HEIMTSA

Health and **E**nvironment **I**ntegrated **M**ethodology
and **T**oolbox for **S**cenario **A**ssessment

Newsletter No. 5

Contents




Overview

Fintan Hurley, Institute of Occupational Medicine (IOM, Scotland, UK)

HEIMTSA finishes at end January 2011 and so now, as we enter the final months, it is a very busy time. The work continues, as before, to revolve around four areas:

- Development of methods for health impact assessment (HIA) and cost-benefit analysis (CBA);
- Development of tools to implement those methods;
- Worked examples ('case studies') showing how use of the preferred approach – the application of full chain methods within integrated environmental HIA – works out in practice; and
- Development of capability through dissemination and training.

Many of these activities are carried out in collaboration with INTARESE (www.intarese.org), so that the Commission and other stakeholders will have a joined-up set of methods, tools and worked examples. In particular, HEIMTSA and INTARESE continue to work together on a Common Case Study, and on an Integrated Toolbox.

The Common Case Study

The Common Case Study is the most comprehensive worked example from HEIMTSA and INTARESE. It concerns the wider environmental health impacts of EU-level policies intended to mitigate and/or adapt to the effects of global warming. In practical terms, this work will contribute to the growing body of evidence that climate change policies can and do have effects, indeed have benefits, much wider than their effects on global warming; and that it is important to consider these additional effects/co-benefits both in policy-making and in public debate.

Methodologically, the Common Case Study covers a wide range of pollutants and other risk factors in many sectors, notably energy, transport and agriculture. The key issue for Rainer Friedrich and colleagues at University of Stuttgart, and for the two project teams, is to identify feasible tasks in the time available. It's looking interesting – more on this in the next issue.

The Integrated Toolbox

This consists of three complementary parts:

- A Guidance System, explaining Integrated Environmental Health Impact Assessment (IEHIA) and what it takes to apply it in real-life situations, including worked examples from both projects and in particular on the Common Case Study;
- A Toolkit of selected stand-alone tools;
- An Integrated Environmental Health Impact Assessment Computational System (IEHIACS).

All three parts draw on the experience of both projects. However, while INTARESE lead on the first two aspects, the Computational System is principally a development of HEIMTSA and is described in the first substantive article of this Newsletter.

Methodology

The main strength of HEIMTSA's methodology lies in its application to complex problems, as illustrated by the Common Case Study. However, the validity of any implementation depends also on the detail at each stage; and HEIMTSA continues to extend its work on detailed methods. The present Newsletter gives brief descriptions of three such developments – on the relationship between Disability-Adjusted Life Years (DALYs) and monetary valuation; on 'cocktails' of pollutants; and on modelling personal exposures to PM from outdoor and indoor sources.

Building Capability – Dissemination and Training

Finally, at this stage of HEIMTSA our focus shifts strongly to Dissemination and Training. Here we are developing plans with help from an expanding Project Advisory Board, and working in close collaboration with INTARESE, also 2-FUN, and other relevant projects (e.g. APHEKOM, RISKASSETS). Some ideas are given in this Newsletter – the programme will be fleshed out more after a joint meeting on Sept 16th. Meantime, we hope you enjoy this Newsletter, and once again thanks to NILU who have co-ordinated getting it prepared and sent to you.

Fintan Hurley
Project co-ordinator

Integrated Assessment Computational Tool

Dimosthenis A. Sarigiannis, Alberto Gotti, JRC, Italy

The computational platform of the HEIMTSA system allows the execution of complex calculations serving the needs of integrated health impact assessment of environment-related stressors and policies

The architecture of the HEIMTSA system is structured around three tiers as follows:

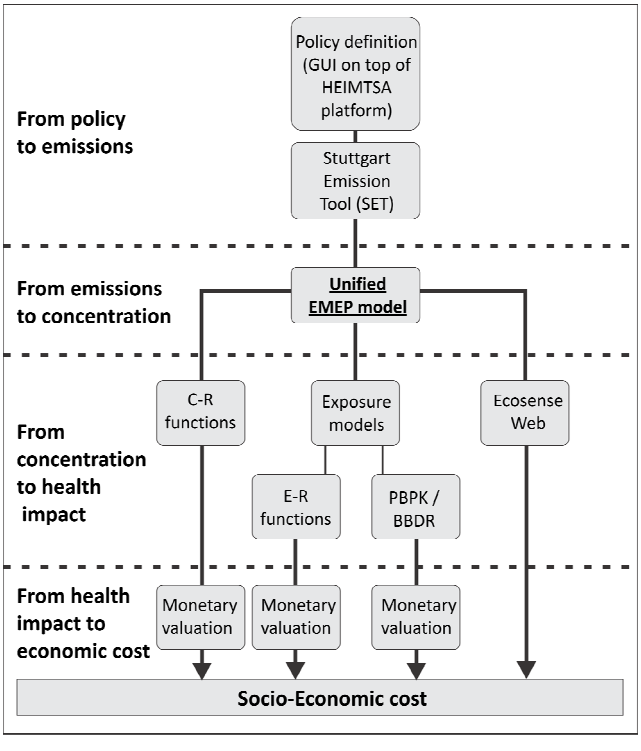
1. The HEIMTSA Client. It needs to have an Internet connection and a web-browser must be installed. Other specific software requirements are not requested since the end-user workstation will not perform any calculations.
2. The "HEIMTSA" main server coupled with a backup server (Application tier), which provides basic services to all HEIMTSA applications in the form of Application Programming Interfaces (APIs) and web-services. It has mainly five tasks:

- To handle the access of each user to the system and manage access rights regarding the management, data extraction and updating of the geo-referenced database.
- To implement the functionalities required in common by the HEIMTSA applications, so that this common set is centrally managed and maintained.
- To manage all traffic of requests for database access to and from the various applications. Each application serves all users by implementing the functional characteristics of each end-user community (research institutes, decision makers). All these applications access the same underlying geo-referenced database, each with its own access rights.
- To implement interfaces for relevant types of data in the HEIMTSA system in order to load different types of data on the database (e.g. concentration maps, emission data, exposure data).
- To visualize and spatially analyse in a web GIS environment the results of each step of the different model chains.

3. The Centralized Geographical Database (Data Tier), which stores and manages all the types of the underlying geo-referenced information (environmental data, modelling results, 3D terrain models, temporal information, statistical data, population density, time activity patterns etc.).

The different models available to the HEIMTSA consortium range from atmospheric dispersion models (outdoor and indoor) to exposure models and from health impact models to monetary valuation functions. Several are very complex systems running on powerful computer servers with extended computation time making their full integration into the platform inappropriate. Only the "simpler" models are implemented directly in the platform; the "complex" ones are run remotely from the owner's computer server. These are accessible to the users via the web through tailored Graphical User Interfaces. In both cases the model input/output will be stored in the centralized GeoDb.

To assist the generic user in executing a model chain and to avoid the creation of inappropriate model chains, some pre-defined chains have been already implemented in the computational platform. The pre-defined model chains have been grouped on the basis of environmental media: outdoor air, indoor air, noise, complex pathways. For each one of them several possible combinations of models have been identified. See for example the case of outdoor air here below:



Relation between burden of disease and cost of illness

Joris Aertsens, Jurgen Buekers, Steven Broekx, Johan Bierkens, Rudi Torfs, VITO, Belgium

HEIMTSA develops an integrated approach considering the impact of environment on health and its consequences. Health impact assessment requires aggregate indicators to inform policy making and to improve the evaluation of policy scenarios. Our research compares 2 measures for the impact on health: (i) the burden of disease (BOD), measured in lost "years" (DALYs), and (ii) the societal cost of illness (COI), expressed in EURO. The relation between BOD and COI is highlighted.

The WHO collects a vast set of data on the Burden of Disease (BOD) expressed in DALYs. The BOD is calculated as the sum of the years of life lost due to premature mortality (YLL) and the years lost due to disability (YLD): DALY = YLL + YLD.

Also a lot of resources go to calculating the Cost of Illness (COI) for several diseases. COI is calculated as the sum of direct and indirect costs (EPA, 2006): e.g. Direct Medical Costs (DMC), and Productivity Loss (PL). While both BOD and COI are relevant indicators for the "burden" or "cost" of diseases for society and thus they are very relevant for policy makers, almost no information is available on their relationship.

Methodology

Data on BOD and COI for 34 German diseases was obtained. Their COI/BOD ratio was calculated. Also the relationships between YLL, YLD, DMC and PL were studied. It was chosen to focus on data from Germany, the European country from which the most scientific studies on COI were available in 2009. Including data from countries differing in GDP per capita, or with important differences in their public health system, would complicate the analysis.

Discussion

Our findings imply that the reduction of 1 DALY for certain diseases will result in a much lower reduction in the "societal cost" than for other diseases. Therefore, when optimizing health expenditures, policy makers should not only consider the BOD, trying to minimize the DALYs, but they should also take account of the COI. This raises the question: "how to trade off between minimizing the BOD and minimizing the COI?", which has ethical implications. Giving priority to minimizing the COI rather than the BOD will prioritize expenditures beneficial for the young and active population (in order to reduce productivity loss), while providing less resources for illnesses that rather affect "non productive" people.

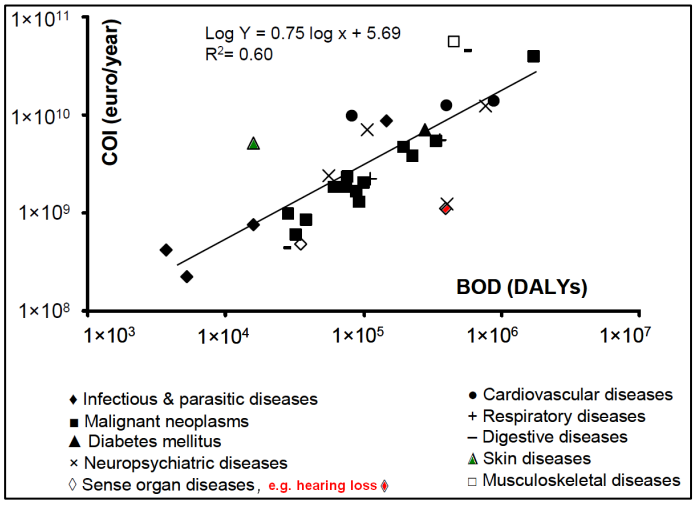


Figure 1: COI per BOD for different diseases in Germany in 2004

More information can be obtained from our report (49 p.) at:
www.vito.be/VITO/EN/HomepageAdmin/Home/WetenschappelijkOnderzoek/p_catalogus

Complex exposure and the effects of 'cocktails'

Dimosthenis A. Sarigiannis, Spyros Karakitsios, JRC, Italy

The current paradigm for the assessment of the health risk of chemical substances focuses primarily on the effects of individual substances for determining the doses of toxicological concern in order to inform appropriately the regulatory process. Given the recently increased public awareness on the link between environmental condition and public health there is an enhanced need for health and safety data.

In Europe, this was signalled in the 6th Environmental Action Plan, where for the first time the issue of environment and health was identified as a key determinant of sustainability.

Since then, a number of legislative initiatives have been undertaken in the European Union with to the aim of reducing the potential adverse effect of environmental pressure on public health as a key dimension for ensuring sustainability. Such regulatory processes include REACH, the Environment & Health Action Plan, the Plant Protection Products Directive and the Water Framework Directive. These policy instruments place varying requirements on health and safety data of chemicals in the environment. REACH focuses on safety of individual substances; yet all the other facets of public health policy that relate to chemical stressors put emphasis on the effects of combined exposure to mixtures of chemical and physical agents.

The European Environment Council has recently recognized the need to develop regulatory approaches for assessing combination effects of environmental pollutants.

Complex pollutants in HEIMTSA

HEIMTSA views the assessment of 'complex' pollutants and mixtures thereof as a key dimension for integrated health impact assessment of environmental stressors. In this regard, the project aims at filling two important methodological gaps.

- Firstly, the quantification of effects across exposure routes, which has not been widely undertaken in previous EU studies.
- Secondly, the fact that in previous studies, the effects of mixtures have been treated as additive with no consideration of the biological plausibility for interactions among the mixture components.

Exposure to mixtures and risk assessment

HEIMTSA recently issued a report on mixtures exposure and risk assessment, which gives an overview of the current state of science regarding the methodologies for quantifying (a) the health effects of human exposure to environmental chemicals by multiple routes and (b) the effects of chemical mixtures. This overview captures current advances in these areas, and goes one step further: it evaluates the relevant work done in the HEIMTSA case studies and draws useful lessons for the development of a comprehensive methodology and its implementation in the HEIMTSA computational toolbox.

The report also provides a concise overview of the most important issues related to biomarkers of exposure, effect, and susceptibility. In order to demonstrate how information on early biological events can be of practical use in risk assessment, the report describes recent advances made using systems biology approaches and '–omics' technologies. These methodologies allow development of a connectivity paradigm that allows an integrated use of biological and mechanistic information to provide a conceptual advancement in the method and practice of health risk and impact assessment. As an example, the report presents state-of-the-art methods for health impact assessment of mixtures of specific chemical families such as pesticides and PCBs.

The report is available as HEIMTSA deliverable at
http://www.heimtsa.eu/LinkClick.aspx?filetick et=4L9vjvAiYO0%3d&tabid=2937&mid=6403

The TooL for Air Pollution Exposure Modelling & Assessment (LAMA)

Lydia Gerharz, University of Münster, Germany; Alexandra Kuhn, University of Stuttgart, Germany; Miranda Loh, THL, Finland; Aileen Yang, Norwegian Institute for Air Research, Norway

Fine particles ($PM_{2.5}$) have been found in several health impact assessments (e.g. CAFE, EBoDE) to be responsible for the largest burden of disease from environmental causes. Past assessments have used estimates of outdoor concentrations of $PM_{2.5}$ as exposure proxies.

Within HEIMTSA this is taken one step further by estimating the person-level exposures of the European population. A HEIMTSA team is developing the exposure model LAMA that can incorporate different types of $PM_{2.5}$ exposure-reduction policy assessments, beyond outdoor emission changes. For example, insulation measures that reduce the infiltration of $PM_{2.5}$ from the outdoors to the indoors can be evaluated, as well as measures that change people's time use. LAMA incorporates a novel estimate of the urban increment, the added concentration over background concentrations, for cities over 50 000 people.

LAMA will estimate annual average population-weighted exposure for EU-30, on a country and grid-cell (50x50km) level, stratified by population subgroups. The model combines the exposure due to outdoor sources plus the exposure due to indoor sources by taking into account the concentration and time spent in single microenvironments. Figure 2 beneath shows a sample run from LAMA for Germany for a baseline scenario using data from 2010.

LAMA in HEIMTSA

LAMA will be used in the Common Case Study to estimate the impact of climate related policy measures like the increased use of biomass burning (particularly wood) as a carbon neutral source of energy. Exposure to wood smoke under a business-as-usual and 2 degree scenario will be examined by modelling the change in outdoor wood smoke $PM_{2.5}$ concentrations (by other teams of the Common Case Study) and the change in indoor concentrations from infiltration and indoor emissions from home wood burning. A second measure of interest will be improving insulation of buildings to reduce the energy demand from heating and cooling. LAMA developers expect that the latter effect will reduce the infiltration of $PM_{2.5}$ from outdoors to indoors and increase the accumulation of indoor sources.

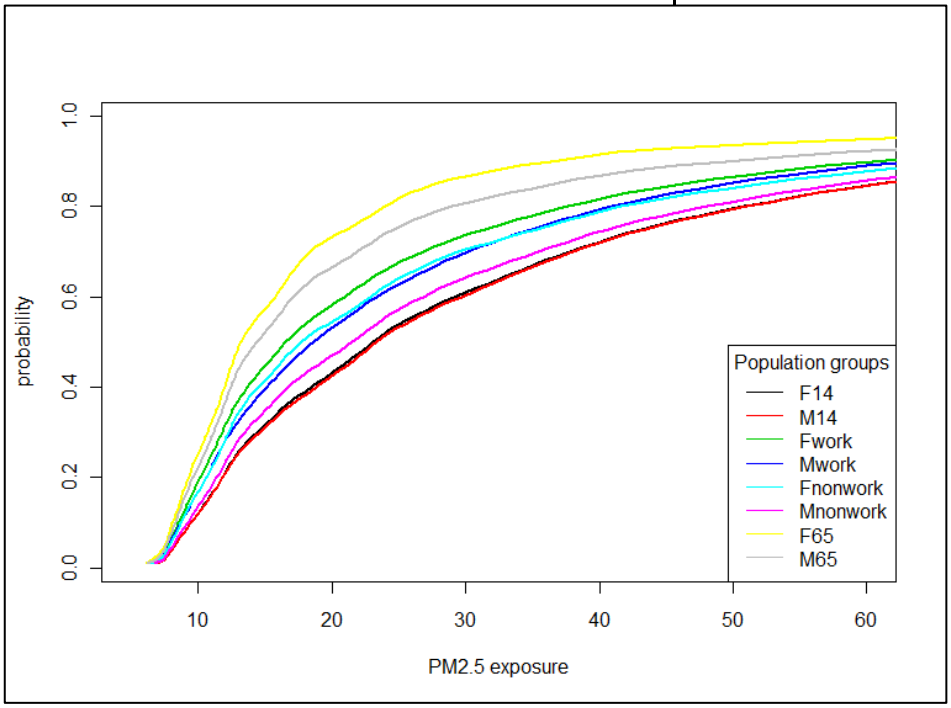


Figure 2: Cumulative probability curves for $PM_{2.5}$ exposure in $\mu g.m^{-3}$ of different subgroups (female/male under 15, between 15 and 64 working/nonworking and over 65) in Germany for baseline scenario.

The LAMA modell

HEIMTSA/INTARESE Toolbox Filling Workshop
Stuttgart, 14-18 June 2010

From June 14 to 18 the HEIMTSA/INTARESE common toolbox filling workshop was held at the University of Stuttgart. The focus of the workshop was the Guidance System, giving web-based support to those who wish to carry out an integrated environmental health impact assessment, and others.

The goals of the meeting were to give the attendees an overview of the Guidance System and train and support the project partners in working with this aspect of the toolbox. Furthermore the aim was to address and solve problems cooperatively in small workgroups – especially regarding usability, layout and structural issues.

As a result of the work and discussions, a "help" section answering most of the questions arising regarding the filling of the Guidance System, was developed.

The Guidance System of the IEHIAS – The Integrated Environmental Health Impact Assessment System, as the toolbox is officially called now – is still under development; the reader will therefore be provided with the link in the next issue.

Thanks to everyone attending the filling meeting, this work has taken a big step forward - and will be improved even more based on the suggestions.

Although a lot of data has been added during the workshop, further contributions from all the project partners are more than welcome.

Once again, thanks to all attendees for making this workshop a success.

Dissemination and Training Activities

Due to the fact that the activities during the final project year will have a focus on dissemination and training, this newsletter includes some information on that topic.

Dissemination *per se* means to scatter or sow a message to a broader audience. The objective of dissemination activities in HEIMTSA is to organise the flow of scientific information within the consortium, to inform all relevant segments of society about HEIMTSA and its activities and to promote the dissemination of project results to the scientific community and further stakeholder groups, such as representatives from EU, industry, regulators and health and environment professionals.

During the first years, HEIMTSA's dissemination activities towards external stakeholders consisted mainly in spreading information about the project idea, whereas during the 3rd year first methods, tools and results could be presented. In the final project year, a proactive approach towards stakeholders will be intensified and expanded by training activities on integrated environmental health impact assessment (IEHIA). Joint-up INTARESE and HEIMTSA methods and tools will be presented by means of working examples with focus on the joint common case study. Training sessions on the purpose and use of the Integrated Environmental Health Impact Assessment System and the HEIMTSA toolbox will be held.

More detailed plans of dissemination and training activities in HEIMTSA are being developed, including via a joint meeting with the HEIMTSA Project advisory Board, and with INTARESE and 2-FUN, on September 16th.

Upcoming events

28 August-01 September 2010
ISES-ISEE 2010
Seoul, KR
http://www.isesisee2010.org/

05-10 September 2010
11th World Congress on Environmental Health
Vancouver, CA
http://www.ifeh2010.org/

12-18 September 2010
SFFR and EEMS Joint Annual Meeting with special interest workshop on environmental health impacts
Oslo, NO

13-15 September 2010
ERA-ENVHEALTH General Assembly Meeting
The Hague, NL

19-23 September 2010
15th international conference on Heavy Metals in the Environment
Gdansk, PL
http://www.pg.gda.pl/chem/ichmet/

20-21 September 2010
Workshop on 'Health Impact Assessment: Achieving success and overcoming barriers'
Mahon, Spain

27-29 September 2010
2nd International Symposium on Green Chemistry for Environment and Health
Mykonos Island, HE

18 October 2010
Indoor Air Quality in Different Life Settings
Brussels, BE

19-22 October 2010
Managing the Urban Rural Interface
Copenhagen, DK

25-26 October 2010
Emerging Exposure Science for developing Chemical Regulatory Policy: REACh, Biocides, TSCA reform
Brussels, BE

27-28 October 2010
From Human Biomonitoring to Policy: A Sustainable 'Marriage' between Health and Environment
Brussels, BE

10-13 November 2010
3rd European Public Health Conference
Amsterdam, NL
http://www.eupha.org/site/upcoming_conference.php

Links to HEIMTSA's 'sister' projects:

INTARESE
INTegrated **A**ssessment of Health **R**isks of **E**nvironmental **S**tressors in **E**urope
http://www.intarese.org/

2-FUN
Full-chain and **UN**certainty Approaches for Assessing Health Risks in **FU**ture E**N**vironmental Scenarios
http://www.2-fun.org/

Health and Environment Networking Portal
http://www.henvinet.eu

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