Climate change and health in the Netherlands

J.A. Wardekker, J.P. van der Sluijs

2014

In: T. Capela Lourenço, A. Rovisco, A. Groot, C. Nilsson, H.M. Füssel, L. van Bree, R.B. Street (Eds.), "*Adapting to an uncertain climate: Lessons from practice*". Springer International Publishing, p. 96-102.

Note: this is the author's final draft of this book chapter. The final publication can be found, as part of a collection of cases-studies, at: http://dx.doi.org/10.1007/978-3-319-04876-5_4

Summary and key messages

This case-study assessed the degree of uncertainty in various potential health effects of climate change in the Netherlands. Important lessons from this case-study were that:

Country: Netherlands
Sector: Health
Water management *(in relation to health)*
Scale: National
Organisation: Public
Decision-type: Strategic

- Potential health effects due to climate change are associated with large uncertainties and knowledge gaps.
- Analysing and characterising uncertainty by means of a typology combining a scale of 'Level of Precision' with 'Relevance for policy' can be very useful.
- There are important differences in the levels of uncertainty of various health effects. For some effects, it is possible to give rough quantitative estimates (the 'order of magnitude') of the health risk, while for others, even the direction of change is currently unknown. These differences have implications for the policy approach taken.

Background

Climate change can influence public health in many, often subtle and complex ways. Some of these potential impacts are direct, such as the impact of heat waves on heat-related deaths. Others are more indirect, such as the effect of changing climates on the distribution of vectors such as specific types of mosquitoes, which affect the distribution and risk of disease outbreaks. There is a colourful mix of information on the topic, ranging from qualitative discussions on plausible impacts, through lists of knowledge gaps and research needs, to detailed quantitative studies. Projections of health risks of climate change are surrounded with uncertainties, leading to difficulties in determining the policy approach.

The Netherlands Environmental Assessment Agency (PBL), has recently produced the assessments "Impacts of climate change in the Netherlands: 2012" (2012) and "Roadmap to a climate-proof Netherlands" (2009) for the Dutch government. Within these assessments it was important to account for uncertainties in a policy-relevant way and so PBL asked Utrecht University to perform several case-studies to contribute to the ongoing work. The goal of this case-study was to characterise the uncertainties associated with various health effects, and to assess the resulting policy implications.

Process

The process carried out by the Utrecht University was as follows:

- A list of 33 potential health impacts of climate change was compiled based on existing Dutch impact assessments and international literature. These impacts were grouped into eight health themes: temperature, allergies, pests, vector-borne diseases, food/water-borne diseases, air quality, flooding/storm and UV related.
- A questionnaire based expert elicitation was completed. National and international experts (scientists and practitioners) were asked to indicate the level of precision with which health risks could be estimated given the present state of knowledge.
- Suggestions were made for dealing with uncertainties in climate change adaptation policy strategies.

Categories of health impacts of climate change included:

- Temperature
- Allergies
- Pests
- Vector-borne diseases
- Food- and waterborne diseases
- Air quality
- Flooding and storm

The results of the study were used as input to The Netherlands Environmental Assessment Agency's impact and adaptation assessment. They were also presented at a World Health Organisation workshop on policy options for climate change and health.

Uncertainty assessment

In the first part of the study the participating experts were asked to assess the 'Level of Precision' with which health risk estimates could be made given the current state of knowledge. They were also asked to provide full backup for their scores. For example:

- Why is it possible to indicate the direction of change, but not provide a quantitative risk estimate?
- What factors prevent a more precise analysis (e.g. is data unavailable, cause-effect relations not understood)?

- What factors are available that allow a certain level of precision to be applied (e.g. well-established models or detailled data sets are available)?

The questions covered the following categories of uncertainties:

- The climate system, e.g. heat wave frequencies and durations.
- The biological systems, e.g. the relationship between climate and insect distributions, and infection biology.
- The human systems, e.g. autonomous adaptation and responses of health systems, effectiveness of hygiene regulations, and disaster response.

Handling of uncertainty: typology used

The following 'Level of Precision' scale was used to assess the degree to which health effects of climate change can be quantified.

1. Effective ignorance
2. Ambiguous sign or trend
3. Expected sign or trend
4. Order of magnitude
5. Bounds
6. Full probability density function (i.e. full quantitative risk assessment possible)

The scale provides a range from a qualitative indication i.e. whether it is good or bad for health, a rough estimate of the order of magnitude (i.e. 'hundreds of cases' of disease versus 'thousands of cases'), or a detailed risk-based assessment.

The uncertainty typology or the 'Level of Precision' scale used is shown in the box. The 'Level of Precision' question was relatively broad. Potentially, some participants could have scored effects assuming standard climate projections (e.g. the Dutch KNMI or global IPCC scenarios), while others could have taken broader ignorance regarding local climatic changes into account. Because the reasoning focused almost exclusively on uncertainties in assessing health impacts (i.e. translating a climatic change into its health impacts), rather than on climatic uncertainties, the scores were interpreted as 'given a climate scenario'. The individual scores, the expertise-weighted descriptive statistics, and the reasoning given for each score were assessed.

The second part of the study dealt with:

- The relevance of health effects to adaptation policy (e.g. where there are high health impacts, high societal or political salience, etc.),
- Specific uncertainties not mentioned in the reasons given for the Level of Precision scores, and
- Uncertainty-robust adaptation options and strategies.

The relevance of health effects to adaptation policy was assessed by asking participants to select and rank the five most relevant effects, while interpreting relevance in a broad way, and to give argumentation for their choices. The aggregated scores provided a reasonable distinction between the highly relevant and the less relevant effects. The arguments for relevance differed between effects. Examples of important reasons include: current vulnerability to the effect (heat-related mortality); large potential health and societal

impacts, difficult to adapt to, and public fright factors (vector-borne diseases); and a large number of people effected and large potential economic impact (hay fever).

The implications of uncertainties for adaptation were discussed using various characteristics of policy options (e.g. costs, flexibility, encroachment, prediction versus capacity-enhancement), and the resulting approach is summarised in the table below.

Table: Appropriate adaptation approaches, considering uncertainty and policy-relevance of health effects (Wardekker et al., 2012).

Health effects have:	**Low policy-relevance**	**High policy-relevance**
High level of precision health risk assessment	Tailored, prediction-based strategies (e.g. risk approach) Focus: low costs/efforts or co-benefits. **Example:** providing shelter for homeless people during cold spells.	Tailored, prediction-based strategies (e.g. risk approach) Consider (but critically reflect on) costly and extensive options. **Example:** financing/subsidizing air-conditioning or other (advanced) cooling systems in buildings.
Low level of precision health risk assessment	Enhance system's capability of dealing with changes, uncertainties, and surprises (e.g. resilience approach). Focus: low costs/efforts or co-benefits. **Example:** general improvement in health care including research, and regular impact & adaptation assessments.	Enhance system's capability of dealing with changes, uncertainties, and surprises (e.g. resilience approach). Consider (but critically reflect on) costly and extensive options, including precautionary options. Assess overinvestment risks and flexibility. Under which circumstances would "robust" measures be advocated and which? **Example:** changing building materials and increasing urban water and parks to reduce the impact of heat in urban areas.

Effect of uncertainty on decision–making

The uncertainties assessed had a notable influence on the policy assessments conducted by the Netherlands Environmental Assessment Agency for the Dutch government; it affected how they discussed climate change impacts on health and adaptation to these impacts. It became clear that adaptation in the health sector requires a strong focus on enhancing system resilience and on capacity building. The use of uncertainty typologies was also important; they allowed for a systematic and structured analysis of the uncertainties, distilling policy-relevant uncertainty information from the complex mix of imperfect evidence. They have led to the advice that a different policy approach would be needed, for example, for vector-borne diseases than for heat-related deaths. In effect they have made the various potential health impacts and their uncertainties comparable, which in turn has enabled adaptation strategies to be differentiated.

The typologies helped to focus on the most appropriate policy strategies for the situation (i.e. for the uncertainty and policy relevance of a particular health effect), given the characteristics of both impacts and policy options:

- For possible climate related health impacts characterised by ignorance, adaptation policies that focus on enhancing the health system's and society's capability of dealing with possible future changes, uncertainties and surprises e.g. through resilience, flexibility, and adaptive capacity are most appropriate
- For climate related health effects for which rough risk estimates are available, 'robust decision-making' is recommended.
- For climate related health impacts which are less uncertain, tailored and prediction-based approaches are more appropriate.

By providing an interpretative framework for a complex mix of uncertain evidence, a systematic, rather than ad-hoc, formulation of policy advice is created. An example is the central role that uncertainties and uncertainty-proofing policy played in the workshop "Policy options for climate change and health" (PBL & WHO Europe, co-organised by UU, at the WHO office in Bonn, Germany, 11-12 January 2010).

Authors: Arjan Wardekker, Jeroen van der Sluijs (Utrecht University)

Contact details: arjan.wardekker@gmail.com, tel: +31 70 340 7021; J.P.vanderSluijs@uu.nl, tel: +31 30 253 7631

References

Wardekker, J.A., A. de Jong, L. van Bree, W.C. Turkenburg, J.P. van der Sluijs (2012). "Health risks of climate change: An assessment of uncertainties and its implications for adaptation policies". *Environmental Health*, 11: 67. http://www.ehjournal.net/content/11/1/67

The paper was summarized in the European Commission newsletter Science for Environment Policy: http://ec.europa.eu/environment/integration/research/newsalert/pdf/317na5.pdf

WHO and PBL (2010). "Policy options for climate change and health: Report on a joint WHO-PBL technical meeting". World Health Organization (WHO) Regional Office for Europe, and Netherlands Environmental Assessment Agency (PBL), Bonn/Bilthoven. http://www.pbl.nl/sites/default/files/cms/publicaties/pbl2010-who-pbl-technical-meeting-climate-change-and-health_0.pdf