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## INFORMATION FOR DECISION-MAKING IN HEALTH AND ENVIRONMENT

Paper submitted by UNECE Secretariat<sup>1</sup>

*“Human beings are the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature” Principle 1 of the Rio Declaration from the Earth Summit.*

*“Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided”. Principle 10 of the Rio Declaration from the Earth Summit.*

**Abstract:** This paper provides an overview of some of the main environmental threats to human health and discusses the need for improving information required for decision making at all levels. Issues related to measuring and monitoring the effect of the environment on health and well-being are also raised. The paper likewise draws attention to the key role of indicators for the monitoring and assessment of policies. Although monitoring systems cannot replace policies and actions directly aimed at improving environmental health conditions, such systems should nonetheless form an intrinsic part of the decision-making process from the very beginning. Government are increasingly recurring to quantitative targets and benchmarks as a way of enhancing credibility and indicator development and performance monitoring have become integral to the overall planning process and good governance.

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## INTRODUCTION

The United Nations Conference on Environment and Development (Rio de Janeiro, 1992) was a landmark summit in more than one way. During this meeting, several ambitious goals were agreed upon by countries, international organisations and non-governmental organisations. The summit also decided to regularly monitor advancement towards these goals and planning is already well under way for the 10<sup>th</sup> Anniversary of the Rio Summit in 2002. This time, when world leaders and experts will gather, in South Africa, the main objective will be to review progress on the many targets set a decade ago. Particular attention will be focused on Agenda 21 that sets out the actions and strategies that need to be taken in the coming decades to achieve sustainability in a number of fields, including human health.

The focus of the current meeting is on indicator development and suitable frameworks. The meeting aims to address, the demand for improved environmental information within the ECE Region. Chapter 40 of Agenda 21, which deals with the need for information for decision-making in the environment field, is particularly relevant to the discussions here. Similarly, the “right to environmental information of citizens,” identified in Principle 10 of the Rio Declaration, is a key element in establishing participatory democracy and involving the public in environmental decision-making. Although there is still a wide data and information gap to be bridged, it is probably fair to state that as a result of the objectives and activities recommended in chapter 40 governments have become more aware of the importance of statistical information for informed decision-making at all levels. According to UN Secretary General, Kofi Annan, the *Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*, represents a “giant step forward towards the goal of sustainable, equitable and environmentally sound development”<sup>2</sup> and paves the way for the active engagement of civil society. He went on to say: “Although regional in scope, the significance of the Aarhus Convention is global. It is by far the most impressive elaboration of principle 10 of the Rio Declaration”. Implementing the right of every person to live in a healthy environment propitious to well-being and the right to be informed about matters of concern in their local environment will further increase the demand for statistics and environmental indicators.

Since the Rio Summit, progress has been noted in a number of areas related to improved information on environmental issues. For example, in the area of environmental health much work has been done on the development of indicators (David Briggs, 1999) and methodologies for assessment of environmental diseases burden (David Kay, et al., 2000). Numerous national and regional initiatives could also be quoted which have helped to promote increased integration of decision-making through the abolition of traditional divisions between policy areas and sectors (UNECE, 2001). Moreover, despite the pronounced differences in health, environment and development between different regions and cultures, it is increasingly recognised that there is a common need for decision-makers to have access to information on environmental hazards to health.

Measuring change is of critical importance for monitoring progress and for the formulation and implementation of policies. Quantitative data, methods and models are essential for accurately assessing the relationship between health and environment. Similarly statistics are needed for monitoring quantitative targets and goals, as well as for evaluating policies

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<sup>2</sup> In the foreword to the Aarhus Convention: An implementation guide

and making these more effective. Although, in many countries in the region an abundance of statistical data are available, the information may not always be policy relevant, easily accessible or comprehensible for the public. Moreover, in the context of measurement at the international level, cross-country comparisons are hazardous and an agreement on at least core issues is still lacking in many areas. However, progress on this front, is beginning to be noted and both the European Union and several inter-governmental organisations (notably UNCSD, UNSD, UNEP, OECD, WHO) are putting considerable efforts into the harmonisation of data and definitions and on establishing comparable data set for monitoring performance.

## **LINKING ENVIRONMENT AND HEALTH**

The World Resources Report in its 1998-1999 edition (WRI, 1998) clearly established that environmental degradation remains a major cause of ill health and premature death in many countries. In the world's poorest countries, environmental health problems stem largely from poverty and the lack of development, while in wealthier countries environmental threats to health are mostly caused by industrial pollution, pollution associated with transport and conversion of fossil fuels into energy. The report also showed that, everywhere, a significant part of environmental health problems could have been prevented through better environmental management.

Environmental threats to human health are usually divided into “*traditional hazards*” associated with the lack of development, and “*modern hazards*”, associated with unsustainable development. The first type includes hazards related to poverty and poor development such as unsafe drinking water; lack of basic sanitation; indoor air pollution and lack of waste disposal. The modern hazards are mostly caused by unsustainable development and include water pollution from over-populated areas, industry and intensive agriculture; urban air pollution from cars, power stations and industry; climate change; ozone depletion and transboundary pollution. In many countries the “*environmental health hazard transition*” has occurred in tandem with economic development. However, in some developing countries the transition is on-going so that the modern hazards have become established before the traditional ones have been significantly reduced, the population of these countries face the highest risks of exposure as they live the worst of both worlds.

Conditions in both the global and the local environment are critical to health and well-being. People are exposed to multiple health risks on a daily basis. Identifying which exposures or combination of exposures undermine health, and to what degree, is a real challenge. Moreover, the incidence and impact of each of the individual hazards is associated with a variety of aspects related to economic and social development. Indeed, the relationship between health and the environment is highly complex and to measure it scientifically is far from straight-forward. To understand better this relationship and the resulting effects and interactions, several “health-and-environment-cause-effect” frameworks have been devised. Among the more popular ones is the DPSEEA model which helps pinpoint the DRIVING FORCE behind, the PRESSURE experienced, the current STATE, the EXPOSURE suffered, the EFFECT of this and the ACTION which can be taken.

Chapter 6 of Agenda 21, outlined what countries and organisations needed to do in order to protect and promote human health. In the preamble it called attention to the fact that both

insufficient development and inappropriate development resulting in over-consumption can result in severe environmental health problems in both developed and developing societies. The driving forces (population expansion, rapid urbanisation, poverty, consumption and production patterns, etc.) create the conditions in which environmental health threats can develop (or be averted). A change in direction of these can therefore alleviate or exacerbate a broad array of environmental health threats. It is very much these driving forces that determine whether a society is moving towards or away from sustainability. Such pressures affect the state of the environmental quality, which in turn can lead to adverse human exposures and negative health effects. To get away from this spiral relationship, Agenda 21 recommended an inter-sectoral approach which recognises the linkage of health, environmental and socio-economic improvements. The experience many governments have had seems to confirm that only this type of approach is truly effective for formulating environmental health policy and for ensuring that priorities are coherent and do not conflict with those of individual sectors.

The World Health Organisation has called poverty the world's biggest killer because it determines an individual's environmental risks as well as access to resources to deal with those risks. However, this does not mean that environmental threats to health are limited to developing countries, in China 2 million people die each year from effects of air and water pollution and in the United States some 80 million people are exposed to levels of air pollution that impair health. Moreover, despite the known effects of lead poisoning, many countries in the ECE region continues to use leaded gasoline, thereby exposing their citizens to brain damage, impaired renal functions and anemia (WHO,2000). There is little doubt, that environmental factors play a greater role in determining health in poorer countries than in wealthier ones where voluntary behaviours (such as smoking and diet) are far greater determinants of health. Nonetheless, environmental factors deserve increased policy attention in both type of societies as they are avoidable causes of ill health.

The decade since the Rio Declaration has seen a marked increase in the coordination of activities in the European region in terms of harmonised policy responses towards achieving environmentally sound and sustainable development. The harmonisation of policy responses to particular problems has taken place through periodic exchanges of information in the form of meetings, conferences and associations between states, often facilitated through the fora of international organisations. Several frameworks for addressing transboundary problems have also been established within Europe through multilateral environmental agreements (MEA). For some of the more complex problems, several long-term international processes have been initiated to address major challenges. An example in the health-environment field is the work on transport, environment and health undertaken under the auspices of the UNECE and WHO-Europe.

## **HEALTH RISKS FROM ENVIRONMENTAL HAZARDS**

Before discussing the major environmental threats to human health, it needs to be stated that while the causal connections are obvious for some diseases and conditions, for others these relationships are far from clear. Indeed for many, all that is known is that there is an association and that this may be the link to ill-health.

In many parts of the world, the general environment (air, water, urban land), workplaces, and even individual dwellings, are so polluted that they pose serious health risks to the

inhabitants. The ability of governments to tackle these problems are often greatly restricted due to lack of means; and even where the means are there the pollution control and health protection measures have often not kept pace with economic development. “*Reducing health risks from environmental pollution and hazards*” was one of the five specific programme areas covered in chapter 6 on Human Health of Agenda 21. To help reduce environmental threats to human health, governments present in Rio agreed to undertake activities in 13 areas among which are urban air pollution; indoor air pollution; water pollution; pesticides; solid waste; human settlements; noise and radiation.

There seem to be little disagreement in the literature that air, water and food are the principal routes of environmental health hazards, with a heavy contribution also from inadequate facilities for household wastes and sewage. The effect of the various main agents on human health is described briefly below:

### **Air pollution**

Air pollutants affect the lung and respiratory tract where they enter the bloodstream and are transported throughout the body. Indoor air pollution from the burning of bio-mass fuels can be particularly hazardous to health when released in close proximity to people. It is estimated to be a major cause of acute respiratory infections that kill 4 million people a year globally.

### **Household wastes**

Poorly managed wastes (particularly excreta because of the pathogens they contain) represents a serious health threat and can cause diarrhoeal disease, cholera, worms and typhoid fever. Uncollected waste in streets and unofficial dump sites is a source of intoxication or infection, particularly to children.

### **Water**

Safe drinking water is universally recognised as a basic human need. Yet more than one billion people do not have access to safe water. Water pollution, whether caused by sewage, nutrients (e.g. nitrates), chemicals or acidification, has a direct bearing on human health and is estimated to be responsible for some 7 per cent of all deaths globally (Murray and Lopez, 1996). Of all the diseases, diarrhea has perhaps the closest link to environmental factors. Finally, the mosquito and snail vectors connected with aquatic environments (e.g. irrigation) cause malaria, schistosomiasis, dengue fever and encephalitis.

### **Food**

Food can be a major route of exposure to pathogens and toxic chemicals. These can be introduced during cultivation, harvesting, processing, storing, transportation or during final preparation for consumption. Health impacts range from mild indisposition to life-threatening illness. In the developed world, chemical food contamination is rare and salmonellosis has remained the most important foodborne disease. More recently, the new variant of the Creutzfeldt-Jacob's disease has had a notable impact on people's meat eating habits.

### **Soil**

In many countries, the direct contact with soil or dusts is a major source of exposure to intestinal worms and other parasites. Although rarely fatal, worm infections nonetheless exact a tremendous toll in developing societies. Because children breath air that is closer to the ground they are more exposed than adults to risks connected with this medium. Global

use of pesticides creates substantial health impacts in all parts of the world, although the exact health effect is difficult to estimate given the many chemicals and types of exposure.

### **Chemicals**

Exposure to chemical agents in the environment, whether through air, water, food or soil, has numerous adverse effects ranging from cancers to lung disease, brain damage to birth defects. Some evidence of the result of exposure to these agents is well known (i.e. lead or mercury) while for the majority of the thousands of chemicals used today, the evidence is suggestive at best. Part of this lack of certainty is due to the fact that cancers may take 10-40 years to develop and many other factors may contribute to their development. Effects of exposure to chemicals are therefore often divided into: *acute effects* which appear very soon after the exposure and *long-term chronic effects* (which are not yet well understood).

### **Housing**

Numerous factors in the home environment influence health, e.g. lack of piped water and sewage connection, high noise levels, poor indoor air quality, inadequate food storage and preparation facilities, high humidity, over-crowding and pests. Many infectious diseases (e.g. cholera and other diarrheal diseases, TB, measles, etc.) are intimately connected with poor and crowded housing facilities.

### **Workplace**

Exposure to health hazards at work are common and can contribute to respiratory diseases, injuries, cancer, allergies, stress, and eye and hearing damage. Exposure to risks at work are likely to be greater in less developed countries because there are fewer safeguards in place that reduce emissions and protect employees from exposure.

### **Global threats**

Some environmental health hazards are of global origin. For instance, climate change, ozone depletion, transboundary air and water pollution, acid rain, loss of biodiversity, deforestation and desertification all have transnational consequence. For such hazards, global agreements and mobilisation are the only remedies.

To further complicate things, many environmental hazards occur in more than one environmental media. The possibilities for exposure can therefore be multiple for the same illness or disorder. Table 1 summarises the potential relationship between exposure situations and the effects on health. Many environmentally related health risks are clearly a result of multiple exposure media and reduction targets for any of these would have to come from coordinated action and agreement across various sectors.

**Table 1 - Potential relationships between exposure situations and health conditions**

Health conditions of concern	Exposure situations					
	Polluted air	Excreta and household wastes	Polluted water or deficiencies in water management	Polluted food	Unhealthy housing	Global environmental change
Acute respiratory infections	•				•	
Diarrhoeal diseases		•	•	•		•
Other infections		•	•	•	•	
Malaria and other vector-borne diseases		•	•		•	•
Injuries and poisonings	•		•	•	•	•
Mental health conditions					•	
Cardiovascular diseases	•					•
Cancer	•			•		•
Chronic respiratory diseases	•					•

Source: WHO 1997

## ESTIMATING THE GLOBAL BURDEN OF DISEASE

Knowledge of the disease burden caused by environmental exposures, and the potential for prevention, would be extremely useful to guide decision-making, priority setting and resource allocation in health and environmental management. Although the environmental factors discussed in this paper are those which have been relatively well studied and which we know pose a health risk, it is not easy to make exact quantitative estimates of the extent to which people suffer adverse effects from exposure. There are two basic approaches used to assess disease-burden from environmental risk-factors: the “*exposure-based*” and the “*outcome-based*” approach (WHO/ILO 1998). While the former estimates the disease burden on the basis of population exposure, the latter is trying to estimate the fraction of a disease burden which can be attributed to a certain risk factor. Although they share the same underlying assumptions on the health-environment link and its quantification, they differ in the data sets they require. Both use the disability-adjusted life year (DALY) summary measure as a common metric.

WHO has invested considerable resources into measuring the weight of each disease in the global disease burden and to develop a summary measure to evaluate the health states of populations (Murray and Lopez, 1996). The measure of population health recently developed, the *DALY*<sup>3</sup>, takes into consideration both fatal and non-fatal health outcomes of disease. Other summary health estimates used are based on mortality data only because of the conceptual and definitional complexity of measuring morbidity and disability in populations. The weight of environmental health problems in the global burden of disease can be studied by using this model and WHO has calculated a summary estimate of their contribution to the overall disease burden (table 2). Applying the estimated environmental fraction for each disease leads to an estimate of the total DALY burden that is due to

<sup>3</sup> The DALY concept estimates the disease burden for all major illnesses and each DALY indicates the loss of a year of healthy life – that is time lost through premature death or time lived with a disability. To calculate a DALY data on mortality and disability are combined. Different weights are assigned to different disability conditions according to severity. Age weighting and discounting are incorporated because it is assumed that future years of life lost contribute less than current ones. The higher the DALY, the higher the disease burden contribution.

environmental factors. This comes out at 23 % of the world's total DALY burden. The diseases that have the largest environmental contributions in this model are diarrhoeal diseases, acute respiratory diseases and unintentional injury.

**Table 2 - Proportion of global DALYs associated with environmental exposures, 1990**

	Global DALYs (thousands)	Environmental fraction (%)	Environmental DALYs (thousands)	% of all DALYs (all ages) (age 0-14)	
Acute respiratory infections	116 696	60	70 017	5	4.5
Diarrhoeal diseases	99 633	90	89 670	6.5	6.1
Vaccine-preventable infections	71 173	10	7 117	0.5	0.49
Tuberculosis	38 426	10	3 843	0.3	0.04
Malaria	31 706	90	28 535	2.1	1.8
Injuries					
unintentional	152 188	30	45 656	3.3	1.6
intentional	56 459	N.E.	N.E.		
Mental health	144 950	10	14 495	1.1	0.08
Cardiovascular diseases	133 236	10	13 324	1	0.12
Cancer	70 513	25	17 628	1.3	0.11
Chronic respiratory diseases	60 370	50	30 185	2.2	0.57
Total these diseases	975 350	33	320 470	23	15.4
Other diseases	403 888	N.E.	N.E.		
Total all diseases	1 379 238	(23)	(320 470)		

N.E.: not estimated

Source: WHO 1997 (DALY data from Murray and Lopez, 1996)

However, because of the complex aetiology of most disease and our murky understanding of the environmental impact, calculating the contribution of each pollutant to disease is currently fairly approximate and the authors at WHO admits that their data can only give but a rough indication. The work on developing a methodology that can more precisely estimate how many deaths and how much disability environmental risks contribute to the global deaths and disease is continuing (Ezzati, 2000). Policy-makers essentially require information and evidence to help them prioritise among the environmental risk factors and concentrate on those where interventions will have the biggest impact in their society.

## IMPROVING INFORMATION FOR DECISION-MAKING

One of the objectives stated in chapter 6 of Agenda 21 (d) is: "to identify and compile, as appropriate, the necessary statistical information on health effects to support cost/benefit analysis, including environmental health impact assessment for pollution control, prevention and abatement measures". Among the recommended activities of the agreed action programme for improving the information base is: to build up environmental monitoring capacities for the surveillance of environmental quality and the health status of populations; to promote research; and the development of methodologies.

To carry out these various activities, environment and health statisticians clearly have a very important role to play. Together with the relevant government departments concerned with policy formulation, statisticians need to be involved from the very beginning to

identify the best data to use for monitoring policy targets in national action programmes. In particular, statisticians can ensure that: the information used is of good quality and based on best sources and practices; that the data are coordinated with collections elsewhere; that the breakdowns employed correspond to standards used in economic and social fields; and that the indicators chosen are user-friendly and measure comprehensively progress towards the goals. Statisticians are also well suited to contribute to the conceptual development of cross-sectoral indicators and to take part in interdisciplinary research on developing a sound analytical framework for quantitative monitoring.

### **Data collection, quality and dissemination**

The importance of regional and local statistics has increased in recent years in many countries. With a greater emphasis on regional policies everywhere, policy makers need to make sure that resources are targeted effectively and efficiently at the areas most in need. In addition, citizens wish and have the right to know more about their local area and how it compares to other areas. While it is known that large differences often exist between regions in countries, it has become clear that significant differences may also be found within a region or urban area. Information at the small area level can help identify such areas and target appropriate action. For example, in the UK devolution for Scotland, Wales, and Northern Ireland has stimulated the demand for information on these areas. In conclusion, there is a growing recognition that, for environment information to be most effective, it needs to be collected at various geographic levels, from the local to the international.

Similarly, to limit the cost of new data collections, statistical offices increasingly have to make maximum use of existing administrative information collected by government departments, regional authorities, or specialised agencies. A growing number of countries are implementing systems that ensure that data held in different administrative registers are geographically referenced. Many environmental issues are local in scope and sources of pollution are typically most severe at the smaller geographic area. To overcome the problem of collecting data for these small units some countries have successfully developed methods of synthetic small area estimation to compile statistics for those themes for which no data exist (Statistics Canada, 2001). Because environmental data do not respect administrative borders, the need for a flexible geographic infrastructure is especially important. Once the infrastructure is in place, considerable savings can be obtained from the use of GIS and satellite sources.

It is generally agreed that the policy relevance and usefulness of data can be significantly improved by intensifying user/producer relations. Statistical services which have user groups to advise them or offer support for users in form of help-lines and advice on standard questions and methodologies have found that this has increased the benefit to both sides and promoted data use and consistency. It has also helped them to identify data gaps and to set priorities in filling these.

As not all population groups are at risk to the same extent, the impact suffered from environmental hazards varies; hence it is necessary to ensure that the information is disaggregated for different subgroups (e.g. children, the elderly, urban/rural, etc). Once collected, efforts have to be spent to make certain that the data are made available to all who would benefit from them and who are likely to use them. Making use of the Internet and having public databases is essential, but the disseminating agency also has a

responsibility to ensure that a user-friendly format is developed for the indicators and that training and technical support in the use and interpretation of the data is offered.

### **Key role of indicators**

Indicators can play an important role in turning data into relevant information for decision-makers and the public by simplifying what often is a complex array of data. In this way, indicators can provide a synthesis of existing conditions and trends which informs decision-making (von Schirnding, 2001). In the case of environmental health indicators they are needed: for monitoring trends in the state of the environment in order to identify potential risk to health; for assessing trends in health to guide policy; to compare the environmental health status of different countries and regions; to help decide on priorities: and to assess the effects of policies and eventually determine best practices.

Developing good environmental health indicators is not an easy task. To be effective, indicators must be user-driven and satisfy a number of different criteria. These have been summarized in the box below.

<i><b>Box 1 - CRITERIA FOR INDICATORS</b></i>	
Of general relevance	<ul style="list-style-type: none"> <li>• related to a specific question or issue of concern</li> <li>• health-related and linked to environment/development factors</li> <li>• sensitive to changes in the conditions of interest</li> <li>• provide early warning of pending changes</li> </ul>
Scientifically sound	<ul style="list-style-type: none"> <li>• unbiased and representative of the conditions of concern</li> <li>• scientifically credible, reliable and valid</li> <li>• based on best available data of acceptable quality</li> <li>• robust and unaffected by minor changes in methodology/scale used for their construction.</li> <li>• consistent and comparable over time and space</li> </ul>
Applicable to users	<ul style="list-style-type: none"> <li>• have relevance to policy and management needs</li> <li>• based on data which are available or can be collected/monitored with a reasonable financial/time resource input</li> <li>• easily understood and usable by potential users</li> <li>• acceptable to stakeholders</li> </ul>
<p>Source : Dr. Y. von Schirnding, WHO. Modified and adapted from Briggs et al 1996</p>	

These criteria have various implications for the construction of indicators, in particular it is critical to know the purpose of the indicator and who will use it. Also, the indicator has to be relevant to policy and provide a meaningful summary of the phenomenon to be measured. It must be understandable to the wider community and be transparent, testable and scientifically sound. Finally, indicators have to be cost-effective which means that they

have to be developed from existing data and be flexible enough so that they will serve more than one purpose.

Since the Rio Conference, many intergovernmental and non-governmental organisations, as well national administrations, have developed sets of relevant indicators for monitoring the goals agreed upon in various World Conferences. For example, the UN Commission on Sustainable Development (UNCSD) has proposed a list of 136 indicators. This number was later reduced to 59. The indicators span the areas outlined in Agenda 21 and are being tested in a number of countries. The EU, through Eurostat, has supported this work. Based on the UN list Eurostat has produced a list of 63 indicators relevant to their member countries which have been tested and published in two reports (Eurostat 1997 and 2001). The publication *World Resources 1998-99*, by the joint authorship of the World Resources Institute, UNEP, the World Bank and UNDP, examined how environmental quality affects human health both in developing and developed countries. Other organisations, such as the OECD, also have developed many indicators, some of which aim at measuring the environmental impact on certain social and health aspects.

WHO, through both headquarters and the regional offices, has played a lead role in developing and coordinating various indicators initiatives covering the environmental impact on human health. For instance, the indicators developed in the 1990s within the Health For All project included several indicators to assess targets and policies related to health and environment. Although WHO has never recommended one unique set of indicators for environmental health, several suites of indicators can be selected from various WHO programs and used for different purposes. For instance, the WHO European Healthy Cities project, the National Environmental Health Action Plans (NEHAPs), etc.

As in other areas, there has been a lot of debate whether a core set of indicators for global use makes sense for examining overall trends in environment and health conditions. In view of the differences between regions of the world, environment and health problems, as well as priorities for managing these, would clearly have to differ. Unfortunately, this makes it problematic to establish a core set of indicators with universal relevance. Nonetheless, regardless of these differences there are problems which have universal relevance, for instance, air, water, sanitation, food safety and waste disposal.

A common set of indicators has obvious advantages such as comparability and aggregability across countries and variable geographies. Moreover, they provide a set of standards for countries to aim for and often are part of the reporting requirements of international treaties. A good example of this is the Common Country Assessment (CCA) indicator framework which covers a range of areas. It was developed by the UN following the World Conferences of the 1990s. This framework is now being used in over 100 countries. As a result of Rio and related global Conferences, much useful data has been generated through global monitoring programmes such as the Global Environmental Monitoring System (GEMS), established by UNEP and WHO.

Internationally agreed upon sets of indicators may not fulfil all needs that countries may have but any core set of indicators can always be augmented and expanded to cover national, regional and local policy concerns. WHO has been the main actor in developing a regional approach to environmental health monitoring and a newly developed framework for the European region will be presented to this meeting for comments. At the national level, many countries in the ECE region have developed national sets of indicators to

achieve better quality of life and to review progress towards sustainable development (e.g. UK-DETR, 2001; Environmental Health Report for Sweden, 2001). Some of these have been inspired by regional or global initiatives and have a core of common indicators, e.g. National Environmental Action Plans (NEHAPs).

### **Monitoring policy outcomes**

Monitoring the outcome of policies is being increasingly recognised as a fundamental tool for assessing the efficacy of national and international policy. It is through such monitoring that governments are able to produce a credible scientific response to uncertainty in a timely and effective manner. Monitoring has also become important in promoting the transparency of policy making. As a consequence, the role of statistics in making governments accountable vis-à-vis their citizens has grown significantly. In democratic society, public opinion and the media provide a powerful incentive for monitoring policy performance and government accountability. Even in the international arena, policy monitoring has been successful in encouraging peer-pressure and has often stimulated compliance with targets and agreed policies.

Monitoring can essentially fall into two categories: quantitative and qualitative. In the context of environmental policies, both types are common. Examples of qualitative monitoring are the ratification of an international treaty or the adoption of a specific programme of action (i.e. Convention on Cross Boundary Pollution). On the other hand, quantitative monitoring, requires the identification of a series of indicators or statistical series by which to measure progress. This implies the ability to develop a monitoring framework that quantifies the policy or the programme and is able to follow its trend in time. Furthermore, monitoring must be regular and systematic rather than ad-hoc and episodic.

The most common approach to monitoring, including environment and health policies, is to monitor the outcome by comparing a given outcome with its expected target over time. Four elements are required in this approach: consistent definitions; indicators with which to measure change; targets against which to compare the outcome; and a benchmark to guarantee consistency in making the comparison. These four elements are the basis for monitoring the implementation of a given policy. Thus, it becomes possible to assess the policy by comparing the outcome measured by the indicator with the pre-determined target. As changes in the measured outcome may occur for a variety of reasons, the inference may at times be arbitrary, (Mikkelsen et al., 2000). Nonetheless, outcome monitoring does offer a starting point, assuming that the framework is sound and that the definition and choice of indicator is robust and does not change over time.

Garonna et al. (2001) have identified nine main elements that are necessary for a more comprehensive monitoring of a policy line or programme<sup>4</sup>. These elements, while not specifically referring to environment and health policies, represent the building blocks of a sound monitoring framework. A much broader array of information is required in this type of policy monitoring, which even in statistically developed societies, is unlikely to be available. Therefore, the application of this type of more comprehensive monitoring framework is not being implemented in many countries.

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<sup>4</sup> The nine elements identified for comprehensive monitoring are: Objectives, targets and benchmarks; Outputs and outcomes; The underlying conceptual and analytical framework; Players; Timing; Spatial factors; Cost-efficiency and effectiveness; Environmental conditions; Data and statistical capacity building.

## CONCLUSIONS

Agenda 21 has been a golden opportunity for health authorities to increase their influence on national planning and to reverse the trend of environmentally damaging and health threatening development. Since the Earth Summit, many countries have instituted new policy and planning tools and some have established inter-sectoral committees for Agenda 21 follow-up. A few countries have even established local Agenda 21. Another example of a new relevant initiative is the National Environmental Action Plans, which ministers agreed upon in 1994 at the Second European Conference on Environment and Health in Helsinki. As a consequence, most European States have now developed their respective NEHAPs and are beginning to put them into effect. At the local level, the WHO Healthy Cities Movement and the Sustainable Cities Movement of UNCHS also deserve to be mentioned.

Effective action to protect health requires coordination and collaboration between several sectors as well as a health system that is partnership-oriented and proactive instead of reactive. Over the past decades we have witnessed a change in how policies are being designed and implemented around the world as government increasingly are making use of quantitative targets and benchmarks. Indeed, many governments have moved towards a more public monitoring of policy implementation as a method of enhancing credibility. Many recent policy initiatives undertaken in the health and environment field also show an awareness of the importance of incorporating forecasts and future trends into policies to assist in evidence-based forward planning. The UK Government Report *Achieving a better quality of life* specifically states that greater use should be made of forward projections and scenarios to indicate the possible effects of actions and the consequences of current trends (UK-DETR, 2001).

Information about the impact of environmental risk factors on human health is necessary at all levels in order to support management and the decision-making process for environmental health protection. Currently, most estimates of environmental risks are based on very uncertain assumptions concerning population exposure patterns and the magnitude of the exposure/response relationship. However, the development of a scientifically sound methodology and estimates of the environmental burden of disease presents a major challenge. Therefore, focused research on the exposure/response relationship is all-important to an improved understanding of the risks and to enable more reliable and relevant modelling. Better exchange of information and research models from different sectors and disciplines will be crucial for making progress. In addition, we need a better understanding of those environment risks that contribute most to the global disease burden and those that can be avoided or reduced. As the cause-effect relationships are particularly complex in terms of sources and diversity of contaminants, interactions with genetic and lifestyle determinants, or other causes of disease, sorting out the exposure-response relationship into an attributable/avoidable fraction is going to demand much help from the research and academic community.

Obtaining relevant data, even at the country level, remains a significant problem for many developing countries which also tend to have poorly developed statistical systems. Much of the available data for these countries are estimates based on rudimentary and incomplete recording systems. Researchers and decision-makers need to be able to obtain higher quality data: disaggregated for relevant subgroups and at variable geographies. Despite the limited data availability in environmental health and the weakness of the evidence in some

areas, several sets of indicators are being developed both nationally and internationally to monitor performance. To avoid indicator anarchy (with large duplication of efforts), agreements are needed at both the national and international levels. For this, cooperation mechanisms that produce standards and guidelines will be essential as will communication between users and producers for cost-effectiveness and data quality. Experience from the various UN conferences of the 1990s has shown that core sets of common indicators with standardised definitions have a strong harmonising influence on data collections (Mikkelsen et al.2000).

Furthermore, an appeal has to be made for the continued development of monitoring frameworks and the incorporation of statistical techniques into the monitoring process. Policy and programme monitoring will increasingly demand the use of advanced data integration techniques and technologies, as well as a more efficient exploitation of all existing data sources such as administrative registers, records and sample surveys. New techniques have to be embraced, such as data visualisation, automatic data collection processes, etc. to allow the best possible data to be made available for the policy process. As concluded by Garonna et al, “without a close and effective partnership with the statistical research and R&D sector, monitoring systems will not be able to reap the full benefits of the information society and respond to the ever more demanding tasks of policy monitoring”(2001, unpublished paper).

Finally, to reach the goals agreed upon for sustainable development, the European region will have to continue developing institutions, mechanisms, and structures for a pan-European dialogue on health and environment. Dealing with this in a collective way will speed up the harmonisation and integration process of both data and policy. Several long-term international processes have already been initiated in Europe to address major challenges, both within the EU and in a wider context. An illustrative example is the work on transport, environment and health undertaken under the auspices of the UNECE and WHO- Euro. Frameworks of this type create unique opportunities for improving environmental and health conditions in the whole region. Health and environment statisticians are encouraged to contribute to the preparation of the Fifth Ministerial Conference, to be held in Hungary in 2004 on the theme “Sustainability in Environment and Health in Europe”.

*As this meeting is part of the Conference of European Statisticians work programme in environment statistics, participants may want to reflect further on the role of statisticians in environment and health agencies. For example, how could statisticians better contribute to some of the processes discussed above; what can they do to improve information for decision-making; and how can they promote the use of indicators and statistical information for policy-use?*

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