

## 5.2 How Useful are Existing Adaptation Guidelines for Reducing the Health Risks of Climate Change?

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### **Abstract**

Climate change adaptation assessments aim at assisting policy-makers in reducing the health risks associated with climate change and variability. This paper identifies key characteristics of the climate-health relationship and of the adaptation decision problem that require consideration in climate change adaptation assessments. This paper further analyzes whether these characteristics are appropriately considered in existing guidelines for climate impact and adaptation assessment. The review finds three assessment guidelines, based on a generalized risk management framework, to be most useful for guiding adaptation assessments of human health. Since none of these guidelines adequately addresses all key challenges of the adaptation decision problem, actual adaptation assessments need to flexibly combine elements from different guidelines.

### **Introduction**

Anthropogenic climate change is an important risk factor for human health (Confalonieri et al., 2007). Current health problems may become more (or less) urgent due to climate change, and new health risks may be introduced to currently unaffected regions. The most recent Global Burden of Disease assessment estimated that in 2000, 166,000 deaths and 5.5 million disability-adjusted life years (DALYs) could be attributed to global climate change (McMichael et al., 2004).

Most adverse health impacts of climate change can be prevented, in principle, by appropriate adaptations. The term 'adaptation to climate change' is used here to refer to any actions by individuals, social groups, or institutions that are undertaken to avoid, prepare for, or respond to, the detrimental impacts of observed or anticipated climate change (Parry et al., 2007, Glossary). The focus of this paper is on 'planned adaptation', which involves the conscious use of information about current and future climate change to reduce current and future climate-sensitive risks.

The reduction of climate-sensitive health risks touches upon issues that have traditionally been discussed by the distinct communities concerned with climate and climate change, risk management, public health, and environmental health. Anthropogenic climate change has many unfamiliar characteristics that limit the applicability of established methods and tools. For instance, scholars with an environmental health background are confronted with the large spatial scale of the hazard, its long time horizon, its complex spatiotemporal pattern, and the large uncertainty of future hazard levels. Recently, efforts to integrate public health with adaptation to climate change and variability have increased. Most importantly, Ebi et al. (2005) present a number of insightful essays on the links between these two domains, and some chapters in McMichael et al. (2003) also address this link.

The present paper complements this literature by evaluating existing assessment guidelines in terms of their relevance for informing planned adaptation to the health risks of climate change and variability. Section 2 provides an introduction to climate impact and adaptation assessments, and identifies key features of the adaptation decision problem that need to be considered in adaptation assessments for human health. Section 3 evaluates existing assessment guidelines in terms of their relevance for assessing adaptation to the health risks of climate change. This evaluation is based on the criteria developed in Section 2 and on the experience of past vulnerability and adaptation assessments. Section 4 summarizes the key findings.

## Adaptation to the Health Risks of Climate Change

Adaptation to the health risks of climate change should be based on an assessment of those risks, and of potential adaptations to reduce these risks. Such vulnerability and adaptation assessments are conducted with different scientific and/or policy objectives, applying a wide range of assessment methods and tools. Füssel and Klein (2006) distinguish climate impact assessments, first-generation and second-generation vulnerability assessments, and adaptation policy assessments. Kovats et al. (2003a) distinguish four increasingly complex stages of adaptation assessment for human health: from identifying a list of adaptation options without evaluation to policy analysis that addresses the feasibility of specific adaptation strategies. Burton et al. (2005) distinguish four approaches to climate change adaptation assessment: hazards-based approach, vulnerability-based approach, adaptive-capacity approach, and policy-based approach. The relative suitability of these approaches in a specific assessment context depends on a multitude of factors, including the current level of climate-related health risks, the time horizon of relevant adaptation options, and the availability and reliability of model-based climate change scenarios and relevant epidemiological data.

### *Prerequisites for Planned Adaptation*

Based on Last (1998), Füssel and Klein (2004) have suggested the following prerequisites for planned adaptation to the health risks of climatic change to be effective:

- (1) Awareness of the problem
- (2) Availability of effective adaptation measures
- (3) Information about these measures
- (4) Availability of resources to implement these measures
- (5) Cultural acceptability of these measures
- (6) Incentives for implementing these measures.

Vulnerability and adaptation assessments can potentially address each of these prerequisites by identifying significant problems and raising awareness of them (1), by identifying effective adaptation measures (2), by identifying co-benefits of adaptation or facilitating the provision of additional resources (3), by educating people in order to raise the acceptability of certain measures (5), by advising on the creation of incentives for actually implementing these measures (6), and by triggering research that may develop new adaptation options (4).

Effective planned adaptation requires that all prerequisites are fulfilled to a certain degree. Since the main obstacles to successful adaptation vary from one decision context to another, scientific analysis and political efforts should be targeted at those elements that are most in need of improvement. Adaptation policy assessments are least relevant if all prerequisites are already fulfilled or when insurmountable obstacles exist to inhibit the fulfilment of certain prerequisites.

### *Ten Characteristics of the Adaptation Decision Problem*

The following characteristics of the decision problem, encountered in planning adaptation for the health risks of climate change, have important implications for adaptation policy assessment (see also McMichael et al., 2003, chapters 4 and 12):

#### *1. Climate change is a complex and uncertain hazard.*

Climate is a complex phenomenon involving many variables that vary on different spatial and temporal scales. The ability to forecast future climatic conditions is limited by uncertainties about future greenhouse gas emissions and about their effects on the regional climate. While changes in average climate parameters such as seasonal temperature can often be described by (subjective) probability distributions, this approach becomes increasingly difficult for extreme weather events and complex

climatic stimuli. Consequently, the applicability of established methods from quantitative health risk assessment in climate impact and adaptation assessment is often limited.

*2. Climatic changes affect human health along very diverse causal relationships.*

Climate-sensitive health risks include those occurring as a direct consequence of exposure to climatic stimuli (e.g., heat stroke, drowning during flood), those mediated via climate-sensitive ecological systems (e.g., water-borne and vector-borne diseases), and those resulting from the wider social implications of climate change (e.g., malnutrition). A variety of quantitative and qualitative methods need to be applied for assessing future risk levels and the effectiveness of potential adaptations. Furthermore, a comprehensive climate change assessment for human health needs to review the main effects of climate change on other sectors since this information may be crucial for assessing indirect health effects of climate change.

*3. The causal relationship between climate and health can be extremely complex, and relevant epidemiological data is often scarce.*

The effect of climatic hazards on the health of individuals and populations is determined by a variety of non-climatic factors, such as wealth, nutritional status, accessibility of health services, acclimatization, and behavioural factors. As a result, the epidemiological relationship between climatic factors and specific health outcomes is highly population-specific, limiting the informative value of epidemiological data from spatial analogues. Temporal analogues are often not available because anthropogenic climate change exposes populations to climatic conditions that they have never experienced before. The less epidemiological data which is available, the more important it is to actively seek for and include the experiential knowledge of regional stakeholders, and to resort to semi-quantitative and qualitative assessment approaches.

*4. Uncertainty in future risk projections is generally large but it varies across regions and health outcomes.*

The uncertainty in projections of climate change impacts is generally large but it varies widely across health outcomes and regions depending on the complexity of the climate-health relationship and the availability of relevant climatic and epidemiological data. Adaptation policy assessments need to address key uncertainties from the outset and evaluate their implications for the robustness of policy decisions.

*5. Adaptation involves a diverse group of actors.*

Some climate-sensitive health impairments can be addressed largely within the public health sector, but many of them require concerted actions with other sectors (e.g., meteorological services, urban and spatial planning, development and housing, agriculture). Adaptation policy assessments should identify key adaptation actors from all relevant sectors early in the process and consider their specific information needs, including appropriate spatial and temporal scales.

*6. The lead time of adaptation options varies widely across regions, health outcomes, and measures.*

Anthropogenic climate change unfolds over a time scale of several centuries. Adaptations to reduce its adverse health effects have shorter, but highly variable lead times. Some measures can be implemented quickly if need arises (e.g., stocking up of medical supplies), others require a number of years (e.g., establishing a heat-wave warning system), and still others take decades before they are fully effective (e.g., changes in town planning to reduce the urban heat island). The temporal scope of an adaptation assessment should be decided based on the policy horizon of potential adaptations.

*7. Human health is already strongly managed.*

Since most countries have a public health system in place to reduce major risks to population health, the most efficient way to reduce climate-sensitive health risks is generally by building upon existing policies and institutions.

8. *Most adaptations to future climate change also reduce vulnerability to current climate variability.*

Adaptations aimed at reducing climate-sensitive health risks that are already prevalent today will also reduce current health risks. Their effectiveness should be evaluated under current as well as changed climate conditions.

9. *Social conditions for adaptation vary widely across regions.*

Different regions vary widely with respect to the level of socioeconomic development, the availability and accessibility of public health infrastructure and services, the current health status of the population, the availability of data and expertise to produce and/or use sophisticated climate scenarios, the infrastructure and financial resources for the implementation of adaptation measures, the time horizon of policy decisions, and cultural preferences. Consideration of these factors is crucial in adaptation policy assessments as they determine the importance of current health risks versus future health risks, the feasibility of specific adaptation options, and the suitability of different assessment approaches.

10. *Adaptation and adaptation assessment is subject to resource constraints.*

Adaptation to the health risks of climate change competes with other public health policies for limited resources. Adaptation policy assessments should therefore attempt to evaluate different options in terms of their effectiveness and urgency, and they should focus on those health risks, regions, and population groups where additional information is most important for supporting good policy. In general, this goal can be best achieved by a multi-tiered assessment.

The discussion above implies that adaptation policy assessments should: integrate adaptation to climate change and variability with existing management policies (denoted as 'adaptation mainstreaming'),

	IPCC 1994 3.1	USCSP 1996 3.2	UNEP 1998 3.3	UKCIP 2003 3.4	UNDP 2005 3.5	WHO 2003 3.6
Clear procedural structure	+	+	o	+	+	o
Flexible assessment procedure	o	o	o	+	+	o
Prioritization of assessment efforts	o	o	o	+	o	o
Identification of key information needs	-	-	-	+	o	o
Inclusion of key stakeholders	-	o	o	o	+	+
Choice of relevant spatial and temporal scales	-	o	o	+	+	o
Balanced consideration of current and future risks	-	o	o	o	+	+
Management of uncertainties	o	o	o	+	+	o
Policy guidance in the absence of quantitative risk estimates	-	-	o	+	+	o
Prioritization of adaptation actions	-	o	o	+	+	-
Mainstreaming of climate adaptation	-	o	o	+	+	+
Cross-sectoral integration	o	o	+	-	+	+
Disease-specific methods and tools	-	o	+	-	-	+
Assessment of key obstacles to adaptation	-	-	-	-	o	o

*Table 1: Suitability of Major Guidelines for Climate Impact and Adaptation Assessment for National and Regional Adaptation Assessments of Human Health. Top rows: Responsible Institution; Publication Year; Cross-Reference to Relevant Subsection. Symbols Indicate the Degree to which a Specific Criterion is Met (+: good; o: partial; -: weak)*

whereby the relative importance of climate change compared to other risk factors needs to be considered; address uncertainties explicitly; and focus on additional information that is most relevant for policy decisions. Guidelines for human health adaptation assessment need to be flexible enough to accommodate the substantial diversity of health outcomes as well as regional socioeconomic and environmental conditions.

## **Guidelines for Adaptation Policy Assessment**

Several international and national organizations have developed guidelines for climate change impact and adaptation assessment. These guidelines describe the main steps involved in assessing vulnerability to climate change and developing effective adaptation strategies. Additionally, they provide guidance on the implementation of these steps. Some guidelines are generic (i.e., intended to be applicable to any climate-sensitive impact domain anywhere in the world) whereas others are targeted at specific systems, sectors, or world regions. Earlier guidelines tend to focus on assessing potential impacts of climate change whereas later guidelines put more emphasis on adaptation planning. Adaptation guidelines have also been developed by some organizations responsible for managing or funding climate-sensitive resources (e.g., Global Environment Facility Program, 2006).

This section briefly reviews six major guidelines for climate impact and adaptation assessment in terms of their ability to provide guidance for national and regional adaptation policy assessments for human health. Table 1 summarizes the results of this review by indicating the degree to which each guideline meets several criteria derived from the discussion in the previous section. Several caveats should be mentioned in this context. First, the review does not judge the “general quality” of these guidelines, which have been developed for different audiences and with different objectives. Second, the review has been influenced by the practical experience with climate impact and adaptation assessments described in the literature. This experience depends not only on the suitability of the underlying guideline but also on factors such as resource availability. Third, the applicability of a guideline may change with scientific progress, e.g., when the ability to project climate change on the regional level improves. Of course, any such evaluation unavoidably contains subjective elements. The remainder of this section discusses each of the guidelines in more detail.

### *Intergovernmental Panel on Climate Change (IPCC) Technical Guidelines*

The IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations (Carter et al., 1994; Parry and Carter, 1998) constitute the first comprehensive approach for guiding impact and adaptation assessments. They aim at guiding analysts through the various methods that can be used to assess the impacts from, and adaptations to, climatic changes, and at structuring the assessment process. The Technical Guidelines implement the hazards-based (also known as scenario-based) approach to climate change impact and adaptation assessment (see Burton et al., 2005, for a discussion of different assessment approaches). Their development was heavily influenced by the experiences of various modelling groups who combined model-based climate scenarios with biophysical climate impact models to project the impacts of climate change on food production, natural ecosystems, and freshwater hydrology. Health impacts are addressed but the focus is cursory and mainly centres on scenario-driven modelling.

Adaptation needs in the hazards-based approach follow exclusively from the incremental effects of anthropogenic climate change. As a result, this approach provides little guidance to countries and regions that lack the data, models, expertise, or resources required to conduct quantitative impact assessments, and it is of limited help if the uncertainty in climate impact projections is very large. Several reviews conclude that the hazards-based approach has yielded few results that are immediately useful for the purposes of adaptation policy design (Klein et al., 1999; O'Brien, 2000; McMichael et al., 2001; Burton et al., 2002; Kovats et al., 2003a). These reviews agree in the importance of using

methods for adaptation assessment that can deal with various levels of uncertainty, and of designing adaptation policies that are effective under different plausible climate and socioeconomic scenarios.

### *USCSP Handbook*

The United States Country Studies Program (USCSP) has developed a handbook for climate vulnerability and adaptation assessment that was intended to be used in tandem with the IPCC Technical Guidelines. Its main innovations are the emphasis on involving stakeholders throughout the assessment and the recommendation that impact/vulnerability assessment and adaptation assessment are conducted largely in parallel.

The original USCSP Handbook (USCSP, 1994) focuses on agriculture and forestry, water resources, and coastal zones. The book version of the USCSP Guidelines (Benioff et al., 1996) also includes a chapter on human health vulnerability assessment but no specific guidance is given on assessing adaptation options for human health. Evaluations of the USCSP Handbook for adaptation assessments largely agree with those of the IPCC Technical Guidelines.

### *UNEP Handbook*

The UNEP Handbook on Methods for Impact Assessment and Adaptation Strategies (Feenstra et al., 1998) was designed to assist developing countries and economies in transition to conduct climate impact assessments and identify adaptation options. The UNEP Handbook consists of two parts. The generic part largely follows the scenario-based approach presented in the IPCC Technical Guidelines. The sectoral part provides specific advice on methods and tools that can be applied in various climate-sensitive impact domains, including human health. The focus of the UNEP Handbook remains on assessing impacts and vulnerability rather than facilitating adaptation.

The UNEP Handbook does not suggest a generic procedural framework for climate impact and/or adaptation assessment. Due to the large uncertainty in projections of future health risks, the health chapter emphasizes the importance of linking climate adaptation with the management of current climate-sensitive health risks. Actual assessments following the UNEP Handbook have faced similar problems as those reported above for the IPCC Technical Guidelines (O'Brien, 2000; Kovats et al., 2003a).

### *UKCIP Framework for Climate Adaptation*

The United Kingdom Climate Impacts Programme (UKCIP) has developed a framework for adaptation decision-making that casts the assessment process in terms of risk management under uncertainty (Willows and Connell, 2003). Key characteristics of this framework are that it is circular, allowing the performance of decisions taken to be reviewed, and decisions revisited through time; it is iterative, allowing the problem, decision-making criteria, risk assessment and options to be refined prior to any decision being implemented; and certain stages within the framework are tiered, allowing the decision-maker to undertake screening, evaluation and priority-setting of climate risks and adaptation options before moving on to more detailed risk assessments and options appraisals. The UKCIP report includes several case studies related to coastal management and natural resource management. Treatment of climate impacts on human health is only cursorily.

The UKCIP Framework provides comprehensive and detailed guidance on climate adaptation decision-making. Since the framework was designed for application in the UK it does not reflect the diversity of regional adaptation contexts, e.g., in terms of the availability of sophisticated regional climate scenarios and of economic resources. The framework does not provide specific guidance on identifying decisions that are potentially sensitive to climate change, on identifying relevant stakeholders, or on raising awareness of the issue of climate change.

### *UNDP – GEF Adaptation Policy Framework*

The Adaptation Policy Framework (APF) project initiated by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) aims to provide guidance to developing countries for conducting adaptation policy assessments in any sector. It was developed in response to the experience gained from applying the hazards-based approach to climate impact and adaptation assessment that treatment of adaptation has rarely gone beyond the listing of potential adaptation options. The APF consists of a User's Guidebook and nine Technical Papers (TPs) published in a single volume (Burton et al., 2005). The technical papers refer to different steps in the assessment approach. However, the amount of sector-specific information is limited.

Key characteristics of the APF are that it treats policy as the overarching purpose, it starts by assessing the effectiveness of coping with recent climate experiences rather than by developing model-based climate scenarios, it links adaptation to future climate change to coping with current climate variability and extremes, it assesses climate adaptation in the context of sustainable development, and it emphasizes the importance of the stakeholder process through the adaptation assessment.

The APF addresses most of the challenges of the adaptation decision problem discussed in Section 2. As a generic framework however, the APF cannot address the specific concerns of human health adaptation, such as providing guidance on the most appropriate methods and tools for assessing future health risks. Furthermore, the APF does not specifically advocate a tiered approach to assessing future risks where the importance of future changes in risks is assessed qualitatively before more detailed assessments are made.

### *WHO–Health Canada Assessment Framework*

The WHO, in collaboration with Health Canada, UNEP, and the WMO, has developed “Methods of assessing human health vulnerability and public health adaptation to climate change” (Kovats et al., 2003b), which aim at providing flexible instructions for conducting a human health vulnerability and adaptation assessment to climate change. The WHO–Health Canada Framework is targeted specifically at national and regional government agencies responsible for assessing the health risks associated with global climate change and for developing adaptations to them. It begins with current health risks and their determinants but also includes, when available, model-based climate and impact scenarios. As a health-specific framework, it provides guidance on assessing vulnerability and adaptation for the most important climate-sensitive health impairments. It also gives useful recommendations on project management, and on dissemination and communication strategies. The main limitations of the WHO Health Canada Framework are that it presents three different assessment approaches without providing guidance on how they might be integrated into an actual assessment; additional adaptation measures are considered only in the final step of the assessment; it lacks coherent information on how the suitability of different approaches can be determined based on regional and disease-specific factors; there is limited guidance on assessing and planning adaptations when uncertainties are too large for quantitative risk assessment; and it lacks guidance on prioritizing potential adaptation measures in terms of their efficiency and urgency.

### *Summary and Conclusions*

Human health adaptation policy assessments aim at facilitating planned adaptation to the health risks associated with climate change and variability by providing information to policy-makers on the health risks associated with climate variability and change, on the effectiveness and costs of feasible adaptations, and on ways to overcome obstacles to their implementation (Sect. 1). Several scientific and professional communities can provide guidance for human health adaptation assessments, including those concerned with climate change, risk management, public health, and environmental health. However, assessing and planning adaptation to the health risks associated with climate change

presents several challenges to analysts. Unfamiliar aspects include the diversity of climate-sensitive health impacts; the complex interaction of climatic, environmental, socioeconomic, demographic and behavioural factors in the causation of diseases; large uncertainties in projections of future climatic and socio-economic conditions; and the scarcity of epidemiological data on the relationship between climatic conditions, non-climatic factors and health outcomes (Sect. 2).

Various frameworks have been developed to provide guidance for climate change vulnerability and adaptation assessments but their application so far in human health adaptation assessments has been limited. Most early studies of climate change and human health have followed a hazards-based approach, as described in the IPCC Technical Guidelines, the USCSP Handbook, and the UNEP Handbook. These studies evaluated and extended the scientific knowledge about the relationship between climatic factors and human health and provided indispensable information on the scale of the problem and on particularly vulnerable regions. However, they offered only limited guidance to stakeholders concerned with adaptation. The main reasons for this are the mismatch in spatial and temporal scales between climate impact projections and typical adaptation decisions, and the limited consideration of scientific uncertainties, current climate-sensitive health risks and socio-economic factors.

Recognizing the limitations of the hazards-based approach in providing policy-relevant knowledge to adaptation decision-makers, recent guidelines for adaptation assessment emphasize approaches that integrate adaptation to future climate change with current climatic risks and other policy concerns (see Figure 1). The most important generic guidelines are the UKCIP Framework, which is targeted at adaptation stakeholders in industrialized countries, and the UNDP-GEF Adaptation Policy Framework (APF), which focuses on the adaptation needs of developing countries. The WHO-Health Canada Framework specifically addresses adaptation to the health risks of climate change and variability.

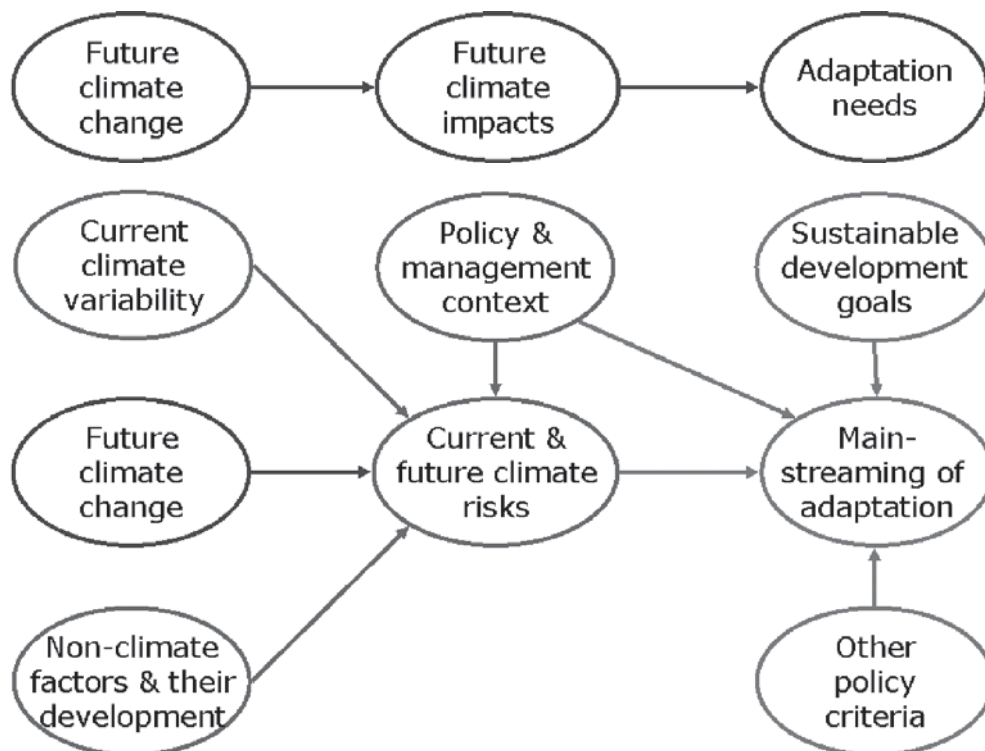


Figure 1: Evolution of Approaches for Determining Adaptation Needs. Top: Linear Hazards-Based Approach; Bottom: Complex Integrative Approach. Source: Füssel (2007)

The APF advocates a flexible assessment approach, it provides criteria for choosing between alternative assessment approaches, and it presents and discusses a wide range of pertinent methods and tools. There is, however, only limited guidance on focusing the assessment on the most relevant information



in a given decision context. The UKCIP Framework recommends an even more flexible approach to adaptation decision-making. Earlier decisions can be revised based on new information, and a multi-tiered approach helps focusing assessment efforts on the most critical impacts and/or regions. The UKCIP Framework is most useful when current climate-sensitive risks are satisfactorily controlled, and when decisions that are potentially sensitive to global climate change have already been identified by relevant decision-makers. Despite their regional foci, both the APF and the UKCIP Framework can provide valuable guidance for adaptation policy assessments in any world region. However, neither framework addresses the specific challenges of planned adaptation for human health. The WHO–Health Canada Framework presents a variety of methods and tools for assessing vulnerability and adaptation to climate change for the major climate-sensitive health risks. Compared to the generic frameworks, however, this framework provides little guidance on integrating the various concepts presented and on focusing the assessment on the key information needs of adaptation stakeholders. In summary, none of the assessment guidelines reviewed here satisfactorily addresses all challenges of adaptation policy assessments for human health. For this reason, actual adaptation assessments should seek guidance from the different sources reviewed here according to their respective strengths (see Table 1).

Of course, good guidelines for adaptation assessment are only one precondition for effective prevention of climate-related deaths and diseases. In addition, resources need to be made available for conducting comprehensive vulnerability and adaptation assessments at different scales. Finally, and most importantly, it is crucially important to come up with the resources and the political will to implement proven public health measures to reduce the burden of disease now and in the future. Stronger action is particularly relevant in those countries and regions with a high burden of avoidable disease today, which are also in the worst position to effectively manage the health risks from climate change in the future.

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