Landeszentrum Gesundheit
Nordrhein-Westfalen

DYNAMO-HIA –
International experiences, results & further perspectives.

Workshop-documentation, 27 - 28 May 2015, Bielefeld, DE.

Gesundheitsförderung Infektionsschutz Gesundheitsdaten Pharmazie Gesundheitswirtschaft Versorgung

GESUNDHEITSCAMPUS
NORDRHEIN-WESTFALEN

www.lzg.nrw.de

DYNAMO-HIA –
International experiences, results & further perspectives.

Workshop-documentation, 27 – 28 May 2015,
NRW Centre for Health, Bielefeld, Germany.

Landeszentrum Gesundheit Nordrhein-Westfalen

Impressum

Landeszentrum Gesundheit
Nordrhein-Westfalen (LZG.NRW)
Gesundheitscampus-Süd 9
44801 Bochum
Telefon: 0234 91535-0
Telefax: 0234 91535-1999
poststelle@lzg.nrw.de
www.lzg.nrw.de

Redaktion
Monika Mensing (LZG.NRW)
Odile Mekel (LZG.NRW)

Namensbeiträge geben die Meinungen der Verfasser wieder. Sie entsprechen nicht unbedingt der Auffassung des Herausgebers.

Layout und Verlag
LZG.NRW

Bildnachweis
Titelbild: dima_pics - Fotolia.de,
Seite 10: Piotr Wawrzyniuk - Fotolia.de

Das LZG.NRW ist eine Einrichtung des Landes Nordrhein-Westfalen und gehört zum Geschäftsbereich des Ministeriums für Gesundheit, Emanzipation, Pflege und Alter.

Bielefeld, August 2016

Contents

DYNAMO-HIA
Workshop objectives and agenda

In May 2015, the NRW Centre for Health hosted a 2-day scientific expert workshop on dynamic modelling, to quantify the health impact of policies influencing health determinants. International developers as well as users of the software tool “DYNAMO-HIA” (a DYNAmic MOdel for Health Impact Assessment) were invited to discuss modelling approaches, risk assessment and results in different countries and settings, address technical issues of the instrument, exchange experience with contributing to policy-making processes and envisaging future perspectives, like cooperational projects and joint databases.

Participants (from left to right): Odile Mekel (NRW Centre for Health, Bielefeld, D), Hendriek C. Boshuizen and Koen Füssenich (both RIVM, Bilthoven, NL), Henrik Brønnum-Hansen (University of Copenhagen, DK), Monika Mensing (NRW Centre for Health, Bielefeld, D), Wilma Nusselder (Erasmus MC, Rotterdam, NL), Florian Fischer (University of Bielefeld, D), Johanna Schönbach and Stefan K. Lhachimi (BIPS / University of Bremen, D).

DYNAMO-HIA:
International experiences, results & further perspectives
27th – 28th May 2015

Landeszentrum Gesundheit Nordrhein-Westfalen

NRW Centre for Health
Penthouse
Westerfeldstr. 35/37, D-33611 Bielefeld
Tel.: +49 (0) 521-8007-3252

Workshop – Agenda

Day 1

10:30 **Welcome + Workshop Information**
Introduction of participants, Expectations

11:00 **BMI prognostic modelling – potential health gains in the elderly population of NRW**
Monika Mensing (LZG.NRW, D)

12:00 **Modelling effects of nutrition improvements on health outcomes**
Stefan Lhachimi (Leibniz Institute for Prevention Research and Epidemiology, Bremen, D)

12:45 **DYNAMO-HIA open questions (1)**

13:15 **LUNCH (snacks)**

14:00 **Using DYNAMO-HIA batch-mode to perform probabilistic sensitivity analysis: the example of modelling health impacts of dietary salt reduction**
Hendriek Boshuizen (RIVM, Bilthoven, NL)

15:00 **The effect of traffic-related air pollution on respiratory diseases in the municipality of Copenhagen**
Henrik Brønnum-Hansen (University of Copenhagen, Dep. of Public Health, DK)

16:00 **DYNAMO-HIA open questions (2)**

17:30 **End of day 1**

19:00 **Joint dinner in the City Centre of Bielefeld**

Day 2

09:00 **Welcome + summary of day 1**

09:30 **The impact of smoking interventions on Disability-Free Life Expectancy and Healthy Life Years in France**
Wilma Nusselder (Erasmus MC, NL)

11:00 **The health impact of interventions on selected lifestyle risk factors in Copenhagen**
Henrik Brønnum-Hansen (University of Copenhagen, Dep. of Public Health, DK)

11:30 **DYNAMO-HIA open questions (3), further perspectives**

13:00 **LUNCH (snacks) and departure**

Welcome

The NRW Centre for Health: overview of activities related to HIA and HIQ

Odile Mekel
NRW Centre for Health (Germany)
Head of Division Health Data and Assessments, Health Care System

Odile Mekel, Head of the Division "Health Data and Assessments, Health Care System", welcomed the workshop participants and gave a brief overview about aims and tasks of the NRW Centre for Health, as well as the history of Health Impact Quantification activities of the Centre. As the current president of the HIA section of the European Health Association (EUPHA), Odile chairs workshops at the annual European Public Health conferences, and is a member of the HIA network of German speaking countries. Until 2008, Health Impact Quantification at the NRW Centre for Health (and predecessor institutes) focussed on environmental risk factors, facilitated since 2005 by using Summary Measures of Population Health as in the WHO Environmental Burden of Disease ((E) BoD) approach as relevant outcomes of quantification. After 2008, the BoD methodology is also used for Health Impact Assessment (HIA) and the scope was enlarged by taking also other risk factors, in terms of e.g. behavioural factors into account.

The NRW Centre for Health organized and hosted a first scientific expert workshop on health impact modelling in March 2010[1], followed by a second workshop in 2011[2]. Tool developers and users of HIQ models discussed experiences and challenges during these workshops. Results and additional comparative work is published in two publications[3, 4].

In the course of this work, the DYNAMO-HIA software was identified as a tool potentially useful for application in North Rhine-Westphalia. This publicly available software can be used, among others, to model the health impacts of risk factor exposure variation dynamically. The tool is currently adopted for North Rhine-Westphalia by the NRW Centre for Health (section "Health assessments and forecasting"), to support regional HIA by impact quantification.

---

1 https://www.lzg.nrw.de/_media/pdf/liga-fokus/LIGA_Fokus_11.pdf
2 https://www.lzg.nrw.de/service/veranstaltungen/archiv/2011/110413_workshop_health_impact_quantification/index.html
3 Fehr R, Hurley F, Mekel OCL, Mackenbach JP. Quantitative health impact assessment: taking stock and moving forward. J. Epidemiol. Community Health. 2012 Dec; 66(12):1088-91 (http://jech.bmj.com/content/66/12/1088.abstract)
4 Fehr R, Mekel OCL, Hurley F, Mackenbach JP. Health impact assessment: A survey on quantifying tools. Environmental Impact Assessment Review. 2016 Feb; 57:178-86 (http://www.sciencedirect.com/science/article/pii/S0195925516000020)

BMI prognostic modelling

Potential health gains in the elderly population of NRW

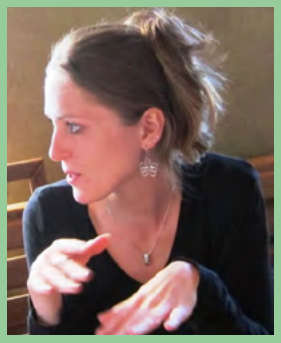
Monika Mensing
NRW Centre for Health (Germany)
Section Health assessments and forecasting

The first adoption of the DYNAMO-HIA tool for the federal state of North Rhine-Westphalia focusses on the risk factor BMI to estimate according prevention potentials expressed in health outcomes, especially in the 60-80 years age group. High BMI is the second most important risk factor (after dietary risks) in Germany when it comes to Burden of Disease: 11% Disability-Adjusted Life Years (DALY) are attributable to high BMI in 2010, contributing to cancer, cardio and circulatory diseases, Type 2 Diabetes (T2DM) (Global Burden of Disease Study 2010) and musculoskeletal disorders. Monika Mensing presented different simulation scenarios, including reduction scenarios assuming that behavioural and/or environmental prevention measures reaching adult population in NRW will substantially lower the probability of becoming overweight over the life course. In addition, a pessimistic scenario was developed, representing the situation that the negative trend during the last 2 decades, the rise of overweight prevalence, would continue in the next 20 years.

The largest health impacts in all scenarios could be estimated for Type 2 Diabetes: in the pessimistic scenario, we would expect approx. 12,000 excess T2DM cases in the 60-80 years old in 2035, compared to the reference scenario that assumes no future major changes in risk factor exposure. In the reduction scenarios, assuming a stable decrease of probability to change from normal weight to overweight (and from overweight to obesity), up to 34,000 excess T2DM cases are estimated to be saved, compared to the reference scenario. Potential health gains in ischemic heart disease were estimated to be much lower – and relevant impact on stroke or cancers could not be identified for the same time period (2015 – 2035).

Modelled health gains by modifying the risk factor BMI seem to be considerably smaller compared to, e.g., smoking. What most modelling approaches have in common, regardless of the risk factor in question, is the lack of longitudinal data on effects of prevention measures.

Modelling effects of nutrition improvements on health outcomes



Stefan K. Lhachimi
BIPS/University of Bremen
(Germany)

Johanna-Katharina Schönbach
BIPS/University of Bremen
(Germany)

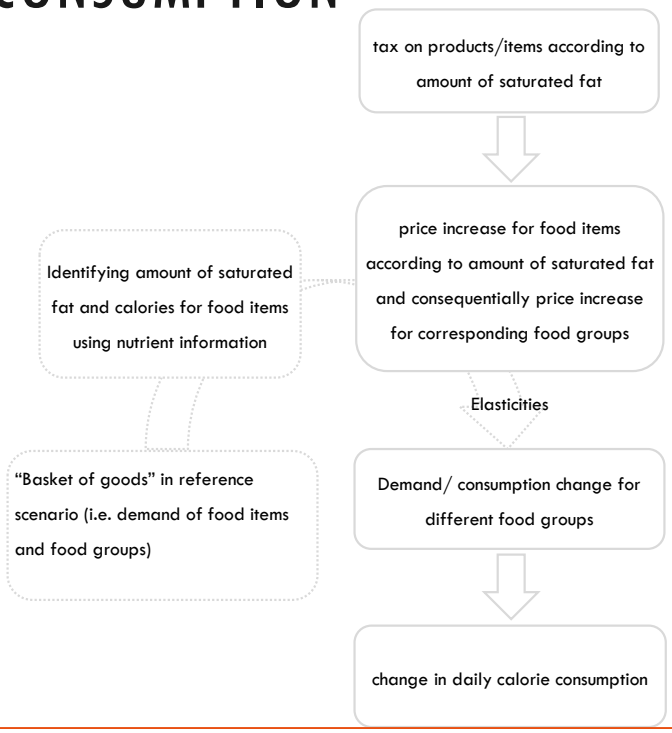
Johanna-Katharina Schönbach and Stefan K. Lhachimi presented a proposed outline for modelling potential effects of nutrition improvements on the risk factor "obesity" and a range of associated chronic diseases using DYNAMO-HIA in cooperation with Silke Thiele (University of Kiel). The underlying idea is to quantify the impact of introducing a hypothetical tax on fat in Germany, namely by taxing products according to their amount of saturated fatty acids (SFA).

With this approach, the authors will simulate a 2004 WHO recommendation about using fiscal policies to influence food prices and hence encourage healthier nutrition.

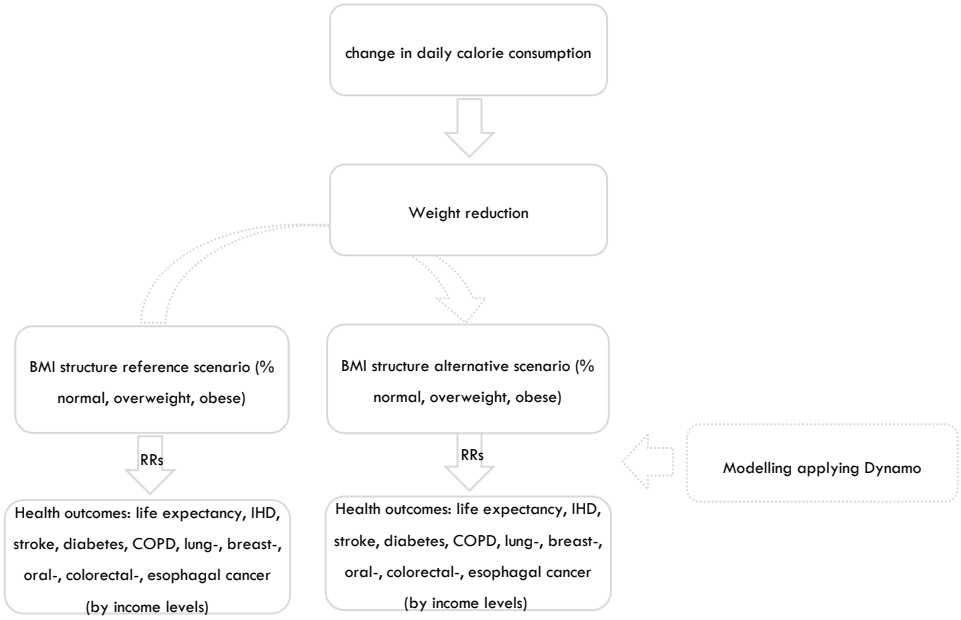
Previous modelling studies have shown potential effects of food taxes and subsidies on diets and corresponding health outcomes (e.g. body weight, chronic diseases), by giving financial incentives to consumers.

The concept examines—via price elasticities—to which extent food intake, its associated calorie consumption and thus BMI could be reduced. With DYNAMO-HIA, the long-term effects of this assumed BMI reduction on mortality, life expectancy and BMI-associated chronic diseases will be quantitatively modelled. The approach accounts for cross-price elasticities. In addition to that, it considers that socioeconomic status groups react differently to price increases, thereby exploring varying efficiency of a fiscal policy with regard to health outcomes.

PART A: FROM „FAT TAX“ TO CALORIE CONSUMPTION



PART B: FROM CALORIE CONSUMPTION TO HEALTH OUTCOMES

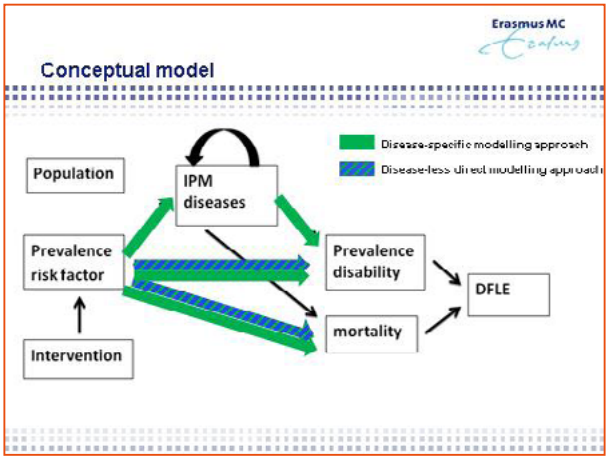


Modelling the effects of intervention and policies

on Disability-Free Life Expectancy using DYNAMO-HIA

Wilma Nusselder
Erasmus University Medical Center in Rotterdam, The Netherlands

Wilma Nusselder led the participants through her scientific work on modelling the Healthy Life Years (HLY) indicator, one of the Summary Measures of Population Health, known as health expectancies. One of the EU's targets is to increase HLY by 2 years until 2020. Impact estimates via dynamic modelling can be of help in this context. In principle, two approaches are conceivable in this context: a) a disease-less direct approach, not modelling diseases, but hazards of mortality and disability that result instantaneously from the risk factor, and b) a disease-specific approach, modelling the sums of risks of mortality and disability whether they have their roots in "background" all-causes or in DYNAMO-HIA-integrated diseases. As an example for a), Wilma modelled the direct effects of different smoking intervention scenarios on all-cause mortality (using relative risks) and disabilities (using odds ratios), looking at the outcomes for HLY and life expectancy for today 15-year-olds in France. The benefit of between about 3 (women) and 5 (men) HLY in a favourable, but unrealistic "smoking-free population"- scenario adumbrates the large losses due to smoking. The scenario "no smoking initiation" requires perseverance, since its substantial effects take a long time in the life-course to manifest, while scenario "all smokers quit" results into much quicker but smaller estimated gains. Reasonable real-life scenarios targeting smoking cessation and initiation seem to have only small effects on Healthy Life Years in the short term. As an example for b), the impacts of physical activity (PA) interventions on Disability-Free Life Expectancy (DFLE) of cohort aged 50 yrs. in the Netherlands were modelled. Data requirements are remarkable:



data on risk factor prevalence in the population and its sensibility to intervention measures are needed and have to be implemented in the software. Furthermore, the associations between the risk factor, chronic diseases, disability and mortality have to be derived from the literature or assessed from individual data. The modelling reveals that the investigated interventions "Active plus" (active-plus.nl) and "10,000 Steps Ghent" could only reach between 0.5 and 1 year gain in DFLE for the cohort, if 100% of the cohort would be reached by these interventions. The overall life expectancy would slightly be prolonged.

The effect of traffic-related air pollution on respiratory diseases
in the municipality of Copenhagen (DK)

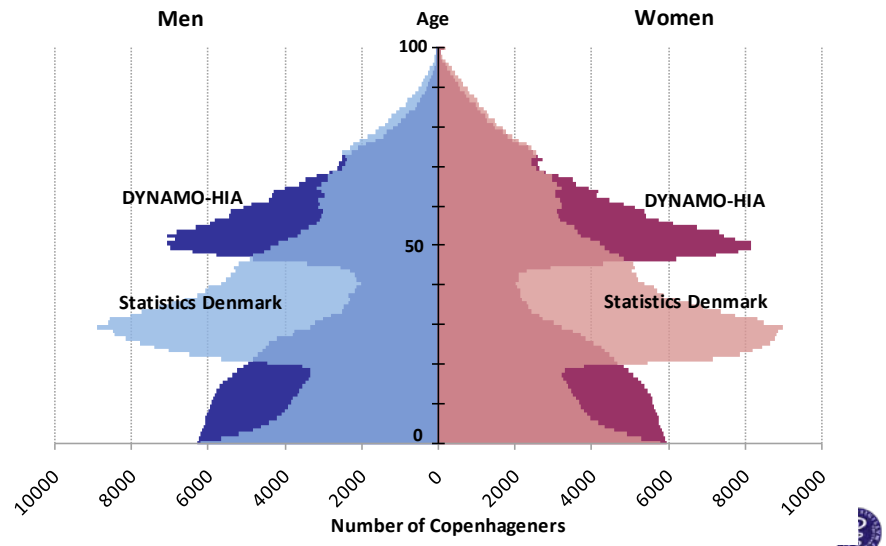
Henrik Brønnum-Hansen
Faculty of Health and Medical Sciences, University of Copenhagen, Denmark

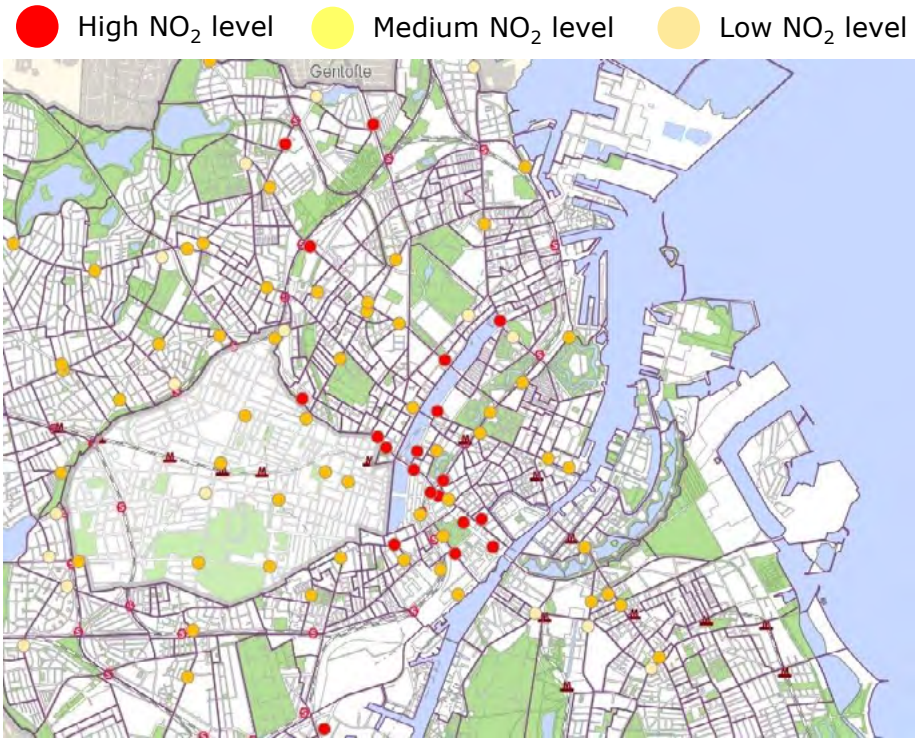
Henrik Brønnum-Hansen introduced an application example of DYNAMO-HIA for the municipality of Copenhagen, capital city of Denmark. Copenhagen, with approx. 580,000 relatively young citizens, is characterized by an above-average population dynamic: young people moving to the city for educational reasons and leaving again when founding families. Therefore, modelling interventions for Copenhagen always bears the risk that the "effect leaves the city", while those who immigrate will only be partly effected. As to modelling health outcomes of air pollution, measuring the exposure, its associations with diseases and the dynamic of the exposed demography mentioned above are challenging tasks.

Henrik used different levels of NO_2 (nitrogen dioxide) concentration as the best available proxy of traffic-related air pollution, increasing the risk of lung cancer and chronic obstructive pulmonary disease (COPD). The exposure was estimated by using publicly available data of 99 air quality measuring stations in Copenhagen.

Explorative modelling results revealed that, if it was possible to reduce NO_2-exposure to a low level throughout the city, an estimated total of approx. 568 life years without lung cancer (men) and 3422 life years without COPD (men) could be gained up to the year 2040. For women: 672 years (lung cancer) and 4092 life years (COPD), respectively. Limitations of the approach, like difficulties to measure exposure to air pollution due to variations in place and time and due to migration have to be kept in mind. Since the presentation at the workshop, much more eligible exposure data has been procured. Thus, the reported results should be considered as very preliminary.

Population pyramid, Copenhagen 2040 from DYNAMO-HIA and Statistics Denmark forecast





The health impact of interventions on selected risk factors
in the municipality of Copenhagen (DK)

Henrik Brønnum-Hansen
Faculty of Health and Medical Sciences, University of Copenhagen, Denmark

Henrik Brønnum-Hansen's second application of dynamic modelling is more broad-based and dedicates to physical inactivity, high alcohol consumption and smoking and their impacts on ischemic heart disease, stroke, lung cancer and COPD. Henrik has access to comprehensive data sources from the Danish national Health Survey, Statistics Denmark, the Danish National Patient Register and the Danish Register of Causes of Death.

The alternative scenarios of the 3 modellings, in comparison to the business-as-usual scenario, can be described as "No citizen is sedentary in leisure-time", "No citizen drinks more than the recommended alcohol limit" and "4 % smoking prevalence in year 2025". The challenge of establishing reasonable transition probabilities between smoking categories was dealt with. Up to the year 2040, women in Copenhagen would gain especially by the cessation of sedentary behaviour, prolonging their period life expectancy by more than 2 years. The (almost) smoke-free Copenhagen accounts for 1 estimated additional year, drinking less for about 0.25 years. For men in Copenhagen, the smoke-free scenario is the most beneficial one, prolonging their life expectancy by approx. 1.25 years. Physical activity during leisure time adds an estimated 1.1 years, drinking less adds approx. 0.2 years.

Data sources

- **Risk factor exposure**
  - Danish National Health Survey
- **Population demographics**
  - Statistics Denmark
- **Incidence and prevalence of relevant diseases**
  - The Danish National Patient Register
- **Mortality from relevant diseases and all-cause**
  - The Danish Register of Causes of Death
- **Estimates of relative risks**
  - Epidemiological studies

Using DYNAMO-HIA batch-mode to perform probabilistic uncertainty analysis

The example of modelling health impacts of dietary salt reduction

Hendriek C. Boshuizen
National Institute for Public Health Environment (RIVM), Bilthoven, The Netherlands

When modelling potential future developments quantitatively, performing uncertainty or sensitivity analysis is indispensable to assess the range of events that might occur and to estimate the accuracy of modelling results. Changing one or more input parameter entering the model (univariate/multivariate uncertainty analysis) and investigate the effects on outputs results are possible approaches to do so. Hendriek C. Boshuizen presented a third option: the propagation of uncertainty by using a Monte Carlo simulation approach. By randomly and repeatingly drawing values from the distribution of the input parameters and including them to the model, hundreds or thousands of output estimates are generated, thus providing a confidence interval for the output of interest. Using DYNAMO-HIA in the so-called batch mode allows automatic running of this vast number of simulations.

Hendriek's PhD student Marieke Hendriksen applied the technique on the simulation of reduced salt intake impact on systolic blood pressure as the risk factor and subsequently on the health outcomes of ischemic heart disease, stroke and mortality. Hendriek presented projected disease prevalence and mortality reductions over 20 years for nine European countries due to a 30% salt intake reduction from this study. The conclusion to be noted: probabilistic uncertainty analysis is feasible, but requires programming skills. The batch mode is also a useful tool for repeated calculations in DYNAMO application fields, so it's worth the effort to become familiar with the technique.

Future perspectives

The presentations of the workshop participants and the lively discussions demonstrated impo-singly the wide range of possible modelling applications of the DYNAMO-HIA instrument.

By the generic character of the software, allowing the user to add further risk factors, health outcomes, and local prevalence data for the geographical area of interest or updated exposu-re-response-functions, DYNAMO-HIA has proved valuable in different scientific issues.

However, it must be acknowledged that the proper use of the instrument requires a certain time for training as well as a comprehensive epidemiological understanding. The challenge of 'translating' future risk factor exposure scenarios, assumptions about behavioural changes due to preventive measures, and consequences for population health into worksheets to be imported in the software should not be underestimated. Questions arising in this context can e.g. be described as follows:

- What to do best when (longitudinal) evidence data is not available?
- How to translate Relative Risks (or Odds Ratios) from meta-analyses of intervention studies, or national Health Goals, into comprehensible transition rates for different age groups?
- What potential pitfalls should be kept in mind, when augmenting the existing DYNAMO-HIA database?
- How to deal with DALYs and the corresponding disability weights?
- How to do feasible sensitivity and uncertainty analyses?
- How to address modelling results to the policy-making process?

Regular communication and an exchange between users of DYNAMO-HIA, as well as other researchers involved in health impact quantification are further on indispensable necessary to ensure reliable modelling results.

Therefore, the workshop participants intend to organize future meetings to maintain the dialog and facilitate cooperational work in this field.

Landeszentrum Gesundheit
Nordrhein-Westfalen

Gesundheitscampus 10
44801 Bochum
Telefon 0234 91535-0
Telefax 0234 91535-1694
poststelle@lzg.nrw.de
www.lzg.nrw.de