

X Assessment of Investment & Financial Flows for Adaptation in the Health Sector



10.1 Introduction

According to the World Health Organization (WHO), climate change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air and water.¹²³ The WHO also states that a “...warmer and more variable climate threatens to lead to higher levels of some air pollutants, increase transmission of diseases through unclean water and through contaminated food, to compromise agricultural production in some of the least developed countries, and increase the hazards of extreme weather.”¹²⁴ Climate change also creates new challenges in the control of infectious diseases. Furthermore, the World Health Organization has concluded that stresses on the climate systems and its consequent impacts consisting, inter alia, in rising surface temperatures, increasingly frequent floods and droughts, as well as changes in natural ecosystems, are inextricably linked to the health of human societies. However, it is the gradual build-up of pressure on the natural, economic and social systems that sustain health that will cause the greatest health impacts, particularly in developing countries where those systems are already under stress.

The IPCC states that “Human beings are exposed to climate change through changing weather patterns (temperature, precipitation, sea-level rise and more frequent extreme events) and indirectly through changes in water, air and food quality and changes in ecosystems, agriculture, industry and settlements and the economy.”¹²⁵ Climatic conditions thus affect human well-being both directly, through the physical effects of climatic extremes, and indirectly, through influences on the determinants of health. According to the IPCC, climate change currently contributes to the global burden of disease and premature deaths, and in its assessments highlights that adverse health impacts will be greatest in low-income countries.

According to the World Health Organization a health system comprises all organizations, institutions and resources devoted to producing actions whose primary intent is to improve health. This broad definition comprises such traditional public health activities as health promotion and disease prevention, as well as other health enhancing interventions that include

¹²³ Climate Change and Health, Report by the Secretariat, EB122/4, 122nd Session, Executive Board, World Health Organization, 16 January 2008.

¹²⁴ Protecting health from climate change, Summary of issues paper, World Health Day 2008, WHO.

¹²⁵ Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich and A. Woodward (2007): Human health. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 391-431.

those efforts to influence determinants of health related to provision of clean air and water, sufficient food, and adequate shelter in order to ensure freedom from disease to all citizens. The direct health-improving activities comprise a broad range of functions from service provision to resource generation, financing and governance of the system.

The general scope of the health sector used in this chapter comprises activities of health care, such as disease prevention, health promotion, and treatment, strengthened by the application of medical, paramedical and nursing knowledge and technology; those activities are provided by the system in performing the functions listed in Table 10-1, defining the functional boundaries for the delineation of the health sector. The assessment will also need to consider the I&FF by sources of funding (financing agents), while expenditures in the health sector when information is available are also classified by categories of provider (health care industries). However, the activities in Table 10-1 that are relevant to an I&FF assessment in a particular country are entirely country-specific, as discussed below in section 10.2.

Table 10-1 provides a list of the functions of the health sector and describes the activities it performs under each set of functions; it is based on the framework created for the development of national health accounts as systematized in the “Guide to producing national health accounts”¹²⁶, which adapts the international classification of Health Accounts (ICHA) published in “A System of Health Accounts”¹²⁷ (SHA) by the Organisation for Economic Cooperation and Development (OECD), while providing flexibility to use a taxonomy of classifications suited to low- and middle-income countries.¹²⁸

¹²⁶ World Health Organization, World Bank, and U.S. Agency for International Development (2003). Guide to producing National Health Accounts with special applications for low-income and middle-income countries. Geneva: WHO, 2003, 309 pp.

¹²⁷ OECD (2000). A System of Health Accounts. Manual, Version 1.0.

¹²⁸ The ICHA classification of health care industries has produced a refinement of the International Standard Industrial Classification (ISIC, Rev. 3, United Nations, 1990). More recently designed or revised classifications such as the Central Product Classification, Version 1 (United Nations, 1998a) and the 1998 revision of the SNA 93 functional classifications are also referred to in the ICHA classification as the System of Health Accounts recommends for health accounting an economic framework and accounting rules, which are methodologically compatible with the System of National Accounts, 1993 Revision (SNA 93), wherever this is deemed appropriate. The System of Health Accounts methodology is currently under revision.

Table 10-1: Health sector functions

Functions	Description
Health care	
Personal health care services and goods	
Services of curative care	Cure of illness or provision of definitive treatment of injury; the performance of surgery; obstetric services; diagnostic or therapeutic procedures.
Services of rehabilitative care	Medical and paramedical services delivered to patients during an episode of rehabilitative care, where the emphasis lies on improving the functional levels of the persons served and where the functional limitations are either due to a recent event of illness or injury or of a recurrent nature (regression or progression).
Services of long-term nursing care	Ongoing health and nursing care given to those who need assistance on a continuing basis due to chronic impairments and a reduced degree of independence and activities of daily living.
Ancillary services to health care	A variety of services, mainly performed by paramedical or medical technical personnel, such as laboratory, diagnosis imaging and patient transport.
Medical goods dispensed to out-patients	Goods and the services connected with dispensing, such as retail trade, fitting, maintaining, and renting of medical goods and appliances.
Collective health care services	
Prevention and public health service	Enhance the health status of the population
Health administration and health insurance	Provided by national and local authorities and social security and private insurers, whose activities are the planning, management, regulation, and collection of funds and handling of claims of the delivery system
Health related functions	
Capital formation	Gross capital formation of domestic health care provider institutions
Education and training	Government and private provision of education and training of health personnel, including the administration, inspection or support of institutions providing education and training of health personnel.
Research and development	Programmes directed towards the protection and improvement of human health, including R&D on food hygiene and nutrition and also on radiation used for medical purposes, biochemical engineering, medical information, rationalisation of treatment and pharmacology (including testing medicines and breeding of laboratory animals for scientific purposes) as well as research relating to epidemiology, prevention of industrial diseases and drug addiction.
Other health related functions	
Food, hygiene and drinking water control	
Environmental health	
Related sectors / subsectors:	
Pharmaceutical industry	
Retail, sale and other providers of medical goods.	
Insurance	

Source: Adapted from section 8.2 Current sensibility and vulnerability, in Chapter 8, Human Health, Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich and A. Woodward, 2007: Human health. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 391-431.

The health system includes all the activities whose primary purpose is to promote, restore or maintain health for the nation and for individuals during a defined period of time, by utilising health worker resources, infrastructure, health commodities (such as equipment and medicines), supplies, information, transport and logistics, communications, and financing. National health expenditure encompasses all expenditures incurred by carrying out those activities.

Health systems at large represent today one of the large sectors in the world economy, with global spending on health care representing almost 8.6% of world gross domestic product (2005) and employing about 35 million health workers worldwide, as estimated by the International Labour Organisation in 1997. There are, however, huge difference in contribution and budgetary allocation across countries.

The methodological approach described in this chapter is focused on the required means to carry out the assessment of the I&FF that would be needed to prevent, minimize or alleviate those impacts on human health at the country level and develop adaptive responses in the health sector.

10.2 Application of I&FF Methodology to Adaptation in the Health Sector

This section describes how the I&FF methodology described in Chapter II would be applied to adaptation in the health sector. Some of the information provided in Chapter II that is relevant to all sectors is not repeated here, so the reader should read Chapter II before reading this chapter.

Step #1: Establish key parameters of assessment

>>> Define detailed scope of sector

Adaptation in the health sector will be driven by countries priorities regarding the impacts and increased health risks associated with climate change. Early on in the process, the question of whether all health impacts are to be examined and considered in the assessment of I&FF, or only a relevant subset will need to be addressed. This decision is critical both due to the complexities of the health sector and to the wide range of direct and indirect impacts on population health.

Hence, to ensure a comprehensive and consistent assessment of the required resource flows to the country's health system in order to design and organize efficient adaptive responses and ensure its implementation, the decision on the boundaries of the system should be made taking into account national circumstances, priorities, and characteristics of the country's health system in place and the nature and diversity of projected impacts at the country level, while also considering the availability of specific information on the status of the health system and

other data and the technical and scientific capacities to analyze and project the trends in health and health related variables.

Most national health systems include public, private, traditional and informal sectors. Formal health services, including the professional delivery of personal medical attention, are clearly within the boundaries of the system.¹²⁹

The national team should be aware that most of the information available about health systems refers almost exclusively to the provision of and investment in health services, that is, those related to the operation of the health care system, including preventive, curative and palliative actions, whether aimed at individuals or at the entire national population. As in most countries, health care services account for the great bulk of employment, expenditure and activity, we recommend that the scope comprise the consideration of those interventions as encompassed by the health care system and other health related activities.

Because the boundary of the health system should also be defined in terms of the range and nature of the impacts being addressed through an adaptation strategy and related activities to be performed, it is essential to have a sound way to categorize those activities by their nature, being careful to provide indications on how the multiplicity of expected impacts and the required interventions is framed in the context of the health system and the corresponding policies, such as those related to essential drugs, technology, human resources and financing.

In this regard, climate change health policies should both estimate the total health impact of climate change across the national population and/or the size of specific health effects in particular vulnerable groups to enable identification of communities and groups – socially or spatially – where targeted adaptation strategies should be developed and implemented. Hence the scope of the assessment can be focused on targeted adaptation strategies at vulnerable groups or consider the population at large.

It is important that the decision on the scope be appropriate to national circumstances at the sector level, especially regarding data availability and the range of the national government entities in which data reside, and the scope of related assessments and modelling that have already been undertaken in the health sector (e.g., National Communications, national health strategies and plans, specific long term health interventions in preventive and curative actions, vulnerability assessments, and National Adaptation Programmes of Action (NAPAs)). In addition, if a model is used in the implementation of the I&FF assessment, the sectoral scope may in some cases also be determined by the scope of the models used.

Some adaptation measures and activities will likely result in mitigation benefits, particularly when investing in health infrastructure. However, these potential benefits in the health sector should be assessed qualitatively only. On the other hand, some of the measures aimed at

¹²⁹ Adapted from Patz JA, McGeehin MA, Bernard SM et al. The potential health impacts of climate variability and climate change for the United States: Executive Summary of the report of the health sector of the US National Assessment. *Environmental Health Perspectives*. Volume 108, Number 4. April 2000.

reducing greenhouse gas emissions, such as the use of clean energy sources for power generation, for transportation, and for home heating, cooking and lighting as well as urban planning measures that enables safe and efficient use of public transport could carry important health co-benefits.

>>> *Specify assessment period and base year*

The assessment period and base year need to be selected for the sectoral analysis. Selection criteria should include sectoral scope, national and sectoral planning horizons, data availability, analytical approach, and the timelines used in previous analyses of adaptation options. This methodology recommends an assessment period of 2005 (the base year) through 2030, if possible and appropriate.

>>> *Identify preliminary adaptation options*

In this step a preliminary set of the adaptation options to be analyzed must be identified. The adaptation measures as identified in previous work (National Communications, NAPAs, etc.) will be collected, and considered against the new information available and the definition of scope of the assessment adopted, and then it is to be decided in what form they can apply for this assessment. This preliminary list of options is needed to consider which analytical approaches can facilitate the process of incorporating the measures to planning and costing its implementation. The selection of measures should be based on the sectoral scope, national and sectoral country priorities, costs of implementation, and prior work on adaptation.

According to the IPCC, global warming will have direct impacts on health including those due to changes in exposure to weather extremes (heat and cold waves); increases in the intensity and frequency of other extreme weather events (floods, storm-surges, cyclones, droughts); and increased production of a number of air pollutants and aeroallergens (spores and moulds). Acting via less direct mechanisms, climate change will affect the transmission of infectious diseases (especially water, food and vector-borne diseases) and have strong intense impacts on regional food productivity.

Amidst the multiple pathways by which climate change affects health, taking into account environmental, social, and health system conditions, the following can be included, as shown in the Table 10-2.

Table 10-2: Climate Impacts Pathways on Health

Weather/climate factors ¹³⁰	Adverse health effects ¹³¹	Range of impacts and health outcomes
Thermal extremes: Heat waves; Cold waves	Heat related illnesses and deaths	More heat-related deaths and illnesses Increases in mortality in vulnerable groups
Extreme weather events: Wind, storm, floods, cyclones	Extreme weather related health effects Storm surge-related drowning and injuries Health problems of displaced populations	Deaths and injuries Infectious diseases Toxic contamination Increased risk of water related diseases Increases in respiratory and diarrhoeal diseases due to crowding Effects on mental health, including mental health consequences of social, economic and demographic dislocations. Injuries and increased risk of disease due to migration and crowding
Drought, nutrition and food security Food safety	Malnutrition	Deaths, malnutrition (under nutrition, protein-energy malnutrition and/or micronutrient deficiencies), infectious diseases and respiratory diseases.
Water and disease Changes in rainfall, water availability and quality	Infectious diseases: Water borne diseases	Water-related diseases: water-borne (ingested) water-washed diseases (caused by lack of hygiene)
	Food borne diseases	Food-borne infectious diseases (including those due to Salmonella, Campylobacter and many other microbes)
Vector-borne, rodent-borne and other infectious diseases	Vector and rodent borne diseases	Malaria, filariasis, dengue, yellow fever, West Nile fever Leishmaniasis Chagas' disease Lyme disease, tick-borne encephalitis African trypanosomiasis Onchocerciasis
Air quality and disease	Air pollution related health effects	Aggravation of cardiovascular and respiratory diseases from worsening air quality
Aeroallergens and disease	Allergic diseases	Changes in aeroallergens (spores, pollens), potentially exacerbating asthma and other allergic respiratory diseases
Occupational health		

¹³⁰ Adapted from section 8.2 Current sensibility and vulnerability, in Chapter 8, Human Health, Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich and A. Woodward (2007): Human health. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 391-431.

¹³¹ Adapted from Paatz et al. (2000).

Weather/climate factors ¹³⁰	Adverse health effects ¹³¹	Range of impacts and health outcomes
Other factors		
Terrestrial changes		Risk of infectious diseases because of new geographic ranges and activity of disease-carrying animals, insects, and infective parasites causing malaria
Altered marine ecology		Changes in incidence of food poisoning from toxic algae
Saltwater Encroachment in Coastal Aquifers:		Greater risk of intestinal illnesses from inadequate water supplies

After having decided which impacts are nationally relevant the project team should identify health outcomes that are both climate sensitive and important in terms of population health at the national level. These might include diseases that have a direct physiological link with climate (e.g., cardiovascular disease), or infectious diseases (e.g., vector-borne diseases and some diarrhoeal diseases). Other impacts of climate change are more indirect, such as health threats due to extreme weather events or rising sea levels. Ideally, all health outcomes which are directly or indirectly linked to climate change should be considered. In practice, the assessment is likely to be limited by the availability of quantitative models describing climate-health relationships.

The national team should then decide which impacts to consider, prioritize, and include, while establishing the boundary of the assessment, bearing in mind that many of the adaptive measures discussed in health impact and vulnerability assessments are not unique to climate change. In fact, the IPCC identified rebuilding public health infrastructure as “the most important, cost-effective and urgently needed” adaptation strategy. Decisions about public health measures indirectly related to climate change, such as sanitation and water treatment, may also have a profound influence on health consequences associated with climate change.

Having considered the adverse health effects described in Table 10-2, it is now possible to complement and refine the initial set of adaptation measures in a systematic manner. Table 10-3 presents a list of general adaptation options.

Table 10-3: General adaptation options in the health sector

Options	Examples of Potential Activities and Expenditures
Vaccination programmes	
Disease surveillance	Climate-change health risk assessments and monitoring Analysis Improved diagnosis of vector borne diseases Vector monitoring and control
Prevention	
Primary prevention: Intervention implemented before there is evidence of disease or injury	Avoiding hazardous exposure Removing causative risk factors Protecting individuals to limit exposure to the hazard Examples:

Options	Examples of Potential Activities and Expenditures
	bed nets supplied to populations at risk of exposure to malaria early warning systems: extreme heat health warnings famine early warning
Secondary prevention: Intervention implemented after disease has begun, but before it is symptomatic by early detection or screening and sub-sequent treatment that averts full progression to disease	Enhancing monitoring and surveillance improving disaster response and recovery Strengthening the public health system's ability to respond quickly to disease outbreaks.
Tertiary prevention: Aimed at minimizing the adverse effects of an already present disease or injury	Better treatment of heat stroke Improved diagnosis of vector-borne diseases
Protective technologies	New drugs New vaccines Warning systems Mobile laboratories Computerized disease surveillance New pesticides Data capture systems
Weather forecasting and warning systems	
Emergency management and disaster preparedness	Links with disaster management and risk reduction planning
Infrastructure expansion and adequateness	
Dedicated health infrastructure	Infrastructure development Primary health care infrastructure Hospitals Laboratories
Prevention and public health service infrastructure	Water supply systems Water treatment Waste water treatment Sanitation facilities Housing Building insulation Storm shelters Flood management structures
Public health education	
Legislation and administration	Changes in legislation, standards and procedures
Research	Develop and test early warning systems Develop and/or operate: GIS software Geo-referencing data Risk assessment Epidemiological research
Training	Programmes on emergency management Programmes on information systems

Sources:

Adapted from Patz JA, McGeehin MA, Bernard SM et al. The potential health impacts of climate variability and climate change for the United States: Executive Summary of the report of the health sector of the US National Assessment. Environmental Health Perspectives. Volume 108, Number 4. April 2000.

Adapted from Compendium of methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change, UNFCCC Secretariat, February 2008.

>>> *Select analytical approach*

Countries can use any of several possible analytical approaches to develop baseline and adaptation scenarios, and derive streams of annual I&FF and O&M costs. There are numerous analytical options available for the assessment of I&FF in the health sector. These range from simple spreadsheet models that can be built by members of the project team to health intervention models.

As in some of the other sectors under analysis in climate impact assessments, the health sciences practice in the use of predictive mathematical models or other forecasting tools has been developing to address scarcity of data, uncertainty and multiple stresses. Infectious disease transmission patterns, for example, are affected by many factors other than climate, and the relationship between climatic variations and disease outbreaks is often transformed by environmental, biological, or societal changes.

To be suitable, sectoral models, grounded in historical data, should be selected that cover each of the impacts included in the scope of study, in order calculate plausible future trends in the health sector over the selected assessment period, incorporate the identified adaptation measures, and project streams of annual I&FF by entity and source.

If suitable models are not available, a health strategy or plan, a projection of trends specific to the sector, or the current situation (assuming the underlying variability), or a combination of those approaches, can be used as the basis for the analysis. The plan or projection chosen (e.g., a national scenario from the National Communications) should describe anticipated changes in the sector over the selected assessment period in sufficient detail to allow the identified preliminary adaptation measures to be re-evaluated and the scale and timing of their implementation identified (Step #5).

With this regard two sources are especially relevant for selecting the analytical approach for the health sector in developing countries; the information provided in climate change reports at the national level and national health plans and programmes, whether they be short, medium or long term.

However, there is an underlying complexity in the efforts to model health impacts as there are different types of evidence for health effects, i.e., health impacts of individual extreme events (thermal extremes, floods, storms, droughts); spatial studies, where climate is an explanatory variable in the distribution of the disease or the disease vector; temporal studies (short and long term) to detect early effects of climate change as well as experimental laboratory and field studies of vector, pathogen, or plant biology.¹³²

¹³² Kovats, R. Sari, Campbell-Lendrum, Diarmid and Matthies, Franziska (2005). Climate Change and Human Health: Estimating Avoidable Deaths and Disease. *Risk Analysis*, Vol. 25, No. 6, pp. 1409-1418, December 2005. Available at SSRN: <http://ssrn.com/abstract=943173> or DOI: 10.1111/j.1539-6924.2005.00688.x

If no previous analysis has been made or is available -as a result of national communication studies or vulnerability assessments- to estimate the expected additional health burden the team should proceed to estimate the attributable burden of specific diseases. Quantifying the relationship between climate and each health outcome involves a statistical analysis of the effect of past variations in climate on disease that yields an estimated change in disease rates, or in the probability of disease occurrence, for each unit change in the climate variable. The mentioned methodological approach has been utilized to quantify health impacts from temperature-related deaths, deaths and injuries from flooding, vector-borne diseases such as malaria and dengue and diarrhoeal disease.

The Table 10-4 includes a list of health models, methods and an example of a data management tool, in order to provide information on some of the extensive set of modelling efforts and approaches under way to address the complex interrelations between health, climate change and climate sensitive-health outcomes.

Table 10-4: Health sector models, methods and tools

Modelling approaches	
Models of data	
Empirical statistical models	Extrapolation of climate/disease relationship in time and space: change of distribution of vectors with change in climate Temperature-mortality (Kalkstein, Moser, etc.) Temperature –Diarrhoeal disease Rainfall-flood-death Temperature/rainfall- Dengue, Malaria (spatial correlations)
Economic models	Models that estimate the likely effect of climate change on measurable economic quantities such as income
Models of processes	
Process-based models (mechanistic or biological)	Theoretically based models of universal application: Vector borne disease forecasting with a model based on vectorial capacity (e.g. Martens) Malaria/vectorial capacity (MIASMA) Heat budget models
Epidemiological models	Susceptible population (S); Exposed (E); Infectious population (I); recovered population
Integrated assessment models	Integrated, systems-based mathematical models that concentrate on the interactions and feedback mechanisms between different subsystems of the cause-effect chain rather than focusing on each subsystem in isolation Systemic multidisciplinary linkage of process-based models: e.g. impact of climate change on the transmission potential of the malaria mosquito and malaria prevalence.
Specific health effects	
Temperature related illness and deaths	Regression model. Time series studies of daily mortality, following methods developed for air pollution studies. Combined with the mapping of heat stress indicators.
Extreme weather events	Epidemiological models and mapping.
Air pollution	Time series models
Vector borne diseases	Mapping. GIS. Biological models. Statistical models. Different methods for estimating future health impacts should be employed if these

Modelling approaches	
Models of data	
	diseases are already present or not. Malaria: Malaria models can be used to estimate the populations at risk for a range of climate and population scenarios. MIASMA model (Martens et al.) links GCM based climate change scenarios with the formula for the basic reproduction rate to calculate the transmission potential of a region where malaria mosquitoes are present. Dengue: CIMSiM is a dynamic life-table simulation entomological model that produces mean-value estimates of various parameters for all cohorts of a single species of Aedes mosquito. DENSiM (Focks et al., 1995) is essentially the corresponding account of the dynamics of a human population driven by country- and age-specific birth and death rates. DENSiM (Focks et al., 1995) is essentially the corresponding account of the dynamics of a human population driven by country- and age-specific birth and death rates.
Water and food borne diseases	Diarrhoeal disease: Time series analysis.
Example of data management tools	
"National Health Accounts v. 2"	Software package. The NHA framework is designed to capture the totality of expenditure flow in the health sector. The framework does not include standard definitions and categories; these must be determined through a combination of national and international discussions and consensus about priorities. http://www.hsph.harvard.edu/ihsg/NHA.html#2

Step # 2: Compile historical I&FF data and other input data for scenarios

Data should be compiled for each investment type, and should be annual, be disaggregated by investment entity, and, if possible, by source, and also be divided into investment flows and financial flows. The definitions of investment types, especially how narrow they are, will depend on sectoral scope and the level of detail of the analytical approach.

>>> Compile annual historical IF and FF data, disaggregated by investment entity and source

Historical I&FF data are needed to provide a basis from which to project possible future scenarios. At a minimum, countries should collect at least three years of historical I&FF data (i.e., for the base year and two years during the previous decade). Ideally, countries would collect ten years of historical data, i.e., for the base year and the previous nine years.

International forms for national accounts include health in the category "Education, health and social work, other community, social and personal services", which implies that identifying the actual investments in the health sector alone may be difficult. Data should be disaggregated by year, source, and type.

In addition, historical data will be available in the country. There is a variety of information sources at the national level that should be considered when conducting the assessment; they include data from national accounts, expenditure reports of the different ministries (i.e. Ministry of Health, Ministry of Finance), Social Security institutions and other governmental agencies, as well as statistical yearbooks and health specific statistical information from the

national statistic agency, both at the national and sub-national level; information from international funding agencies; national reports of related entities such as private medical insurance and pharmaceutical industry; health research centers and academic institutions; household expenditure surveys; censuses; and administrative records.

National health accounts (NHA)¹³³ estimates, including expenditures in preventive medicine and infrastructure development, are available for a hundred and ninety one countries, provide a systematic and consistent source of data on which to base the assessment, and should be utilized, where appropriate.

National health accounts aim at monitoring resource flows in a country's health system and capture the full range of information contained in these resource flows, including financing sources, financing agents, providers, beneficiaries, functions, and costs, by expressing the basic macro identities between expenditures, consumption plus investment, provision of goods and services and sources of financing, taxes plus payroll taxes and private disbursements.

In the methodology chapter of the Guidebook the requirements for compiling annual historical investment and financial flows data are specified. This section focuses first on where to obtain the data required for fulfilling the Template for One Year of Historical I&FF Data (Table 2-4) and then on how to prepare the information in order to be able to fulfill the template.

To complement and expand the national information available at the pertinent government institutions and agencies and/or in the cases when data is not complete or partially not available to the project team, complementary data can be obtained from the following sources:

- **World Health Organization (WHO).** The organization maintains a publicly available database, WHOSIS, the WHO Statistical Information System, which is an interactive database bringing together core health statistics for the 193 WHO Member States. It comprises more than 70 indicators, which can be accessed by way of a quick search, by major categories, or through user-defined tables. The data are also published annually in the World Health Statistics Report.
- **The National Health Accounts (NHA)**¹³⁴ website provides evidence to monitor trends in health spending for all sectors - public and private, including level and composition of health expenditures and to monitor trends in different health care activities, providers, diseases, population groups and regions in a country. It helps in developing national strategies for effective health financing and in raising additional funds for health.
- **The Global Health Atlas.** In a single electronic platform, the WHO's Communicable Disease Global Atlas brings together for analysis and comparison standardized data and

¹³³ World Health Organization (2003). Guide to producing national health accounts: with special applications for low-income and middle income countries.

¹³⁴ <http://www.who.int/nha/en/>

statistics for infectious diseases at country, regional, and global levels. The analysis and interpretation of data are further supported through information on demography, socioeconomic conditions, and environmental factors. In so doing, the Atlas specifically acknowledges the broad range of determinants that influence patterns of infectious disease transmission. The Global Health Atlas has several related sites, as follows:

- Global Tuberculosis Database
 - Global Atlas of the Health Workforce
 - FluNet
 - DengueNet
 - RabNet
 - Global Alliance for the Elimination of Blinding Trachoma
 - Project Atlas: Resources for Mental Health and Neurological Disorders
 - Global Information System on Alcohol and Health.
- Statistics from WHO regional offices, including Africa, Asia, and Latin America and the Caribbean.
 - In addition, the WHO Global InfoBase is a data warehouse that collects, stores and displays information on chronic diseases and their risk factors for all WHO member states.

Macroeconomic health related information can be found at The Commission on Macroeconomics and Health, launched by WHO in 2000. The Commission's mandate was to examine the links between health and macroeconomic issues, including mobilization of domestic resources and health and international development assistance and health, and published reports on national macroeconomic and health, on external resource flows to the health sector and country situation analyses, with the participation of Cambodia, Caribbean Community, China, Ghana, India, Indonesia, Mexico, Nepal, Rwanda, Senegal, Sri Lanka and Yemen.

The World Bank provides a database with statistical series on health nutrition and population information under the HNPStats – the World Bank's comprehensive database of Health, Nutrition and Population (HNP) statistics¹³⁵. There is a wealth of scientific literature that provides analysis and information that can complement national information.

After the information has been collected and compiled the national team has to decide on how to organize the available information and fulfill the mentioned Table 2-4 specifying the amount of I&FF per year, for each kind of investment type, according to the policies and measures, plans, actions, programmes, activities, and projects that are being implemented, considering the origin of these investments according to the categories indicated in the methodology chapter of the Guidebook.

¹³⁵<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTDATASTATISTICSHNP/EXTHNPSTATS/0,,menuPK:3237172~pagePK:64168427~piPK:64168435~theSitePK:3237118,00.html?>

To facilitate that task the following table (Table 10-5) lists the different investment types that are being made to support the operational conditions and functions in the health sector. It is necessary to bear in mind that the purpose of this table is to organize the information that is going to constitute the set of inputs that allows the aforementioned Table 2-4 to be filled in.

Table 10-5: Examples of investment flows and financial flows in the health sector

Year 2005		
List of investment flows and financial flows	IF (2005 US\$)	FF (2005 US\$)
Public health management: Health policy, planning and management Use of scientific evidence in the formulation and implementation of public health policy Public health and health systems research International collaboration and cooperation in health		X
Public health legislation and regulations Enacting health legislation, regulations and administrative procedures Health inspection and licensing Enforcement of health legislation, regulations and administrative cross-sectoral procedures		X
Monitoring the health situation		X
Prevention, surveillance and control of communicable and non-communicable diseases: Immunization Disease outbreak control Disease surveillance Prevention of injury		X
Personal health care for vulnerable and high-risk populations Maternal health care Infant and child care		X
Occupational health		X
Specific public health services School health services Emergency disaster services Public health laboratory services		X
Health promotion		X
Infrastructure Hospitals Nursing and health care facilities Primary health care infrastructure Other buildings Medical and diagnostic laboratories Ambulance services and movable equipment Communications Blood and organ banks	X	
Technology Drugs Pollutions control methods Vector control technologies New vaccines Warning systems	X	

Year 2005		
List of investment flows and financial flows	IF (2005 US\$)	FF (2005 US\$)
Mobile laboratories Computerized disease surveillance New pesticides		
Equipment Hospital equipment a. Laboratory b. Health care facilities	X	
Training		X
Research Food hygiene and nutrition Radiation used for medical purposes, Biochemical engineering, Rationalization of treatment and pharmacology Epidemiology, Prevention of industrial diseases Drug addiction		X

X Indicates likely type of flow

In addition, the financing agents in national health accounts are the institutions and entities that pay for or purchase health care. Financing agents can include institutions that pool health resources collected from different sources, as well as entities (such as households and corporations) that pay directly for health care from their own resources. The overall framework is shown in the following table:

Table 10-6: Investment entities and sources of I&FF in the health system

Investment entity	Source of funds	Investment entity
Households	Domestic	Private households' out-of-pocket payment
Corporations	Domestic	Private social insurance Other private insurance
	Foreign (*)	Firms and corporations (other than health insurance) Non-profit institutions serving households (other than social insurance)
Governments	Domestic (Budgetary)	General government Territorial government Central government
	Foreign (*) Borrowing	State/provincial government Local/municipal government
	Bilateral foreign aid Multilateral foreign aid	Social security funds

(*) Foreign: rest of the world

>>> *Compile annual historical O&M data, disaggregated by investment entity and source*

Historical O&M data are also needed to provide a historical basis from which to project possible future O&M costs for new physical assets. Annual O&M costs for the physical assets that are in operation during the historical period, and for assets purchased prior to the historical period but that are still in operation, should be collected. The number of years for which historical O&M data are collected should be the same as is done for historical I&FF data (i.e., for three to ten years). Information about the expected lifetimes of the assets in operation during the historical period, and annual fluctuations in O&M costs, also need to be collected.

The O&M data for assets purchased during the historical period should be tracked separately from the O&M data for assets purchased before the historical period so that the total costs of assets purchased during the historical period can be estimated. Table 2-5 illustrates the disaggregation of three years of annual historical O&M cost data for an asset purchased in 2003.

The O&M data that need to be collected may reside in one or more of same locations for I&FF data (e.g., national accounts, ministry records and plans, industry records, statistical agencies, utilities, research institutions). If such data are not available, countries should utilize one of the following approaches to derive estimates:

- Adopt O&M cost data from similar assets in other countries, and adjust the O&M data to in-country production and consumption rates.
- Derive estimates from proportional relationships between O&M costs and total costs, or between O&M costs and capital costs (e.g., 10%, 25%, or 75%). Use either standard assumptions about proportional relationships, or proportional relationships observed in other countries.

The International Monetary Fund (IMF) Government finance statistics manual contains an economic classification of expenses, and the system of national accounts uses the same breakdown. These and similar categories have been used by governments as a standard framework for describing public expenditures by entities such as the ministry of health or social security fund. Even in countries at a very early stage of development of health accounts, the trend is to develop classifications compatible with the IMF standard.

A classification scheme only for O&M costs is shown in Table 10.7 that can be easily related to the to the mentioned IMF framework, and, as with other schemes, can be collapsed or expanded as required by policy needs and permitted by data.

The framework explicitly excludes consumption of fixed capital, interests, subsidies to providers, transfers to households and capital expenditures at large.

Table 10-7: Components of O&M

O&M cost categories	
	Current outlays
Salaries or wages of personnel	Compensation to human resources: Wages Social contributions Non wage labour income
Materials Supplies and consumables	Supplies and services: Material supplies Drugs and pharmaceutical Other supplies Services
	Other current expenditures
Source: O&M specification in the Methodology Guidebook (pp. 15-16)	Source: Financing flow chart, Resource cost, Financing flow in the Health System, National health accounts, Country Information, WHO.

The Table 2-5, as indicated in the methodology chapter, should be filled by including historical annual O& M (associated exclusively to the investment flows types) described in Table 10-8, with the exclusion of financial flows corresponding to government programmes (essentially FF in that table).

>>> *Compile other input data for scenarios*

In addition to historical I&FF and O&M data, the characterization of the scenarios and derivation of annual costs for the scenarios will require the collection of other historical and non-historical data relevant to the sector. What data are needed will depend on the analytical approach chosen, the sectoral scope, and whether I&FF for mitigation or for adaptation measures are to be assessed. For example, if a model is to be used, basic socioeconomic data may be needed for model inputs (e.g., population and economic growth projections, demand forecasts for health services, etc.).

Step #3: Define baseline scenario

This step entails characterizing the sector over the assessment period, assuming business-as-usual conditions, by providing a description of what is likely to occur in the sector in the absence of additional policies to address climate change.

The national team should ensure that the analysis of the evolution of the baseline scenario is not a static one by considering the expected trends in the key variables that constitute the main elements that define the baseline scenario.

For the baseline scenario a set of assumptions on the likely evolution of those variables might be defined on the understanding that the historical trends will persist with no substantial changes other than the potential deterioration of the determinants of health and other

condition. The current disease situation is anything but stable as a consequence of multidimensional changes that include population growth, fast urbanization, intensive farming practices and environmental degradation, while new diseases are emerging at a faster rate, the globalization trends create vastly increasing opportunities for the rapid international spread of infectious agents and their vectors, in a world characterized by high mobility, economic interdependence and electronic interconnectedness, expanding vulnerability and health hazards across countries. Then, the baseline scenario would be anything but static and the patterns of medium and long term change in the health sector might reflect the intensive changes that impact on population health without even considering the adverse effects of climate change and the inception of a national strategy to address climate change adaptation needs. Thus, measures that would be introduced to address some of the current circumstances and tensions, might also be included in the baseline scenario.

A model can be used in the analysis, to develop and define the baseline scenario. Otherwise a health sector plan, national health strategies and diverse specific programmes, a projection of trends, or the current situation (assuming no change), or some combination of these different planning tools, can be used as the basis of the projection. The role of the private sector and its decision making patterns, including the potential evolution of economic conditions, demand side considerations and overall evolution of the national economy, should also be taken into account when defining the baseline scenario.

In cases in which countries have been increasingly aware of climate change adverse effects and have already made progress in addressing climate change, these measures should be reflected in the baseline scenario, rather than trying to separate out current action on climate change. This is particularly important given the desired outcome of the analysis, specifically the additional resources needed to address climate change, i.e., above and beyond resources already invested in adaptation.

Step # 4: Derive I&FF estimates for baseline scenario

>>> Derive annual IF and FF estimates, disaggregated by investment entity and source

The source of these data, or method of derivation, will depend on the analytical approach to be used, the scope, and the types of investment entities that are relevant for the health sector. The I&FF estimates may be the output from a model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions, as appropriate.

>>> Derive annual O&M estimates, disaggregated by investment entity and source

As with I&FF data, O&M estimates may be from the output from a model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment

entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

Step # 5: Define adaptation scenario

In general terms this step entails developing a description of what is likely to occur in the sector, over the assessment period, in the presence of new policies and measures to address climate change in the health sector by considering the future impacts of population health, and direct and indirect exposures.

Climate-related adaptation strategies should be considered in the context of broader public health concerns such as, inter alia, population growth and demographic change, poverty and exclusion, current availability of health care and existing public health infrastructure and installed capacity in relation to population, sanitation, nutritional status of the population and of the most vulnerable groups, and environmental degradation. These conditions constitute the basis for the determination of the national strategy to enhance adaptive capacity in the sector considering expected socioeconomic trends, technological change, new adaptation measures that will be implemented including the nature, scale, and timing of each, and expected investments in the sector given implementation of the measures.

The main goal of an adaptation strategy, including the management of environmental risks and targeted public health programmes, is to reduce potential adverse climate change health effects. In this context, it is necessary to strengthen adaptive capacity by enhancing the ability of institutions, systems and individuals to adjust to potential damages. Improved weather warning and preparedness systems, buildings and infrastructure, all can be considered measures to reduce human health risks in the event of a changed frequency of weather disasters.

Operationally, the starting point for the definition of the adaptation scenario is to re-evaluate, confirm or modify the preliminary set of the adaptation options that were identified in step #1, given the analytical approach chosen in that step and the data compiled in step #2; thus the set should be now revised or expanded if needed. The analysis necessary to define the adaptation scenario is done by considering a set of questions including:

- What is the purpose of the adaptation efforts at the national level?
- To what socially relevant health outcomes should the country adapt to?
- What are the future projections for those expected health outcomes?
- Who is vulnerable to those health outcomes?
- Is additional intervention needed?

In addition, when considering the essential features of the adaptation scenario, it is useful to analyze whether it is necessary to modify or expand existing prevention measures, to reinstitute effective prevention programs that have been neglected or abandoned, and to consider and assess the possibility of new risks to the population at large or to particularly vulnerable groups, focusing on how much it will cost to treat these additional cases of disease,

in order to achieve estimates of I&FF that reflect only the additional costs of climate change. The adaptation scenario would then include the estimates of future burden of disease due to climate change at the national or sub national levels in order to identify the options available in terms of policies and measures and the scientific and technology options to address the main health expected outcomes.

It is recommended that at this stage, countries also undertake a prioritization of the adaptation measures, based on national or regional climate change concerns as well as national development priorities, and preferred sustainability pathways. The next task is to specify the options available in terms of adaptation and the concrete activities that the selected mitigation options imply by considering the range of options and types as depicted in Table 10.3 and Table 10.5.

The clearer and complete the planned activities in the health adaptation strategy that is implicit in the adaptation scenario, the more accurate the I&FF and O&M assessment for the sector will be.

Step #6: Derive I&FF for adaptation

>>> Derive annual IF and FF estimates, disaggregated by investment entity and source

The source of these data, or method of derivation, will depend on the analytical approach, the scope adopted for the sector, and the types of investment and entities that are relevant.

>>> Derive annual O&M estimates, disaggregated by investment entity and source

The output of this step will be a stream of annual O&M costs for each investment type for the entire assessment period, disaggregated by investment entity and source.

Step #7: Estimate changes in I&FF needed to implement adaptation

The changes in IF, FF, and O&M costs that are needed to implement the adaptation measures in the health sector are calculated according to the general methodology as outlined in Step 7 in Chapter 2 of this Guidelines. The changes in investments and financial flows are obtained by simply subtracting baseline scenario costs from climate change scenario costs. There are two primary objectives of this step: 1) to determine how cumulative IF, FF, and O&M costs would change; and 2) to determine how annual IF, FF, and O&M costs would change. Five separate sets of calculations should be completed – two for estimating changes in cumulative IF, FF, and O&M, and three for estimating changes in annual IF, FF, and O&M. In addition, if subsidy costs are included explicitly in the assessment, the changes in subsidy costs may be calculated. The accompanying volume on reporting (Reporting Guidelines for the Assessment of Investment and Financial Flows to Address Climate Change) contains worksheets that can be used as models for developing country-specific worksheets for performing these calculations.

Step # 8: Evaluate policy implications

Health sector policies will be needed to induce the relevant entities identified in the assessment to implement the proposed measures and incur the related I&FF. It will be important to convene a discussion among relevant stakeholder regarding the set of regulations or incentives necessary to influence investment decisions. When addressing policy options, social, economic and environmental benefits should be assessed qualitatively.

The evaluation should allow the formulation and implementation of appropriate policies at the national and also at the sub-national scale, considering the broader view of vulnerability patterns, according to socioeconomic conditions, and providing insights into the processes that cause and exacerbate vulnerability in countries participating of the assessment.