- www.dynamo-hia.eu

- Tool
- User guide
- Macros

Funding

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Health and Consumer Protection
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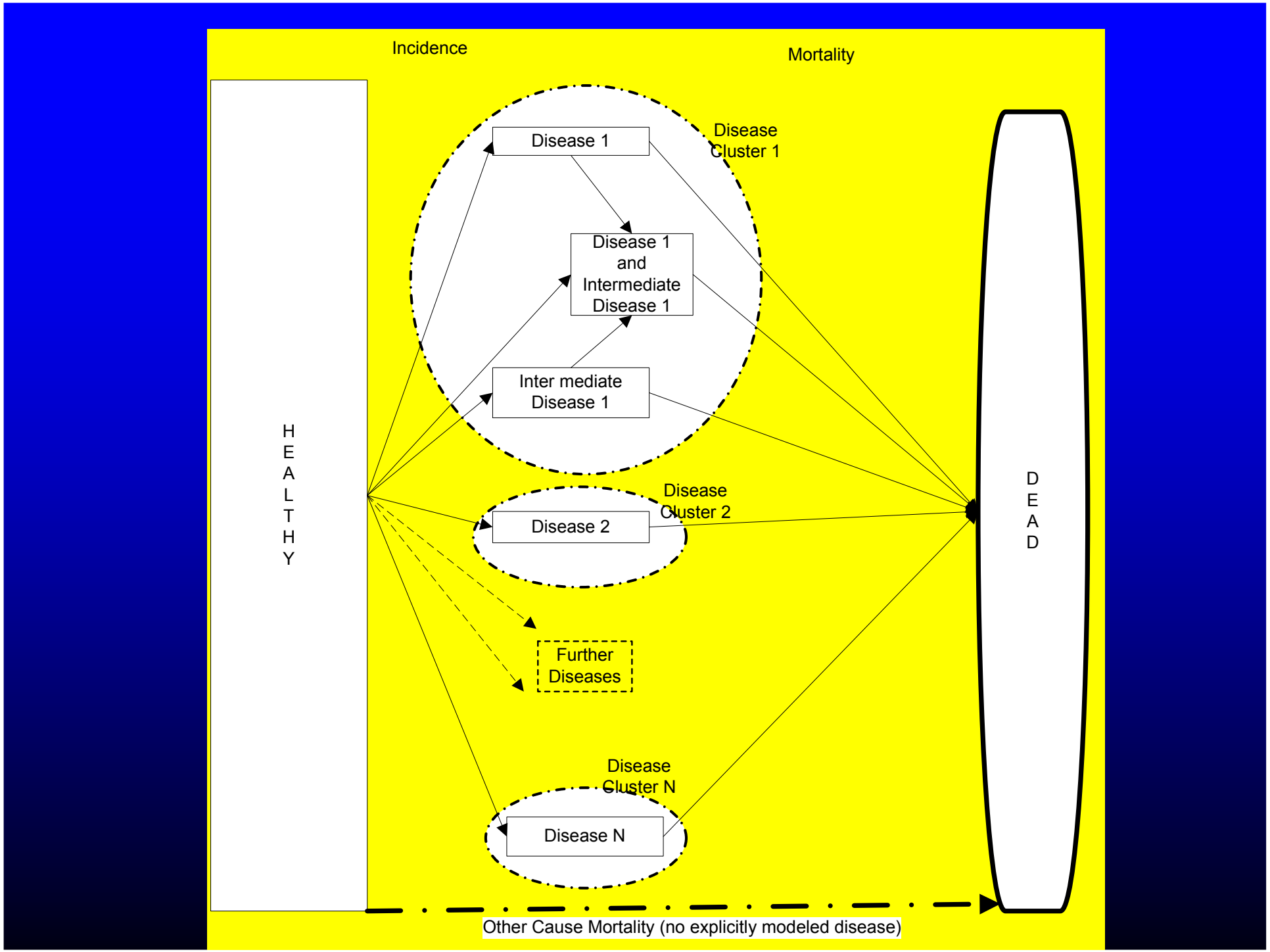
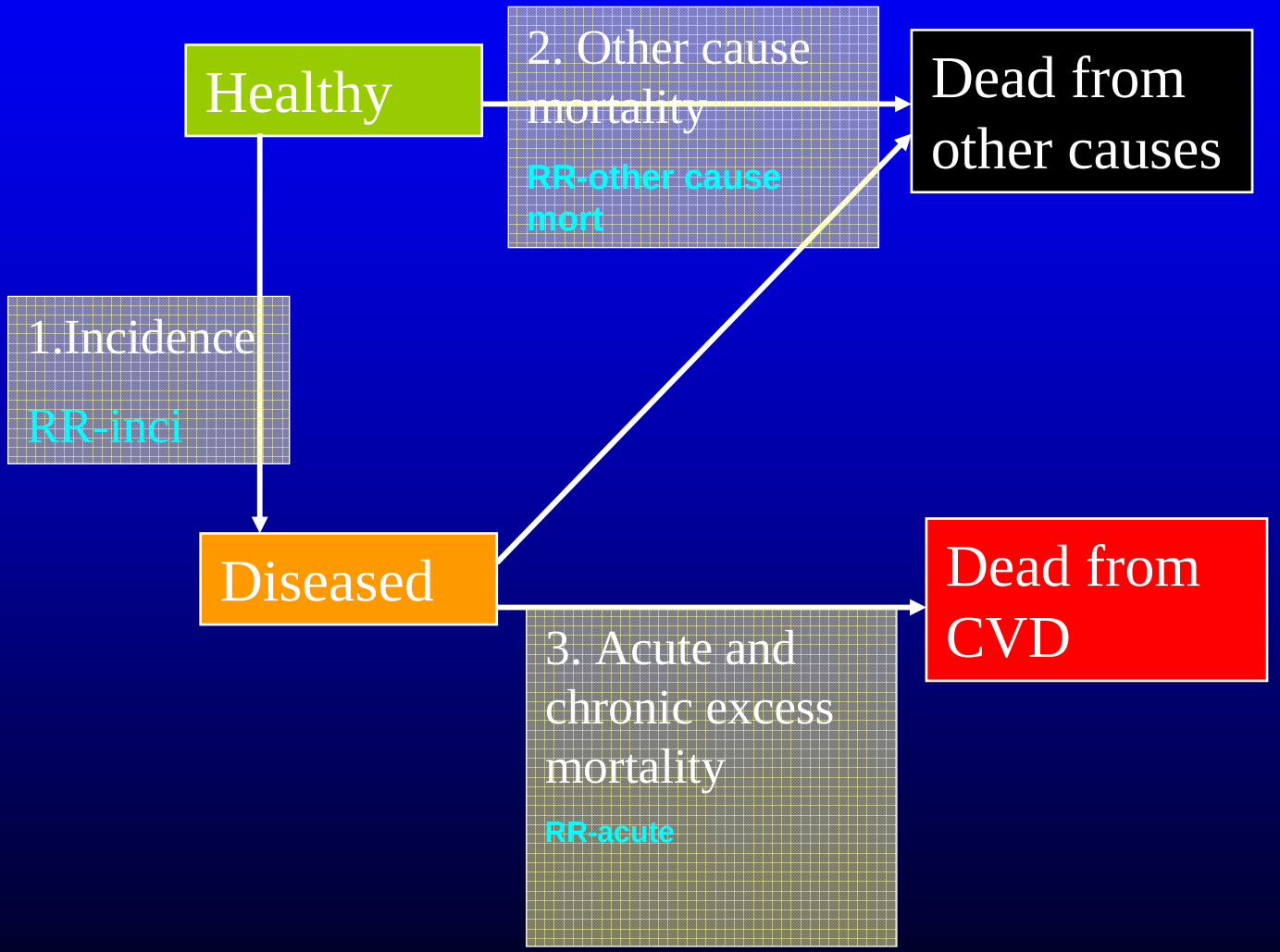
THANK YOU FOR YOUR ATTENTION

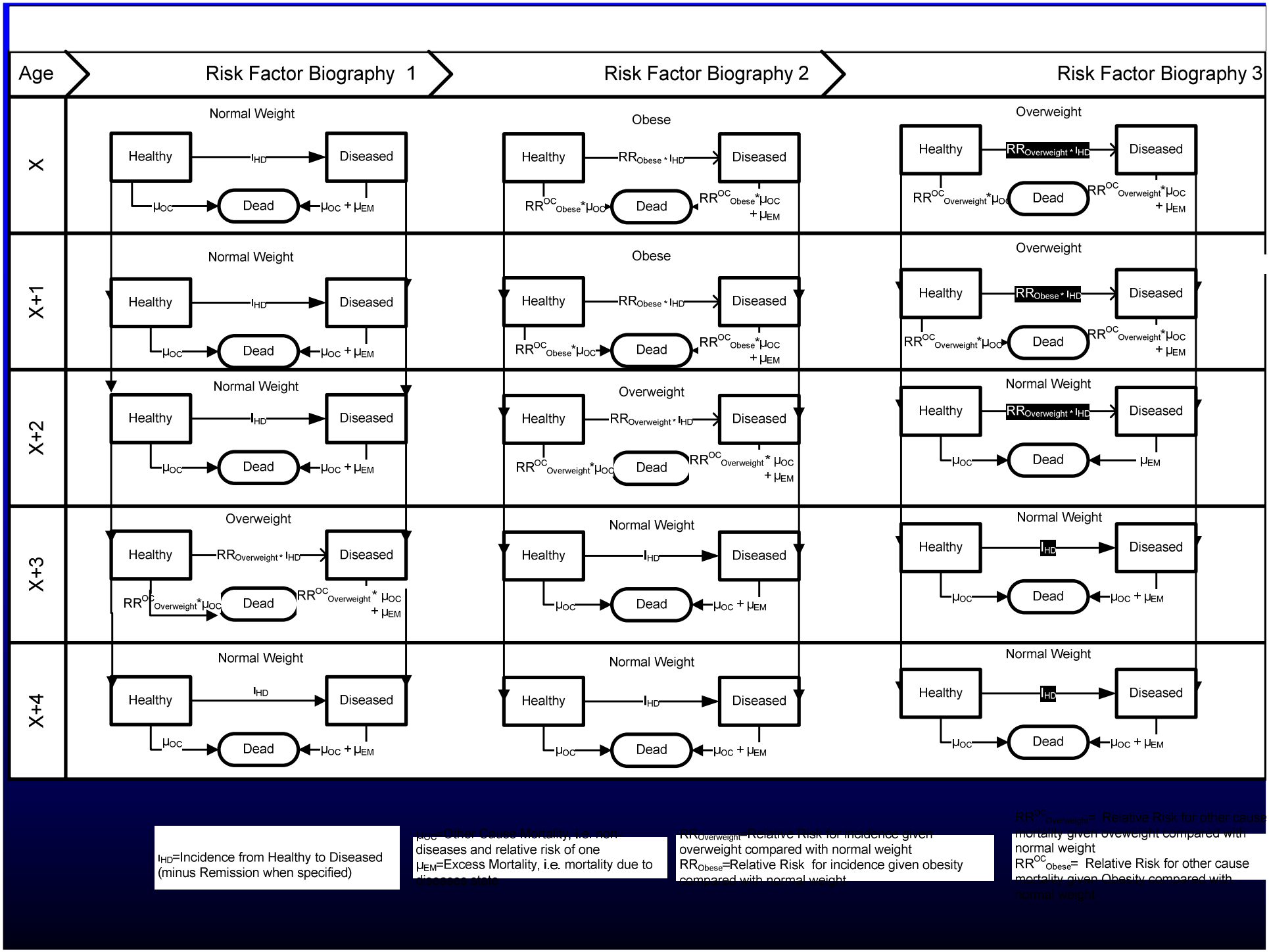
Data already in DYNAMO-HIA

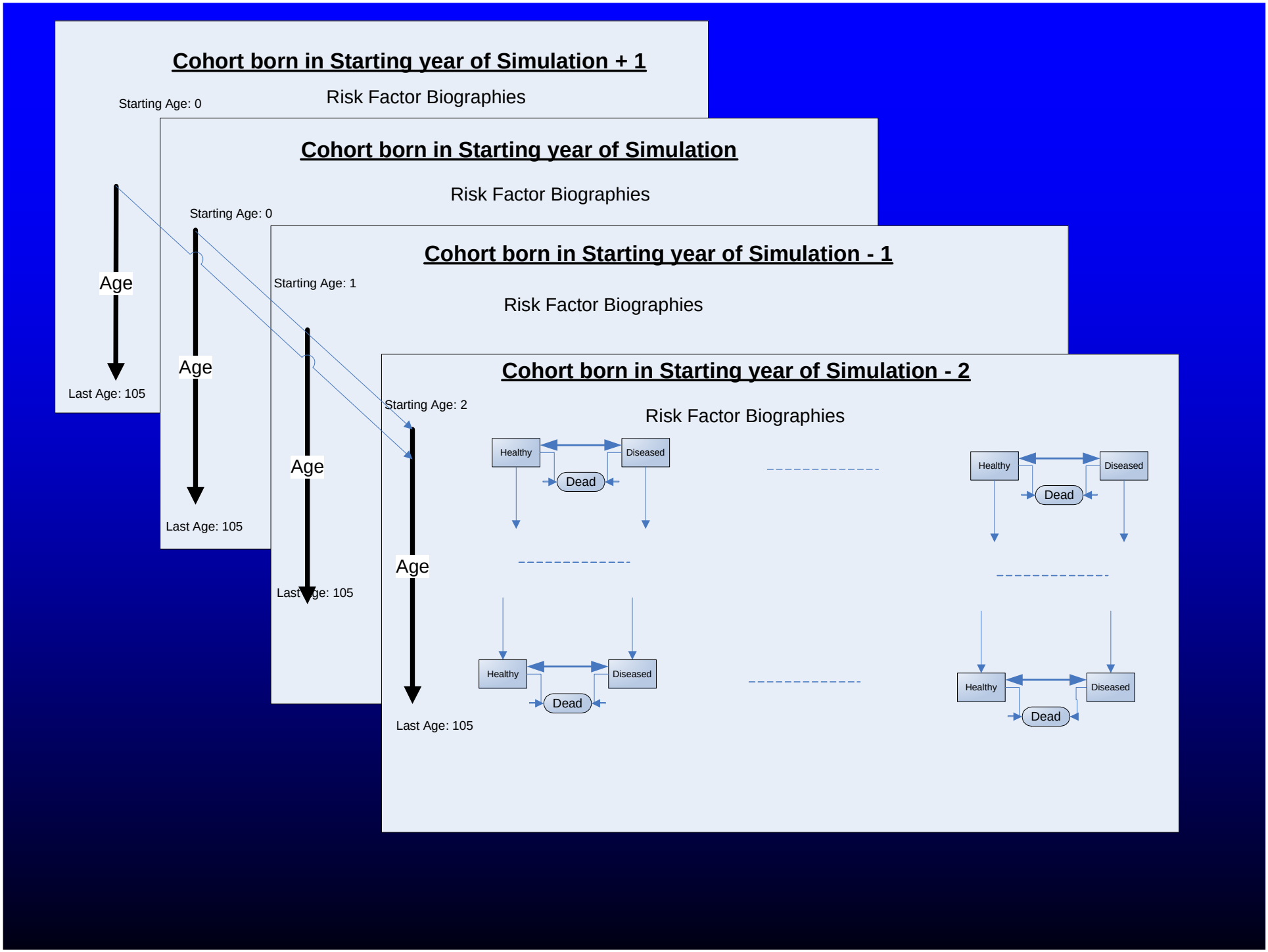
- Population numbers and future new borns: all MS
- All-cause mortality and all-cause disability: all MS
- Exposure distribution of risk factors
  - BMI: 3 categories/ continuous: 15 MS
  - Alcohol: 5 categories: 16 MS
  - Smoking: 3 categories: 18 MS
  - Smoking: former smoking by time since quitting: 8 MS
- IPM (including indirect estimated):
  - Diabetes: 11 MS
  - IHD: 11 MS
  - Stroke: 23 MS
  - COPD: 20 MS
  - Cancers: lung, breast, colorectal oral, oesophagus: 22 MS
- RRs linking exposure to health outcomes: one set for all MS
- Daly weights for diseases: one set for all MS


Incidence
Mortality
HEALTHY
Disease 1
Disease Cluster 1
Disease 1 and Intermediate Disease 1
Inter mediate Disease 1
Disease Cluster 2
Disease 2
Further Diseases
Disease Cluster N
Disease N
DEAD
Other Cause Mortality (no explicitly modeled disease)

Multi state model used in DYNAMO-HIA example for one disease life table




Age
Risk Factor Biography 1
Risk Factor Biography 2
Risk Factor Biography 3
X
X+1
X+2
X+3
X+4
Normal Weight
Obese
Overweight
Healthy
Diseased
Dead
I_{HD}
$RR_{Obese} * I_{HD}$
$RR_{Overweight} * I_{HD}$
μ_{OC}
$\mu_{OC} + \mu_{EM}$
$RR^{OC}_{Obese} * \mu_{OC}$
$RR^{OC}_{Overweight} * \mu_{OC}$
$RR^{OC}_{Obese} * \mu_{OC} + \mu_{EM}$
$RR^{OC}_{Overweight} * \mu_{OC} + \mu_{EM}$
I_{HD}=Incidence from Healthy to Diseased (minus Remission when specified)
μ_{OC}=Other Cause Mortality, i.e. rich diseases and relative risk of one
μ_{EM}=Excess Mortality, i.e. mortality due to disease state
$RR_{Overweight}$=Relative Risk for incidence given overweight compared with normal weight
RR_{Obese}=Relative Risk for incidence given obesity compared with normal weight
$RR^{OC}_{Overweight}$= Relative Risk for other cause mortality given overweight compared with normal weight
RR^{OC}_{Obese}= Relative Risk for other cause mortality given Obesity compared with normal weight


Cohort born in Starting year of Simulation + 1
Risk Factor Biographies
Starting Age: 0
Age
Last Age: 105
Cohort born in Starting year of Simulation
Risk Factor Biographies
Starting Age: 0
Age
Last Age: 105
Cohort born in Starting year of Simulation - 1
Risk Factor Biographies
Starting Age: 1
Age
Last Age: 105
Cohort born in Starting year of Simulation - 2
Risk Factor Biographies
Starting Age: 2
Age
Last Age: 105
Healthy
Diseased
Dead

Quantification tool for HIA

- Predicting health effects is at the core of HIA, but using a quantitative model is still rare in HIA

- Ready to use tool may facilitate quantification in HIA

- No existing tool per 2008 that meets criteria for standard tool

Criteria for a standard tool for quantification in HIA

- 3 criteria to ensure that model structure is sufficiently advanced to model changes in risk factor exposure in a real life population in transparent way:
  1. real-life population
  2. dynamic projection
  3. explicit risk factor states

- 3 criteria to ensure wide applicability accounting for constraints of decision making process
  1. modest data requirements
  2. rich model output
  3. generally accessible