General introduction to DYNAMO – HIA tool

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Purpose of this presentation

- Bird-eye view of DYNAMO-HIA

- More information on:  
  [www.dynamo-hia.eu](http://www.dynamo-hia.eu)

- Or email:  
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What is the health impact of

- Increase price of smoking
- Increase excise tax on alcohol
- Ban advertising unhealthy foods
Without quantitative tool

“Good work .... but I think we need just a little more detail right here”
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

Risk factor → Diseases → Mortality Disability SMFH

• 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)
Tool starts from population-based data

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

But data need is:
• Incidence of diabetes in 40 year old women
• % overweight for 40 year old women
• RR association between overweight and diabetes

Often not available

Available & Used in DYNAMO-HIA
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
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
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
Dynamo compares reference and intervention scenario

Intervention scenario:
- Change in current RF prevalence
- 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 a generic tool that:

- simulates a real life population through 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 a 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](http://www.dynamo-hia.eu)
- Tool
- User guide
- Macros
Funding

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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
Disease 1
Disease Cluster 1

Disease 1 and Intermediate Disease 1

Intermediate Disease 1

Disease 2
Disease Cluster 2

Further Diseases

Disease Cluster N

Disease N

Other Cause Mortality (no explicitly modeled disease)

Incidence

Mortality

HEALTHY

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

1. Incidence
RR-inci

Healthy → Diseased

2. Other cause mortality
RR-other cause mortality

Diseased → Dead from other causes

3. Acute and chronic excess mortality
RR-acute

Diseased → Dead from CVD
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