Environmental Health Services in Europe

5

Guidelines for evaluation of environmental health services

by Christina H. Drew,
Jaco van Duivenboden
and Xavier Bonnefoy

WHO Regional Publications, European Series, No. 90

The World Health Organization was established in 1948 as a specialized agency of the United Nations serving as the directing and coordinating authority for international health matters and public health. One of WHO's constitutional functions is to provide objective and reliable information and advice in the field of human health, a responsibility that it fulfils in part through its publications programmes. Through its publications, the Organization seeks to support national health strategies and address the most pressing public health concerns.

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Guidelines for evaluation of environmental health services

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Foreword

For over a decade, the Member States of the WHO European Region have been demonstrating their commitment to improving environmental health services. The First European Conference on Environment and Health, held in Frankfurt-am-Main in 1989, spelled out the principles for integrating environmental health services. Five years later, the Second European Conference in Helsinki provided a clear mandate for action on environment and health in Europe through the development of national environmental health action plans (NEHAPS). The need for improved policy tools to strengthen the management of environmental health services was also emphasized in Helsinki. Subsequently, at the Third European Conference, in London in 1999, even further attention was paid to local processes for planning, implementing and evaluating environment and health activities.

NEHAPS have become a tool that provide Member States with a substantive framework for developing a path towards sound environment and health management, in partnership with all sectors. Many Member States have also asked for guidance on specific aspects of the delivery of environmental health services. This series of publications entitled Environmental Health Services in Europe was developed to respond to these requests. The first two volumes outline the concepts applicable to environmental health and environmental health services and describe the current status of environmental health practice in the European Region. The third and fourth

volumes address staffing and professional profiles, and provide guidance on the education and training of environmental health professionals.

This, the fifth in the series, provides practical guidelines – repeatedly requested by the Member States – for evaluating environmental health services. Evaluation is an essential component of all health service delivery that is too often overlooked. It is frequently ignored because it is not always seen as directly productive. Nevertheless, evaluation is the only way to learn from the successes and failures of the past and thereby improve policies and procedures for the future. To illustrate the difficult concept of evaluation, various examples of environmental health service evaluation are presented.

The production of this book involved a series of discussions and meetings with a wide range of dedicated and knowledgeable individuals and representatives of Member States. In particular, I would like to thank Ms Drew and Mr van Duivenboden, without whose persistence and commitment the book could not have been completed. In addition, the many consultants and advisers who have worked on this project must be thanked for their gracious donation of time and expertise. Specifically, Mr Martin Eriksson and Dr Andreas Kappos were instrumental in the development of the case studies presented in Chapter 6, and Ms Isabelle Goi, Mr Jean Pierre Foirry and Mr Laurent Gilotte contributed significantly to the section on economic evaluation tools in Chapter 4.

It is hoped that this volume will lead to a better understanding of evaluation, to new initiatives to introduce evaluation into daily practice and to more discussion of evaluation among environmental health service providers.

Marc Danzon
WHO Regional Director for Europe

Introduction

The aim of this book is to provide practical guidelines that assist local environmental health practitioners in evaluating their services. Because the productive worth of evaluation is often obscure, this management step is frequently overlooked. Nevertheless, it is an essential component in developing, implementing and improving the policies designed to protect health and the environment and enhance the quality of life. Without assessing existing services, their intended consequences will remain unknown, as will knowledge of whether the proper instruments and timing have been employed. In a climate where environmental health services are challenged by the sheer magnitude and diversity of services, limited resources and many scientific uncertainties, evaluation is especially critical. It is the only way to learn the benefits and cost to society of environmental services.

The management cycle includes policy development, implementation and the crucial step of evaluation. Because the broad range of environmental health services demands different evaluation strategies, and because the different evaluation concepts, tools and communication techniques can be combined in an infinite number of ways, no single or ideal evaluation model can be offered. The goal of this publication is, therefore, to introduce environmental health professionals to evaluation principles, tools and examples from which they can pick and choose elements to suit their specific needs. It is designed not to answer all the questions practitioners have, but rather

to guide them towards questions that must be answered to evaluate and improve services.

This volume has evolved from several interactions with Member States of the European Region that have identified gaps in the management and evaluation of environmental health ser-vices. The three European conferences on environment and health – held in Frankfurt-am-Main, Germany (1989), Helsinki, Finland (1994) and London, United Kingdom (1999) – all emphasized the need for integrating environmental health services, developing policy tools, and strengthening local processes for planning, implementing and evaluating environment and health activities *(1–5)*. In addition, previous volumes in the series on environmental health services in Europe have identified the lack of a clear evaluation methodology *(6,7)* and emphasized the need for environmental health service managers to obtain evaluation skills *(8,9)*. The need to improve evaluation methodology was specifically endorsed by the Second Consultation on Environmental Health Services, held in Vilnius, Lithuania, in November 1994 *(10)*.

The structure and format of the present publication are the result of a comprehensive study of evaluation methodology, a review meeting with several environmental health professionals and the conclusions *(11)* and recommendations of the Second Consultation of Senior Government Officials on the Development of National Environmental Health Action Plans, held in Dubrovnik, Croatia, in October 1996 *(12)*.

The elements discussed and proposed in this book should be used by environmental health professionals (at international, national and local administrative levels) to assist in a number of management activities, such as:

- improving the quality and quantity of information reaching managers, thereby strengthening their ability to make decisions about future environmental health services;

- choosing among and prioritizing the various types of environmental health service;

- accounting for expenditures on services to political leaders and communities;

- assessing whether policies have been effective in achieving their objectives;

- identifying opportunities for more efficient delivery of environmental health services;

- providing a mechanism for recognizing changes in public needs and wants, thereby allowing environmental health services to be adjusted accordingly;

- identifying more specific research needs; and

- interacting with the community to ascertain its wants and needs.

This book is organized into six chapters. Chapter 1 lays the foundation for the rest of the book. It reviews evaluation principles and focuses on issues pertaining to preparation, planning and design.

Chapter 2 reviews the concepts that underlie environmental health services and discusses how they relate to evaluation. It reviews the development of environmental health services and the inherent difficulties in evaluating these services. The objectives of, potential subjects of and partners for evaluation are also discussed.

Chapter 3 discusses in detail data and indicators, the essential building blocks of evaluation. It describes characteristics that make indicators most useful and discusses in some detail several types of indicator (including process indicators, environmental indicators, health indicators and urban indicators).

Chapter 4 focuses on the process of conducting an evaluation. It presents methods for collecting and analysing the information required for evaluation. Particular attention is given to two areas of environmental health service evaluation that have thus far been overlooked: economic evaluation tools and qualitative evaluation techniques.

Chapter 5 focuses on the final stages of evaluation: writing and disseminating results and conclusions in ways that foster their use in management decisions. It reviews potential uses for evaluation and discusses factors contributing to effective use.

Chapter 6 presents several case studies of evaluation.

The need for evaluation is well documented, as are many strategies for its execution. The purpose of this book is not to repeat existing efforts, but to apply evaluation concepts specifically to environmental health services. With this objective in mind, references and suggestions for further reading appear at the end of each chapter, and key recommendations are presented in boxes throughout the text.

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1

Evaluation Principles and Procedures

This chapter reviews the critical components and purposes of evaluation, as well as general theories of evaluation. Questions discussed here include: Why evaluate? Who evaluates? What can be evaluated? and What evaluation criteria can be used? In addition, many of the terms used throughout the book are defined. Finally, this chapter presents a general evaluation plan, which lays a foundation for the rest of the book.

Evaluation of health services is an established field. Several books and reports have been published on the subject, both inside and outside of WHO *(1–3)*. This publication does not intend to rewrite these documents or restate their arguments. Instead, it aims to fill a gap identified by Member States: to provide a practical introduction for environmental health professionals and managers to evaluate their services. The first task is to review the most critical components and aim of an evaluation, to see how these relate to the overall framework of environmental health service management.

The WHO Regional Office for Europe has developed a strategy for promoting health for all in the twenty-first century. Goals and objectives of this plan are broken down into 21 targets *(4)*. These targets not only define the health goals for the European Region, but also describe actions and initiatives that can be taken by Member States to reach the targets. Health for all monitoring reports such

as the one published in 1998 *(5)* present the latest health statistics for the European Region. Reporting progress towards the targets is a key component of the health for all evaluation strategy. These reports, however, represent an extremely broad effort to evaluate health programmes at the regional level. Individual Member States are also responsible for monitoring and evaluating their health services.

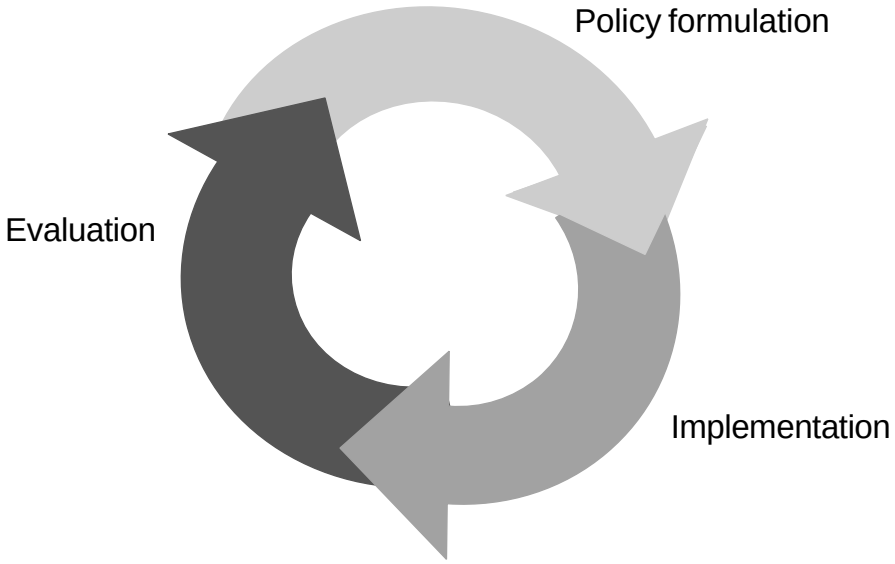
WHAT IS EVALUATION?

Over the years many definitions of evaluation have been developed *(1–3,6,7)*. In 1981 WHO defined evaluation as, "A systematic way of learning from experience and using the lessons learned to improve current activities and promote better planning by careful selection of alternatives for future action" *(1)*. Another definition of policy evaluation is: "A systematic assessment and appraisal of policy content, organization, process and effects" *(6)*. These definitions provide a foundation for action, but they do not fully describe the contribution of evaluation to the overall management process.

Evaluation is one aspect of the broad management strategy sought by WHO and its Member States. Fig. 1 shows a simplified conception of this management "cycle". Policies are first developed and then implemented. Thereafter, evaluation assesses the quality of various aspects of those policies. Policy effects are not the sole focus of evaluation because other aspects of policy implementation and development may also be covered. Furthermore, even before a policy is implemented, evaluation may occasionally contribute to the management process. Moreover, identifying and appraising alternative actions can be one of the contributions of evaluation. Finally, the cycle is completed by taking experience and knowledge gained through the evaluation and feeding them back into the policy development phase. This feedback is an integral part of the management process. If the data collected are ignored in formulating future policies, then valuable resources are wasted. To guide future planning and decision-making, evaluation should be both a flexible and action-oriented part of the management cycle.

Comparisons are a necessary part of evaluation. They provide a framework for analysis; a given situation is often more fully understood

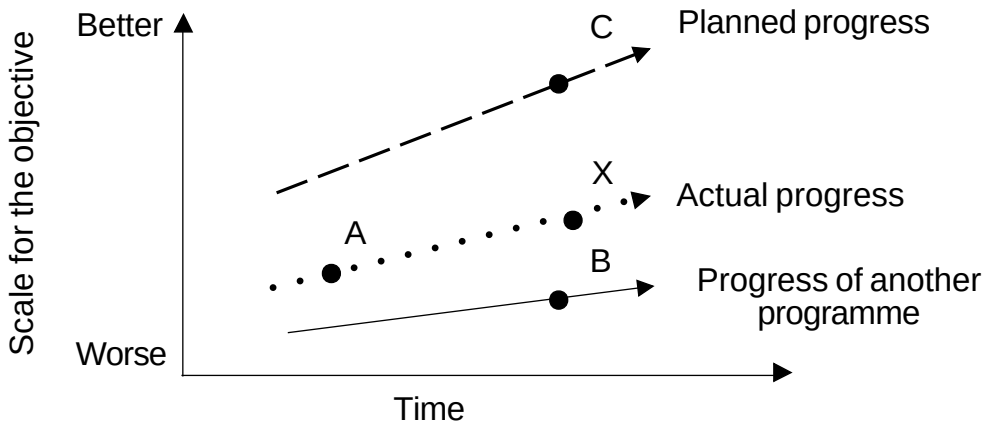
Fig. 1. Management cycle



if it is compared with something else. Generally, evaluators make one of three possible types of comparison: the present situation is compared with the past situation, with other situations (similar in context) or with a predetermined standard based on statistical, economic, political or social theories.

Fig. 2 illustrates the three types of comparison. The dashed line represents planned progress of a particular programme, the dotted line represents actual progress and the solid line represents the progress of another programme.

Fig. 2. Types of comparison used in evaluation



Looking at point X in isolation presents little useful information to a manager. However, when point X is compared to points A, B or C (that is, to the past situation, to another situation or to the planned targets), it is possible to judge the speed and progress of the programme – in other words, to evaluate it. Comparing data from the present situation to historical data (point X to point A) is one of the most common comparisons, and rightly so. It is important to understand the trends (direction) associated with the progress of a programme. Comparing point X to another programme (point B) may be useful as well, as long as circumstances support a fair comparison. The comparison of actual to planned progress (points X and C) is also possible. In some cases, however, there is no specific or operational target with which to compare point X.

Time is an extremely important element in all evaluations; ideally, comparisons should be made more than once. One-time analyses provide only limited "snapshots" of a given situation. To judge the progress of an activity over time, a whole series of snapshots is preferable. If the time scale is long enough, several evaluations can be conducted at regular intervals, and a monitoring system would provide information for the interim periods. If a project's time scale is shorter, the frequency of such snapshots should be adjusted.

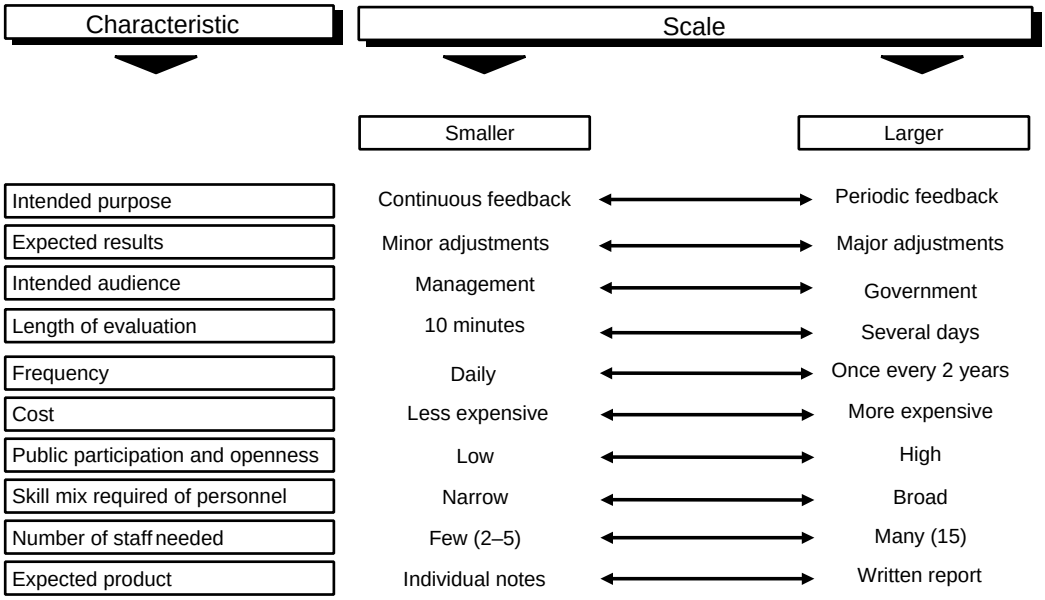
DESIGNING AND PREPARING FOR EVALUATIONS

Evaluation is complex and requires time, resources and planning. This section will address the overall evaluation design and several factors that contribute to the success of an evaluation. Additional details are also provided in Chapter 5.

Designing evaluations

Before the individual components of an evaluation are addressed in detail, the overall design must be understood. First, a manager should decide on the general scale of the evaluation – large, small, or somewhere in between. It may be helpful to remember that the magnitude of an evaluation should correspond to its purpose and that all the elements will generally have the same scale. Fig. 3 portrays (in an array) some of the different characteristics of an evaluation. Each characteristic is discussed further in subsequent sections of this chapter.

Fig. 3. Scale and characteristics of evaluation



The characteristics vary in scale. In general the level of intensity for all the different characteristics will be relatively similar.

Examples that illustrate the extreme cases are relatively easy to find. A small-scale evaluation might be a 15-minute daily staff meeting intended to provide an ongoing channel of communication within a certain group of people. This is an inexpensive activity, adding little to the overall cost of a project. Only a few people are involved, with no specific skill mix, and the intended audience would be the managers themselves. Little planning is required, but a good leader might be needed to keep discussions relevant and productive. Public participation would be limited given the frequency and detailed nature of this type of evaluation. A clear advantage to this type of evaluation is its ability to quickly and inexpensively provide information about day-to-day operations. Such an evaluation is limited, however, because of the tendency to focus on small day-to-day problems rather than on larger institutional or structural problems.

In contrast, a large-scale formal evaluation can be appropriate for a service funded by a national or international grant programme. Such an evaluation might take place after a programme has been in place for several years, and may focus on the efficiency of the service or on the outcome in the population. It may take several days or

weeks to complete, and might be organized during major project milestones only (for example, the midpoint or end). Personnel requirements are likely to be greater owing to the need for qualitative and quantitative (including statistical) analysis and owing to the broader range of issues that are likely to be evaluated. To provide evaluators with the information required, collaboration with a broad base of programme staff is necessary. Systematic planning and financial resources are also required in this type of evaluation. A formal report is likely to be written and disseminated to interested parties, including the granting organization. The advantage of this type of evaluation is that it is a thorough, fundamental analysis rather than an incremental improvement. But this also implies that small-scale developments within a service may go unnoticed, especially when evaluators are not from the programme under study.

Fig. 3 is a simplified presentation, and most evaluations will fall somewhere between the two extreme examples just described. Because the scales will not always be exactly proportional and because straight lines cannot always be drawn across the various characteristics displayed in Fig. 3, flexibility has to be maintained, and managers need to keep in mind how the information collected for the evaluation will be used to help them improve services.

Preparing for evaluations

Preparing for an evaluation requires consideration of several factors that affect its success. These factors include support, flexibility, cost and public participation. Each factor is discussed in more detail below.

Support

Appropriate financial and political support is essential for effective evaluation, as is the support of staff and management. For large-scale evaluations, broad support at both the national and the local level helps provide an atmosphere that is more conducive to producing meaningful results. For smaller-scale evaluations, such as the daily 15-minute staff meeting, support is manifested in other ways, such as staff punctuality, germane discussions and the introduction of new ideas that improve service. In both large-scale and small-scale evaluations, a sound communication strategy is essential to secure political support – before, during and after an evaluation.

Flexibility and flow of information

Evaluations have to be responsive to unforeseen situations that arise. For time-consuming, large-scale evaluations in particular, the strategy should be flexible enough to deal with changes in context. One key to maintaining flexibility is information flow, the foundation of the management process. Essential to information flow is the selection and delivery of important information to the right person at the right time. Because an evaluation is largely a matter of collecting data, gathering information and feeding these back into the decision-making process, it is important to integrate the evaluation with the information system. Again, the exchange of information is the key issue here. Medium- to large-scale evaluations, therefore, should follow a similar process, consisting of codified steps defined before performing evaluation activities. In smaller-scale projects and ongoing evaluations, some of the steps are less formal or can be combined. To ensure flexibility and the flow of information, every environmental health service activity should establish evaluation as a component at the outset of that activity. Evaluation plans can and should contribute significantly to effective, efficient and equitable environmental health service management.

Cost

The cost of an evaluation is also an important consideration. Each step in the evaluation process (outlined below) is associated with a specific cost, either direct or indirect. Direct costs, such as actual resources needed for the evaluation team (supplies, salaries, office space, time) are easier to account for than indirect costs (which are not identifiable with a specific product, function or activity). The cost of not completing an alternative task – the opportunity cost – should also be considered. For the planning process to be effective, proper financing, time and other resources have to be set aside to perform the evaluation, as well as to produce, copy and disseminate results. Cost issues and economic tools are discussed in more detail in Chapter 4.

Public participation and openness

The importance of public participation, open decision-making and access to information has steadily gained recognition throughout the European Region. Agenda 21 and the Rio Declaration emphasized the need for public participation in achieving sustainable

development. The European Charter on Environment and Health, adopted in Frankfurt-am-Main, Germany, in 1989, highlighted the importance of the public in dealing with environmental and health challenges. In Helsinki, Finland, in 1994, the public and nongovernmental organizations (NGOs) were recognized as indispensable partners in the development of national environmental health action plans (NEHAPS). The most significant development in this area occurred at the Fourth Ministerial Conference "Environment for Europe" held in Århus, Denmark, in 1998 *(8)*. At this landmark event, the participants endorsed the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, which provided a legal framework for environmental civic rights in the Region.

Building on the Århus Convention was a major topic of discussion at the Third Ministerial Conference on Environment and Health, held in London, United Kingdom, in 1999. The following are some examples of important issues that relate to access to information, public participation and access to justice that were highlighted at the Conference *(9)*.

- Access to information is not only critical for making sound public decisions that relate to environment and health policy, but is also critical for individuals, so that they can make informed choices to improve their own health and environment.

- Information policy should aim to ensure that public authorities are accountable and operate transparently, and that the public is better informed through awareness-raising measures.

- A system that meets demands for public access to information should contain a general presumption in favour of access, delineate the scope of information covered and the range of bodies required to provide it, broadly define the terms of access (time limits, costs, form), and make provisions for a limited number of exemptions.

- Individuals should always have the right to access information about their own health. Individual privacy should be respected by structuring health information to prevent identification of individuals.

- Information held by the private sector should be addressed to ensure its adequate flow into the public domain.

- Public communication and active dissemination of information are essential for developing and implementing environmental health policies. A well informed public is more able to participate effectively in decision-making and more likely to support policies designed to create a healthier environment.

- Communication on environmental and health matters is not a simple one-way process but should involve debate, dialogue and feedback, especially during decision-making processes.

- Several key "actors", including governments, doctors, environmental health professionals, educational institutions, businesses, trade unions and NGOs, play important communication roles.

- Communication technologies are rapidly evolving and should be incorporated into communication policies. Television, radio, newspapers, the Internet, educational institutions and product labelling are just some of the important ways to provide information to the public. New technologies for expanding the dialogue with the public are also evolving. It must be recognized, however, that new technologies bring new problems as well as new opportunities.

- The Århus Convention provides a legal framework for public participation in specific activities: programmes, plans and policies (Article 6), and general rules and regulations (Articles 7 and 8, respectively).

- Access to the judicial system is fundamental to providing the public with meaningful involvement in environmental and health matters. Efforts should be made to overcome financial and practical barriers to such access.

In accordance with the principles laid out in Århus and London, evaluations should occur in an open and interactive environment that includes dialogue with anyone affected by or interested in the

activities under review (stakeholders).[1] Public involvement will not always be feasible; certain evaluations may be too small in scope and too detailed for extensive public interaction. Open and transparent communication, however, is always warranted and, in most cases, evaluation results should be made publicly available.

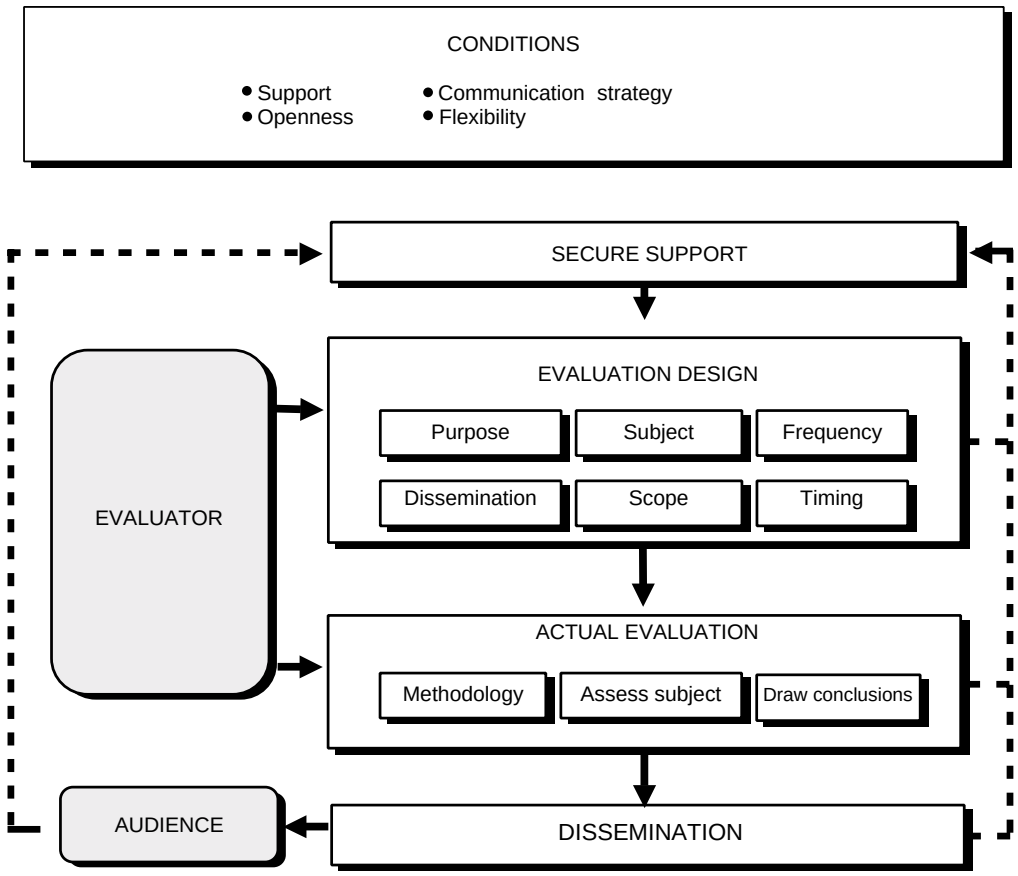
THE EVALUATION PLAN

Before embarking on any kind of evaluation, the development of a clear plan is necessary. This plan informs all parties involved about the scope, purpose, methodology, information base and intended use of the results. The plan should clearly state what data are to be collected. Since many evaluations are based on comparisons over time of the same data, managers have to ensure that the correct data are collected from the outset. A clear plan also helps to maintain fairness in evaluations. The plan should clearly state what criteria will be used for the evaluation. This is particularly important when evaluators are drawn from outside the programme or process to be evaluated. A clear plan can also avoid resistance to an evaluation. Many people do not like to be evaluated because they feel they are being judged under circumstances they cannot control. If managers know at the outset what criteria will be used to judge them, they can act to improve these elements. In addition, criteria have to be chosen and defined very carefully, because there is a risk that service activities will only focus on the criteria that are measured specifically. Whenever possible, the plan should be developed and agreed to in writing. Finally, to remain responsive, the plan should be flexible and allow for adjustments that might become necessary during the evaluation process. The steps presented in Fig. 4 provide a broad guide that can be tailored to, and thus used in, almost any type of evaluation.

Fig. 4 reflects the most important elements of virtually all evaluations. The factors (or conditions) that foster effective evaluations include sufficient support, sound communication, openness and flexibility. These factors are discussed below.

[1] Throughout this volume, the term "stakeholder" is broadly defined as parties interested in or affected by environmental health services.

Fig. 4. Suggested steps for an evaluation plan



The first major step in an evaluation plan is to secure operational, political and financial support. In some cases (as indicated by dotted arrows in Fig. 4), the later phases of an evaluation may also influence support. For example, preliminary results of an evaluation may encourage managers to support a more elaborate dissemination strategy. The "audience", the people for whom the evaluation takes place, can also influence the amount of support an evaluation will get along the way, though sometimes only indirectly.

The second major step is the development of an evaluation design. This involves the identification of the purpose, scope, subject, frequency and timing of the evaluation. It is also recommended that before carrying out the evaluation, the design should account for the dissemination of the evaluation results. Though the evaluation design is partially the responsibility of the evaluator, it may also be the work of the initiators of the evaluation.

The third major step is to perform the evaluation itself. This step involves three basic activities. First, identify and select one or more suitable methods for gathering and analysing the necessary data. Evaluators should consider using both quantitative and qualitative tools for gathering data. A combination of these is recommended (see also Chapter 4). Second, gather data and use them to determine such components as service effectiveness, efficiency and outcome. Last, develop and document the results and conclusions.

The fourth major step is to disseminate the results to the appropriate audience. Keep in mind that the steps and activities in Fig. 4 comprise only a very rough outline of a real evaluation. (A more complete sample outline for an evaluation plan is presented in Box 1.) In addition, it is important to remember that the steps described should be closely integrated into the management cycle. Evaluation is not a separate or isolated process, but an essential element of formulating, implementing and improving environmental health services.

THE PURPOSE: WHY EVALUATE?

There are many reasons for evaluating services. In a health service context, often the broad purpose is to "improve health programmes and the health infrastructure for delivering them, and to guide allocation of resources in current and future programmes" *(9)*. In individual situations, many different questions about a particular service may be answered by the evaluation. The following is a list of such questions.

- What has been achieved?
- Are the objectives being fulfilled?
- Could the objectives be fulfilled more cheaply?
- Are the programmes and practices fair and are costs and benefits equitably distributed?
- Are the activities sustainable for future generations?
- What difference has the service made?
- Are the objectives correct and sufficient for this population?
- Are the needs of the population being met?
- What are the strengths and weaknesses of the service?
- Could the resources used be put to better use by providing different services?

Box 1. Evaluation plan outline

Preface: Approaches to foster support, openness, good communication and flexibility

I. Support

A. Organization providing funding
B. Expected support from management and appropriate political officials
C. Target audience and other stakeholders

II. Design

A. Purpose
B. Scope
C. Subject
D. Frequency
E. Timing
F. Cost and benefits
G. Public participation
H. Evaluation personnel
- required skill mix for personnel
- number personnel needed

I. Dissemination strategy, audience

III. Actual evaluation

A. Methodology
- data to be collected
- indicators
- methods of analysis

B. Results
C. Conclusions and recommendations
- linking evaluation to future plans and policies
- strategy for maximizing use of results

IV. Dissemination of results

A. Audience(s)
B. Method(s) of dissemination
C. Format of expected product

- Is the amount of information collected appropriate?
- What can be done to improve efficiency?
- How can this information be used to plan future services?
- What are the implications for future service levels?
- How should current policies be adapted in response to the new knowledge?

Managers have to ask themselves why questions such as those above should be answered. Many of the questions are narrowly

focused, but in combination these questions may lead to a greater understanding of the overall context. Though economic factors may often be the primary motivation for starting an evaluation, this is not always the case. For example, reviewing programme targets and the means to reach those targets on a periodic basis can provide opportunities to learn what is and is not working in a particular activity or programme. This is discussed further in Chapter 2.

Often the information collected, the way it is collected and the way it is presented will vary considerably because of its intended use. Defining the purpose and scope of an evaluation is therefore an integral, preliminary step. Additionally, evaluations should distinguish between outcomes that result from the services themselves and those that result from uncertainty or chance. Often this distinction is blurred, but stating what is unknown is very important to the long-term viability of the management process.

Minimizing conflict

It is important that evaluations be used constructively. An evaluation should go beyond simply justifying past actions and identifying past inadequacies. The information should be directed towards future decisions and actions. Evaluations are not meant to be a judgement that affects staff on a personal level. Instead they should serve as an educational tool for both those evaluating and those being evaluated, and should focus primarily on institutions and policies rather than on the actions of individuals. Since evaluation involves judgement, the character and purpose of this judgement are important. As mentioned before, the primary reason for evaluating any health service is to learn about the implementation of policies, determine their consequences, and feed this knowledge and information into future efforts to formulate and implement policy.

Undertaking a full-scale evaluation of services can be risky for an organization. A participatory approach from the outset is highly encouraged, particularly when the performance of personnel is part of an overall evaluation; otherwise, an adversarial relationship may evolve between evaluators and those evaluated. For example, personnel being evaluated may perceive the evaluators as opponents who try to take away funding or reduce staffing, and evaluators may characterize personnel being evaluated as obstructive to the process.

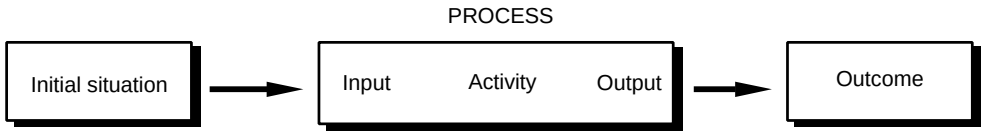
Both these conflicting claims may be legitimate in certain situations. It is a manager's task to recognize and prevent resistance to evaluation. Managers can emphasize that learning about implementation of policies, or determining the specific outcome of a service, does not necessarily mean taking funds away from existing programmes. In addition, if from the start the individuals being evaluated know, or help develop, the criteria on which they will be judged, the entire procedure is likely to be less intimidating and confrontational. Emphasis on the educational aspect of an evaluation goes a long way towards reducing confrontation between those being evaluated and those evaluating.

There is great potential for distorting the meaning of *evaluation.* Many health programmes and services claim to evaluate, yet they do not carry out any systematic analysis of their efforts. Although it may be difficult to evaluate a service in a strictly scientific way, the most systematic evaluation procedures available should be utilized. Similarly, avoiding simplistic conclusions from evaluations is also necessary. It is difficult, but tempting, to classify health programmes and services as either successful or unsuccessful, good or bad. Usually, such designations are of little value because they omit further explanation and discussion of the factors contributing to programme success or failure. Furthermore, uncertainties and unanswered questions about an evaluation will always exist. Though completely avoiding these unknowns is impossible, stating them explicitly is necessary.

THE SUBJECT: WHAT CAN OR SHOULD BE EVALUATED?

The subject of an evaluation should reflect its intended purpose. For example, if the main purpose of an evaluation is to determine whether the needs of the population are being met, then the subject will be the relationship between the specified goals and the identified needs in the population. All the different components of the service, either individually or in conjunction with other components, may be evaluated. Fig. 5 illustrates the composition of a generic health service. All governmental services and programmes begin at a certain point in time, then they alter inputs and activities to create outputs and desired outcomes. Inputs are the resources, including the raw material, money, personnel, training and time, that are used to plan and

Fig. 5. Generic health service model



carry out different activities. Process refers to the transformation of inputs into activities and outputs, which are the results of the planned activities. Outcome can be thought of as the change in the population as a result of the outputs. The food inspection service is a simple example of an environmental health service. Personnel and money (inputs) are budgeted for a certain number of inspections (activities) during a given period of time. As a result of these inspections, some establishments are fined or closed because of health code violations. These results are the outputs. The reduction in, or lack of, food poisoning episodes in the population are then said to be the outcome of the food inspection service.

Confusion may arise about the distinction between output and outcome. The following example may help in better understanding these concepts. The Regional Office for Europe of the World Health Organization has specified 21 health targets for the region *(4)*. Generally, these targets correspond to *outputs* – that is, measurable, specific results. Together, the targets contribute to the overall goal of the World Health Organization, ensuring health for all in the twenty-first century. This goal, like others (such as becoming a more sustainable society), is related to *outcome* – that is, more general, population-wide results that may be difficult to measure. Targets, therefore, generally refer to measurable, specific actions or results. On the other hand, goals refer to more general sets of actions, which may be hard to measure. When planning an activity, it is useful to set targets that are measurable: this may facilitate the production of meaningful results when evaluating programmes or services.

In the past, WHO has defined six basic subjects for an evaluation: relevance, adequacy, process, impact, efficiency and effectiveness *(1)*. To these subjects we add equity and sustainability. Each subject is discussed in some detail in the following sections. Definitions for these terms are based on those found in the WHO publication

on guiding principles for health programme evaluation *(1)*. The subjects are presented in a specific order intentionally. Ideally, relevance and adequacy should be the first items explored and evaluated. For example, the impact of a service is irrelevant if it does not respond to a specific need in the population.

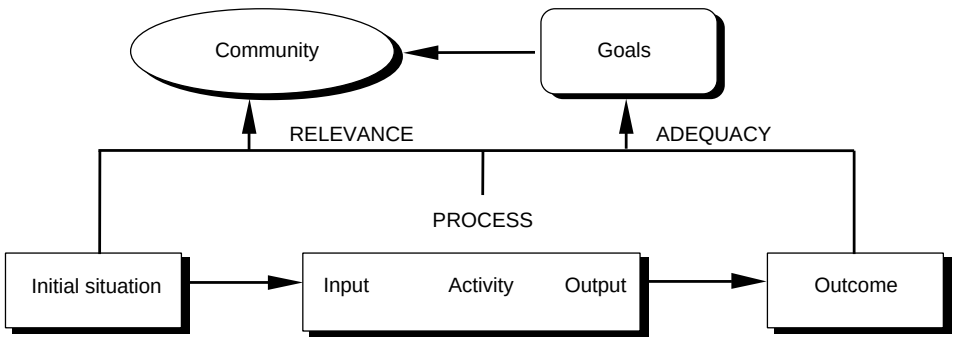
Relevance

The ability of programmes, activities, services and institutions to respond appropriately to human needs (reflected in social and economic priorities) should be evaluated. Relevance relates these different components of environmental health services to the social and economic policy goals of the community. In other words, relevance refers to the appropriateness of the service. For example, even if a service caused a change in health status, that change may not be related to the changes envisaged by the planners – that is, it is not *relevant* to their pre-established needs. This concept is illustrated in Fig. 6 as the relationship between the whole community and the health service, because human needs provide the basis for the relationship. Goals and objectives should also be evaluated for relevance.

Adequacy

Adequacy refers to sufficient attention being paid to certain previously determined courses of action, such as the various issues to be considered during broadly based programming. In other words, do the goals specified sufficiently address the needs identified? Both the goals themselves and the relationship between goals and services can be evaluated for adequacy.

Fig. 6. Evaluation subjects: relevance and adequacy



Process

Process refers to the relationship between inputs and outputs (see Fig. 7). Evaluating a process deals with comparing actual activities with those scheduled. The reasons for achievements and shortcomings should be noted, along with remedies for shortcomings. The purpose of a process review is often to facilitate the monitoring of day-to-day activities, the supervision and implementation of ongoing activities, milestones, personnel matters, supplies and equipment, and the monitoring of how money is spent in relation to the budgets allocated. Process evaluations also allow managers to discriminate between problems that arise from the planning of activities and those that arise from preparing for and implementing activities.

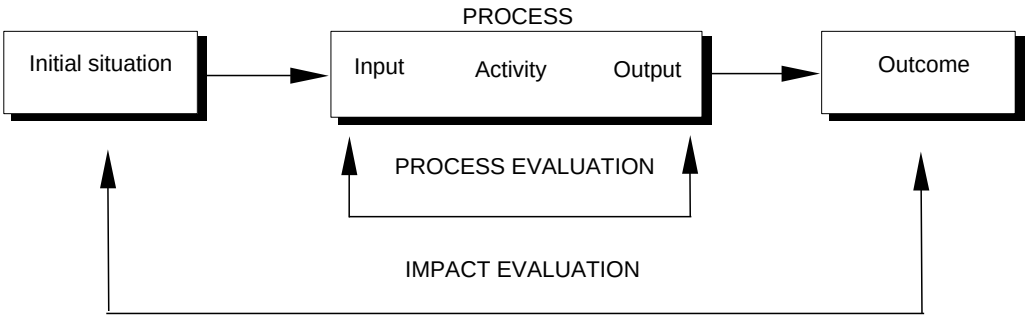
Impact

Impact is an expression of the overall effect of a service on health and related socioeconomic development. The evaluation of impact is an attempt to measure the more encompassing population-based consequences of the services. The outcome is thus compared to the initial situation. In general, it is much easier to study process than to study impact.

Efficiency

Efficiency refers to the direct relationship between the results obtained from a service (outputs) and the amount of effort expended in terms of human, financial and other resources (inputs), health processes, technology and time. Efficiency demonstrates how well the outputs have been produced from the inputs. The aim of assessing efficiency is to improve implementation, but it also serves to identify the strengths and weaknesses of monitoring. Financial

Fig. 7. Evaluation subjects: process and impact



auditing is a particular type of monitoring that often aims to improve efficiency. Placing a monetary value on inputs, outputs and outcome is one method of establishing programme efficiency. This, however, is not an easy task, especially for measurements of outcome. In fact, economic quantification of environmental impacts and environmental health impacts is the subject of much debate in the field of environmental economics (more about efficiency can be found in Chapter 4).

Effectiveness

Effectiveness expresses the degree of attainment of the predetermined objectives and targets of a service. Effectiveness is assessed in order to improve the formulation of services, objectives and goals. Qualitative analyses of effectiveness are often preferred to quantitative analyses because they provide an in-depth, specific insight into context and circumstances (more about quantitative and qualitative analyses can be found in Chapter 4). Assessment of effectiveness should also be carried out with the community in mind: their satisfaction and dissatisfaction with services are essential to a successful programme. When combined with adequacy, effectiveness represents the degree of attainment *by the services themselves*. For example, a cursory evaluation may show that environmental health service targets are being met. More detailed research, however, may show that this success is not the result of the service's activity, but is instead the result of a wholly different development, such as the status of the national economy. Thus, the impact of the service may not be particularly effective. An important distinction between effectiveness and impact is that effectiveness focuses broadly on the contribution of a particular service in attaining the predetermined targets of a service or policy, while impact does not.

Equity

Equity implies "that everyone should have a fair opportunity to attain his or her full health potential and, more pragmatically, that no one would be disadvantaged from achieving this potential" *(1)*. Equity, however, is a particularly difficult subject to evaluate because it can be defined in a number of different ways, even for the same situation *(3)*. Owing to differences in socioeconomic conditions, spending the same amount of money in different areas can have different results. For example, in providing for clean drinking-water, there are at least three ways to define equity:

1. *in terms of input*: authorities may decide to spend equal amounts of money on water supply in both richer and poorer areas;

2. *in terms of outputs*: authorities may decide to spend money so that richer and poorer areas receive the same water supply services (more money may be needed in poorer areas to compensate for prior differences in services); and

3. *in terms of outcomes*: authorities may decide to spend money so that richer and poorer areas have the same level of a certain disease (again, even more resources may be required in poorer areas to compensate for prior differences in services, as well as to compensate for differences in socioeconomic conditions).

The definition chosen influences the results of the evaluation and, thus, should be adhered to throughout the process.

Sustainability

At the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992, sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" *(10)*. World governments recognized that economic development, health status and environmental resources are closely related, and they agreed to pursue sustainable development. This is a long-term process and may not result in significant health changes in the short term. In addition, sustainable does not necessarily mean healthy, because promoting sustainable development may remove or diminish attention to important health issues *(11)*.

Programmes and procedures can be evaluated in terms of their sustainability. An intervention should be sustainable not only in terms of environmental resources, as suggested at the Rio conference, but should also be sustainable in terms of financing, personnel commitments and political will. Despite growing attention to sustainable development, the ability to conclude that a particular service is or is not sustainable remains elusive. So far, it has only been possible to argue that one activity is more or less sustainable than another.

In summary, the subject of an evaluation may vary widely, depending on the questions that managers wish to answer. In addition, the order in which the above subjects are addressed is important. For example, impact cannot be evaluated unless the evaluator is reasonably sure that the programme has been implemented as planned (that is, unless a process evaluation has been done), and measuring efficiency cannot be done without first knowing the impact of a service.

WHO EVALUATES AND WHEN?

Choosing the appropriate evaluator is an important concern that is closely related to the designated purpose of any evaluation. Designating a team of people from relevant sectors who have an interest in planning and managing the progress of the evaluation is an exercise frequently performed to determine the subject, scope and time frame of the evaluation. Evaluators should possess the necessary skills and knowledge to do an evaluation. One of the purposes of this publication is to help provide these skills.

Internal and/or external

It is important to consider the position of the evaluators and their relationship to the programme being evaluated *(12)*. Internal evaluators are affiliated with the organization being evaluated and external evaluators are not, and each has its strengths and weaknesses.

Internal evaluations are useful because the analysis is likely to contribute directly to the information needs of an organization. Moreover, data collection is more straightforward and less expensive. The credibility of internal evaluations, however, is often challenged because the results may only have limited use outside the organization, the potential subjects for evaluation are narrow and the evaluators are perceived as being biased.

External evaluations are more effective when addressing broad governmental issues and programmes between different sectors of government. Results may be more widely used because external evaluators have greater access to decision-making processes and are perceived as having more authority and credibility. In comparison with internal evaluators, professional evaluators (consulting firms,

auditing offices, academic institutions) may be more experienced, or possess a broader range of evaluation skills. Lack of familiarity with the programmes to be evaluated may, however, limit external evaluations, and managers may be less willing to accept an outsider's view.

Often, especially in larger evaluations, both internal and external reviewers are employed, which helps to prevent conflicts that arise from the perceptions that outside evaluators do not fully appreciate a programme and that internal evaluators are not objective. The best combination of internal and external evaluators will depend on the programme or service to be evaluated.

Timing and frequency

The frequency of evaluations is an important decision. It should be often enough to produce meaningful information, but not so often as to prevent the progress of the work at hand. It is natural for smaller-scale evaluations to occur more frequently than large-scale evaluations. For example, it is not feasible to conduct large-scale evaluations on a weekly or even a monthly basis. But it is also undesirable for them to occur only at the end of a project or at an intervention. The monitoring and information systems should be able to provide information on a regular basis, thus allowing infrequent full-scale evaluations. Midterm evaluations may be a viable solution to the issue of frequency. The optimum time frame should be derived from a consensus among advocates and designers of an evaluation. It is important to remember that evaluation should reflect the continuing nature of the management process. Sometimes, evaluations are seen as discrete events that occur only at the end of a project, service or intervention. Although it is recommended that projects always be evaluated at their conclusion, this is clearly not the only time for an evaluation; less formal information and monitoring systems should identify problems as they arise throughout a programme's implementation. The essential task is to pass on correct information in time to make the necessary decisions. Thus, the evaluation manager needs to strike a balance among such competing factors as time, cost and personnel constraints in order to determine the optimal time frame and optimal format (formal or informal) for a major evaluation of the information collected.

Box 2 summarizes the key recommendations of this chapter.

Box 2. Key recommendations from Chapter 1

Recognize evaluation as a part of the ongoing cyclical management process

Identify interested and affected parties as soon as possible; develop political and community support by bringing them into the decision-making process

Keep evaluations open to new circumstances, new facts, new opinions, new ideas and new stakeholders

Develop and follow a written plan for evaluation; disseminate it to the stakeholders at the beginning of the project (see Box 1)

Prevent the perception that evaluation is a judgemental activity; stress its educational and constructive nature

Narrow the scope of the evaluation according to its intended purpose

Strive to develop a clear monitoring and information protocol that delivers important information to decision-makers but limits unimportant information

Include a mixture of internal accounting of programme operations and external reviews of them

Distinguish between outcomes that result from the services themselves and those that result from uncertainty or chance

Avoid oversimplified conclusions

Be both flexible and action-oriented in order to guide future planning and decision-making

Promote issues of equity, intersectoral collaboration and community participation

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2

Theoretical Framework for Evaluating Environmental Health Services

The previous chapter presented general principles and concepts of evaluation. This chapter builds on that foundation and applies the same concepts specifically to environmental health services. It begins by defining terms and briefly tracking the historical development of environmental health services. Next, reasons for evaluating environmental health services are provided. Then, some of the particular difficulties of environmental health service evaluation are discussed. The last two sections explore the evaluation subject, authors and audience.

CONCEPTS AND DEVELOPMENT OF ENVIRONMENTAL HEALTH SERVICES

Environmental health is a relatively new term that has been used to define both a condition affecting human health and a professional discipline. The term has evolved and has come to mean different things to different people. Recent international meetings *(1–3)* have attempted to develop consensus definitions of environmental health and environmental health services. The terms described here have been generated and accepted at these international meetings and have been used in previous volumes in this series *(4–7)*.

Environmental health

Many countries have difficulties in working with the definitions of public health, sanitation, hygiene and environmental health, and often freely interchange the terms. Questions also arise about the relationship between healthy lifestyles and environmental health. These difficulties are further magnified when terms are translated into other languages, which naturally reflect different cultural and historical developments. In many countries, the term environmental health arouses interest because, historically, environmental and health matters have been dealt with in a generally unrelated manner. The WHO Regional Office for Europe has been actively pursuing and promoting a common definition for environmental health *(4)*:

> Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.

Environmental health comprises diverse interest areas, including but not limited to: air pollution, food safety, the built environment, injury prevention, land use planning, noise pollution, occupational health, chemical safety, radiation, tourism, waste management and water management. As with other disciplines, including infectious disease control, health education, epidemiology, health research and mental health, the discipline of environmental health serves as one component of public health.

One of the main goals of integrating environment and health is to look at many different sectors with a holistic view. The exact mixture of sectors to be included in the discipline of environmental health will inevitably be defined differently by different countries, and debating the inclusion or exclusion of particular sectors would not serve the purpose of this publication. The point to be emphasized is the need to measure and explore more broadly the interactions and interrelationships of the different sectors.

Environmental health services

The term environmental health services is also a relatively new concept and is defined as follows *(5)*:

> Environmental health services can be defined as those services implementing environmental health policies through monitoring and control activities. They carry out that role by promoting the improvement of environmental parameters and by encouraging the use of environmentally friendly and healthy technologies and behaviour. They also have a leading role in developing and suggesting new areas of policy.

This definition implies a very specific meaning for the word service – that is, it refers to the institutions that implement, create or otherwise address environmental health issues. But the term environmental health services is used equally to describe the *work and activities* that are carried out by these environmental health institutions and agencies. Environmental health services act as the direct interface between the policy-makers and the subjects of that policy. They also relate directly to the general public, in dealing with their complaints and concerns about environmental health issues. There is a need for such services to be appropriately targeted and sympathetically responsive to public needs, while at the same time being representative of the views of the authorities (local, regional or national government). One of the more difficult tasks for any service delivery is to ensure that services are appropriately targeted and responsive, and this is particularly relevant for environmental health services. Environmental health service managers require accurate assessments upon which decisions for the future can be based; however, the methodology for performing such assessments in the environmental health arena is not very strong.

An improved methodology to gauge the process, impact, relevance and adequacy of services is required. Such a methodology would help to raise the quality and quantity of information reaching managers, thereby strengthening their ability to make decisions about the delivery of future services. In addition, methods for evaluating health services can also help in developing more clearly the role of a service and its formal strategy. This volume aims to fill some of these gaps.

Historical development of environmental health

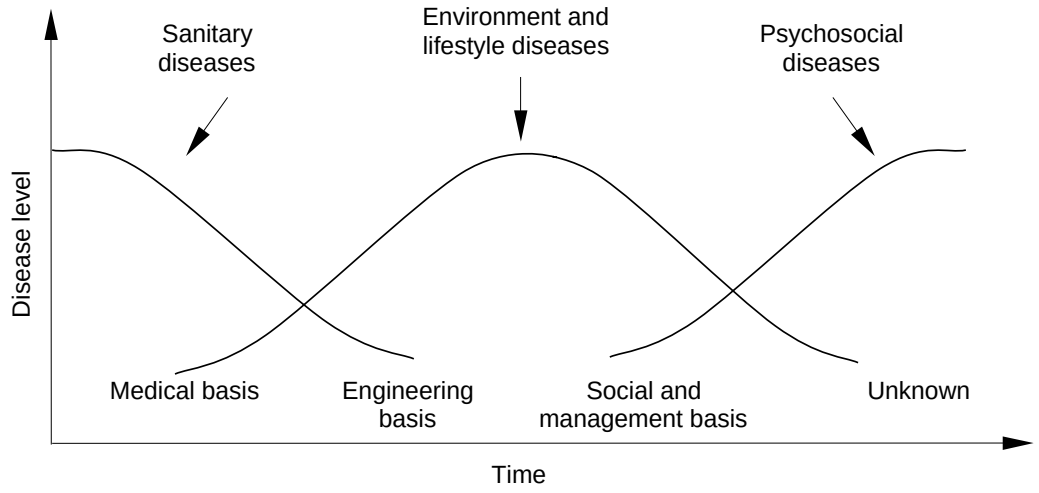
The issues addressed by environmental health services must be determined for a specific situation and are particularly dependent on socioeconomic circumstances and traditions. It is impossible to argue that present expenditures for preventive health measures will

abolish the need for future expenditures. Clearly, the nature of human ailments has changed in the past and will continue to change in the future, constantly requiring new resources. It is the job of public health professionals to track that change as it occurs and to try to predict future changes in order to provide the best health services for the population. The diagram shown as Fig. 8 has been used to model the long-term development of two aspects of public health: changes in disease patterns and subsequent professional responses.

Health transition theory suggests that in most countries the character of disease has changed with industrial development. Sanitary diseases (that is, acute health responses associated with poor living conditions, improper sanitation and overcrowding) have given way in many areas to "environment and lifestyle" diseases, which generally develop over a longer period of time and have less direct links to the environment. Similarly, as these diseases are better controlled, psychosocial diseases, such as mental depression, will need to be addressed. The focus of professional development is changing from a substantially medical and engineering discipline to social, behavioural and management disciplines.

The model appears applicable to most countries in the European Region, although certainly each country might fall on a different place along the time axis. The location depends primarily on the

Fig. 8. Professional responses to changing disease patterns



Source: MacArthur & Bonnefoy *(5)*.

level of economic wealth within a country and its individuals. Similarly, different regions or localities within a country (and even within cities) might appear in substantially different places along the disease axis. This can be clearly demonstrated by the rise of tuberculosis and other "diseases of the poor" in many declining areas of large cities. It is possible to move along the time axis, but as progress occurs the requirements of the environmental health services will change. Once the basic needs for survival of a population are addressed, the possibilities for environmental health activities seem only to be limited by resources. Nevertheless, the problem of scarce resources is a serious one throughout the Region; thus, in all countries, environmental health services should be carefully chosen and planned to have a specific impact. Again, this publication does not aim to prescribe which environmental health goals national, regional or local authorities should choose; they have to complete this task on their own. It aims instead to provide a methodology for evaluating the services provided at a given time, and after the decisions have been made. Once the tools for evaluation are used, and a well organized evaluation plan is established, prioritizing services should become easier.

Some of the disciplines addressed here will not be applicable immediately to all countries in the Region, but will take on a growing importance as their development progresses according to this model. Applying the theory in this way will give countries along the first part of the time axis opportunities to share experiences with others, thereby possibly moving them further along the time axis. Integrated information sharing may allow countries to better prioritize services and to utilize or apply research completed elsewhere. This volume is especially targeted at those countries currently in the middle of this process – that is, countries with enough economic strength or sufficient political will to devote substantial resources to the prevention of diseases of environment and lifestyle.

Fig. 8 also serves to illustrate the changing qualities needed by health-related professionals to address problems associated with changes in disease patterns. How the progression and rise of one type of disease occurs is open to speculation. Perhaps as one disease begins to be cured the others become more apparent, or perhaps the public begins to demand progressive improvements once one disease

has become manageable. The progression and rise of diseases is also closely connected to broader developments, such as those in economy, culture and science.

For diseases of environment and lifestyle, the skills required have changed from purely medical to those more focused on engineering and management. For example, it is already apparent that reports of diseases related to psychosocial factors are increasing and, in the future, will need to be addressed by professionals with different skills. This emphasizes the need for building competency within environmental health services. Two previous volumes in this series address these aspects of training and curricula development *(6,7)*.

In general, the diagram depicted in Fig. 8 is relevant for most European countries. Where sanitary or hygienic problems have been predominant, the response has been to utilize the skills of doctors and engineers. This is the present situation in many of the countries of central and eastern Europe (CCEE), although the need for environmental health professionals trained in management and social science is now recognized. Facing the new environmental health challenges is possible only if service staff have the appropriate and varied skills necessary. The breakdown of traditional roles does, however, take time and a lag phase is inevitable. It is very difficult to predict and prepare for future service needs, but this is a basic function of all managers and politicians. Evaluation of current services is the foundation upon which decisions about the future are based.

WHY EVALUATE ENVIRONMENTAL HEALTH SERVICES?

There are numerous reasons for carrying out an evaluation of an environmental health service. Primarily, it is important to address the general management goals of evaluating the effectiveness, efficiency, impact, process, relevance and adequacy of policies, activities, objectives, services and goals. Evaluations can be used to determine what has been achieved by the service, how the service works, and how to improve the efficiency and process of services. Without evaluating environmental health projects, it is difficult to ascertain whether and how well objectives have been achieved. Thus, an examination of the capabilities and effectiveness of services can

be used to assess whether policies have been effective in achieving their objectives. In addition, evaluations provide valuable information about the process of delivering services. Furthermore, learning more about how the services operate may demonstrate problems in the implementation process. Knowing what the problems have been helps define ways to improve the efficiency and effectiveness of the service.

As a tool, improved evaluation also assists managers in choosing between the various types of environmental health service that an authority can provide and, perhaps, in prioritizing them. In the past, the mixture of environmental health services that authorities have chosen to provide has rarely been the result of scientifically calculated or strategic planning. A careful evaluation of the benefits of current services could identify unnecessary redundancies, or gaps that require filling. Unfortunately, while it is relatively easy to find material that provides advice on how to design and implement specific environmental health services (for example, waste disposal or food inspection), there is little guidance on how to choose between different services, or between specific actions. One can ask: Given limited resources, which service has the better impact on the health of the population? One can also ask: Which has a smaller, negative impact on the environment? Both questions are important, but not easily answered, given the current methodology and practices of service delivery.

Evaluations also serve to improve the knowledge of programme impact. This knowledge in turn helps justify expenditures on

Box. 3. Primary reasons for evaluating environmental health services

Draw upon experiences to improve overall service delivery
Improve efficiency and process of services
Determine effectiveness and impact of goals, objectives and services
Ascertain relevance and adequacy of goals, objectives and services
Describe expenditures on environmental health services to political leaders and communities
Recognize and respond to public needs and wants
Prioritize research and plan for the future
Prioritize actions and decisions
Find allies in other agencies, services or sectors

environmental health services to political leaders and communities. An evaluation of services may also act as a mechanism through which changes in public needs and wants can be recognized. In order to evaluate any of the service goals, objectives, outputs and outcomes, managers first need to know public expectations and wishes. A proper method of evaluation helps to identify inadequate and irrelevant services and helps to ensure that such services will be adjusted accordingly.

Additionally, an evaluation may be used as a mechanism for prioritizing research. "Further research required" is a familiar phrase. Often, public and environmental health officials do not have the luxury of waiting for additional research; instead, they make decisions based on the best available information. In such cases, the precautionary principle[2] is applied and the need for more research remains. It is therefore important that the most relevant questions be addressed first, and evaluation is a tool for determining where to begin. Research is also tied to the need for applying the knowledge gained from an evaluation to making decisions about the future, because once the gaps have been defined, research can be directed to address these gaps. A balance should be struck between the need to act immediately and the need to wait for further information.

Evaluation may also foster interactions between agencies and organizations that ordinarily do not cross paths. Through these interactions, personal relationships and alliances between individuals with similar objectives and perspectives may be developed.

As stated in Chapter 1, managers should ask themselves why they are evaluating services (Box 3). Sometimes an evaluation is the result of economic or financial considerations; in other cases managers may simply wish to know how much progress has been made. The need to inform and convince the public about the value of the service is also an important underlying reason to evaluate. Evaluation may, in some cases, open the door to two-way communication with the public (see Chapter 5 for more information on communication

[2] The precautionary principle instructs managers to take action in the interest of protecting public health, even when fully conclusive evidence is unavailable. In other words, when faced with large uncertainties, managers are encouraged to err on the side of overprotection.

issues). Finally, the value of having an integrated programme of services is greater than the simple sum of its components. A thorough evaluation of programmes may provide examples of this to service managers.

BARRIERS TO EVALUATING ENVIRONMENTAL HEALTH SERVICES

Environmental health services are particularly difficult to evaluate through traditional mechanisms. Many years ago a WHO working group *(8)* identified several of these difficulties, but most of them have not yet been adequately addressed. There are six main barriers to effective evaluation.

1. Environmental health services try to produce a non-event. How can it be proved that a non-event is the result of a service?

2. Services are administered by several agencies, such as health, environment, agriculture, industry and transport.

3. Environmental health services address three different time periods: the past, present and future.

4. There are many weak and indirect links between environment and health effects; long latencies are usually associated with known environmentally caused diseases.

5. It is difficult to define the community and, thus, to determine the relevance and adequacy of the services.

6. Unreliable information limits long-term comparisons.

An important way to overcome these barriers is to recognize and discuss them with the evaluation team at the beginning of and throughout the process. The remainder of this section discusses each of these barriers and suggests ways in which they can be addressed.

Proving a negative

Many environmental health services strive to produce non-events; in other words, the purpose of many environmental health services

is to prevent an adverse effect from occurring. Thus, if the services are well targeted and managed properly, their effects will be to produce the *absence* of an event. If there are no events to measure or discuss, how can a manager prove that the services are working properly? Similarly, it is a problem that many environmental health services work to maintain the status quo. Measurement is especially difficult when health effects fall below what is detectable individually, or what is unacceptable socially. So, while it may be easy to identify services that are not working properly (complaints from citizens generally provide a good warning system), it may be difficult to prove that services *are* working properly. Typically, these problems have been overcome by identifying changes in health status, in environmental parameters or in indicators of them that, given a proper design, might be related to service activities.

Multi-agency responsibility for environmental health services

Environmental health services have traditionally been administered through more than one governmental agency, thus making coordination of evaluation efforts difficult. Typically, it is not just ministries of health or of environmental protection, or both, that deliver environmental health services. Many other sectors and their ministerial authorities, such as agriculture, industry, energy, transport, tourism and labour, are involved. Generally, none of these authorities knows what services the other sectors and authorities are providing, and so a comprehensive evaluation of the effects of the services is not possible. There have been recent efforts to promote intersectorality. The Helsinki Declaration *(9)*, for example, places particular emphasis on improving coordination among different governmental authorities dealing with subjects that relate to environmental health. Additional efforts, however, are required to increase the probability of a sufficient evaluation; for instance, a coordinated evaluation of all environmental health services in the relevant sectors could be incorporated into NEHAPs.

Past, present or future?

Another barrier to effective evaluation methods is that environmental health services must address and act in three different time periods: the past, present and future. These services must repair past damage, protect the present environment and provide good practices

in the future. Policies cannot simply address only one of these periods of time; a balance should be made among them. For instance, it may be difficult to quantify the value a particular resource will have in the future.

Inadequate links to health outcomes

Despite the advances of the past 20 years in understanding the links between exposure to environmental agents and its impact on health, there are still many questions and unproved theories. This lack of a clear scientific link has hindered the development of comprehensive indicators that measure such health effects. Furthermore, the long latency periods associated with many environmentally caused health effects create difficulties for comprehensive evaluations. Many types of environmental health service are trying to prevent health effects that occur over a long period of time, and that only rarely manifest themselves in the general population. Programmes that are implemented today may not produce measurable impacts on health for months or sometimes years. Thus, the use of traditional epidemiological methods to measure and evaluate the impact of programmes is often inadequate.

The entire community is the client

Evaluating environmental health service activity can be done within the broader context of its clients or target population. Generally, it is easier to evaluate a service directed at a well defined, limited population; however, unlike some health services that have more or less defined populations (for example, mothers and children of low socioeconomic status in many maternal and child health services), the community as a whole is usually the "client" of environmental health services. In many cases, it is therefore very difficult to narrow or further define and measure the "community" that benefits from particular services. In such cases it may also be problematic to promote or evaluate equity – that is, it is hard to identify which individuals receive attention, protection or care, and which do not. When the entire community is the client, it is sometimes difficult to strengthen a manager's abilities to improve services that are based on the needs and wants of the population. This, however, is not always a major problem. For example, environmental health services may be focusing only on specific risk groups, such as children or the elderly, that are in specific need of help. This focus on a well defined, limited

population facilitates population-based measurements in evaluation research.

Data of unknown quality

One of the biggest barriers to effective evaluation is unreliable information. Because of their nature, most environmentally caused health effects require analyses of long-term health trends. Though there is a great deal of long-term health and environmental quality monitoring data available for the CCEE and the newly independent states (NIS), the validity and reliability of much of these data have been questioned (for example, see the Estonian case study in Chapter 6). A decade after the fall of the Berlin wall, countries, and sometimes local authorities, are developing their own monitoring systems that are occasionally incompatible with each other. This makes comparisons between and within countries unreliable.

Problems of data quality and compatibility are not limited to the CCEE and may even cause difficulties in western Europe. For example, significant advances in technology in the past few decades have improved water sampling techniques, making them much more sensitive to toxic substances. In some areas, current raw data, when compared with data from as recent as 5 years ago, appear to indicate that drinking-water is becoming more toxic. It is much more likely, however, that the change is due to more accurate sampling techniques than to truly higher levels of toxicity. But it is still a problem for managers to distinguish between these two scenarios, especially if they are trying to use the level of toxicity in drinking-water as an indicator of success of their water protection service. It is a dilemma: on the one hand, it is desirable to utilize new technologies as they become acceptable and unrealistic to expect managers to ignore such technologies; on the other hand, managers clearly have to act to ensure that their water sampling techniques are consistent and that they produce accurate and reliable results.

Tools from other disciplines

The barriers to evaluating environmental health services have not been adequately addressed or resolved since a WHO working group *(8)* met almost 30 years ago. Furthermore, barriers such as poor data quality are unlikely to be fully resolved in the near future. Admittedly, there is much to be done in certain areas, but this should not

be used as an excuse for not conducting evaluations. Evaluation is absolutely necessary for the delivery of quality environmental health services. Much can be done immediately to improve evaluations based on tools used by other disciplines. The remainder of this book describes some of these tools in some detail and suggests how they might be adapted and applied in the context of environmental health services.

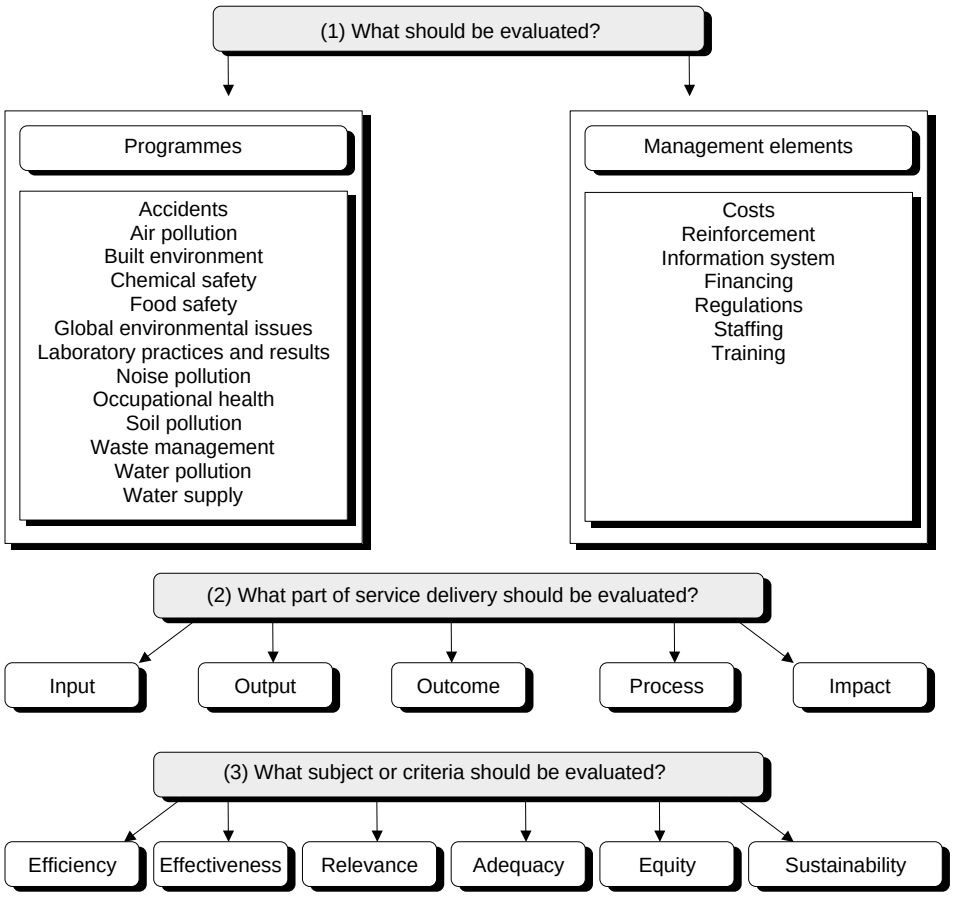
WHAT ASPECTS OF THE SERVICES ARE TO BE EVALUATED?

As stated in Chapter 1, what is evaluated (the subject) is closely related to the goal or purpose of the evaluation. It is strongly recommended that a team of interested parties first clearly define the purpose of an evaluation and then decide the subject and scope of the evaluation. A balance should be reached between extremely specific evaluations, which provide more detailed information on a limited range of topics, and general evaluations, which provide conclusions that are less specific but may be more widely applicable.

It is impossible for authorities to evaluate environmental health services in their entirety at one time. The tasks and duties of environmental health services are simply too vast and diverse. Furthermore, resources are not likely to cover evaluation of each subject (such as efficiency or relevance) for each of the different aspects of environmental health services. In this context, "aspects" refers to the various programmes that can be evaluated (such as accidents, waste management and laboratory practices) or to management activities (such as enforcement, financial management and training). Individual countries and districts have to prioritize evaluations according to local circumstances. Fig. 9 presents three questions related to the subject of an environmental health service. This figure is intended to serve as a guide and to initiate discussion, but is not intended to relate all potential services that fall within the realm of environmental health.

It is clear that both specific programmes (interventions) and different elements of management should be evaluated, so these two areas have been separated in Fig. 9. As the figure suggests, all types of management and intervention can be evaluated, yet some will

Fig. 9. The subject of environmental health service evaluations



inevitably be more useful than others. Some examples have been singled out in Box 4, with the intention of clarifying what each type of evaluation achieves for the evaluator. Examples of questions that might be answered by each type of analysis are included in the brief descriptions that follow. In addition, these examples are meant to provide a more concrete understanding of a manageable subject for an evaluation.

WHO AND FOR WHOM?

As stated in Chapter 1, it is recommended that a team of interested people be selected to manage large-scale evaluations. Creating a team that includes a mixture of people directly involved with the programme (or decisions to be evaluated) and impartial reviewers with evaluation experience is often the preferred strategy. Depending on the

Box 4. Examples of what to evaluate

Inputs and outputs of training personnel
Analysing inputs and outputs determines the utilization of resources and the delivery of planned activities. For training personnel, this might include an analysis of the cost, supplies, personnel and person-hours (the inputs) and an analysis of the number of people trained and the number of training sessions completed (the outputs). Such an analysis might include the information provided in the training courses, but it would not give any indication of the quality of the services.

Outcome of a car accident prevention programme
Outcome is studied in order to measure changes that occur at the population level as a result of programme activities (outputs). For example, investigating the outcome of a car accident prevention programme would mean looking for changes in the number and types of car accident. If alcohol were an important consideration, the number of accidents related to alcohol might be measured. Also, a change in behaviour (such as the practice of wearing a seat belt) may be a key consideration.

Relevance of a particular regulation
Relevance pertains to whether the right thing is being addressed. Regulations, for example, can be studied for relevance. To do this, one might ask whether a risk being addressed is important enough to warrant regulation. For the case of anti-smoking regulations, one might want to determine whether they would be warranted in public restaurants.

Adequacy of an air pollution monitoring service
Adequacy attempts to measure whether enough of the right thing is being done. Air pollution monitoring services may be studied to determine whether the right substances are being monitored in the right place, at the right time, with the right techniques and for a long enough period of time.

Process of waste management
Process is the means by which inputs are transformed into outputs – that is, the activities that occur. Analysing the process of waste management services can identify important strengths and weaknesses in the procedure. By tracking the process of waste generation, collection and end-use/disposal, one can gain valuable insights into ways to improve processes and create incentives for recycling, reducing and reusing waste.

Impact of food safety programmes
Impact analysis is concerned with the broad, population-based consequences of services (outcomes). For example, fluctuations in food-related morbidity and mortality might be a measure of the impact of food safety programmes.

Efficiency of the enforcement procedure
Efficiency relates the results of a service (outputs) to the resources and efforts put into that service (inputs). It provides a gauge of how well plans are carried out. A monetary value is usually involved with assessments of efficiency. For the case of enforcement, a manager might look at the efforts to improve compliance to certain measures. What level of compliance is achieved, given the amount of resources devoted to the enforcement procedure? (In this case it is especially important to distinguish between voluntary compliance and that which is a result of active enforcement policies.)

Box 4 (contd)

Effectiveness of staffing profiles
Effectiveness relates outputs to the goals specified. In terms of staffing, a key question would be: Is there sufficient manpower available (with the necessary skills) to address the problems the service is facing? Can staff handle problems effectively?

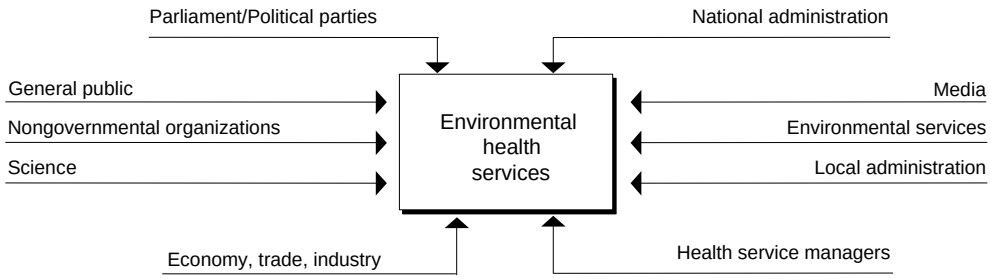
Equity of built environment policies
Equity is concerned with equal opportunities to fulfil health potential. One could ask whether a given policy is causing or perpetuating disadvantages in certain groups. For example, from the built environment sector, some urban redevelopment schemes disproportionately burden low-income groups by displacing low-income housing with upper- or middle-income housing.

Sustainability of financial arrangements
Sustainability generally refers to three types of resource: environmental, financial and personnel. It is important to ask whether these different types of resource are conducive to the long-term continuation of services, without depleting the resources for future generations. For example, financial structures can be evaluated for sustainability by asking: Do the current financial arrangements provide for continuation of services?

scope of the evaluation, the mixture of skills, training and experience within the evaluation team should be diverse – the more complex the evaluation, the more diverse the mixture should be. The mixture would of course include expertise in the appropriate discipline and familiarity with the programme or process in question, and might include social scientists, statisticians and information managers. Having a management representative involved (even as a silent participant) can also help produce a useful evaluation. Sometimes cross-disciplinary evaluations (drawing on professionals from other sectors) are warranted. Some programme directors have found that personnel from other sectors can bring a fresh perspective and can provide training and expertise to the evaluator. A range of expertise in different disciplines is desirable to avoid the criticism of having a narrow perspective. An important goal is to perform a credible evaluation by involving expertise appropriate to the scale of the task to be performed.

Earlier in this chapter it is noted that environmental health services often act as an interface. Many different organizations interact and cooperate with environmental health services, including parliament, academic and scientific sectors, the media, the general public and industry (see Fig. 10). It is important to remember this context,

Fig. 10. Environmental health services and cooperating organizations



as evaluations may have different target audiences in different organizations.

Evaluations benefit the authorities who implement the services, those who pay for the services, those who plan for the future, those who direct research, the professionals who work with the programmes, and the population at large. These are the groups for whom evaluations are conducted. Presumably any effect that a service has in a particular situation will be improved once the service is evaluated and adjusted according to the results. Once the evaluation is completed, the service will improve by becoming more responsive to public needs and wants, and by becoming more effective and efficient. This should improve the health of the population (which may or may not be measurable). In addition, a high return from a well targeted evaluation can be expected. It is important, therefore, to identify the target audience for which the evaluation is being performed. If the target audience is well specified, the task becomes clearer and it is more likely that the results of the evaluation will be useful to the service.

All the examples in Box 4 have been based on the assumption that these evaluations are occurring “for managers”, that is, that managers are evaluating services for their own use and to augment their ability to improve the services. Naturally, there are additional groups “for whom” evaluations can be done. Thus, an additional dimension can be added to Fig. 9. For each potential evaluation, a different group may have a different reason for evaluating the service. For example, when services are subsidized by donor agencies, these agencies may want to evaluate the process in order to illustrate

accountability; or they may evaluate sustainability in terms of personnel requirements. Different types of population could also be considered; then, each such subdivision might include international groups, national groups, middle-sized geographical areas (for example, a county or district), local areas (for example, a town or city), or even a specific subpopulation based on exposure (for example, children, the elderly or pesticide applicators).

Evaluating *a service*, *a programme*, or *the management* is an oversimplified notion. It is essential to clearly define and narrow the scope of the evaluation, particularly when faced with limited resources. Only specific aspects of the service, programme or management can be evaluated. The scope reflects the intended purpose of the evaluation, and thus may be narrowed by the type of service or programme to be evaluated, by any of the traditional evaluation subjects, by the intended target audience, or by the population affected.

Box 5 summarizes the key recommendations of this chapter.

Box 5. Key recommendations from Chapter 2

Clearly define and narrow the scope of the evaluation so that it becomes both a meaningful and feasible activity

Staff the evaluation team with individuals with the appropriate range of expertise

Be aware of the specific features of the environmental health service that may affect the evaluation techniques and procedures

Find ways to address or account for the barriers to evaluating environmental health services

Consider the context surrounding various organizations that cooperate and put the delivery of environmental health services into that context

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3

Data and Indicators

Once the purpose, subject, scope, frequency and timing of an evaluation have been established, the evaluator must determine what to measure and how to measure it. The tools that make measurements possible are data and indicators; they are also the building blocks of comparative evaluation. This chapter concentrates on indicators, describing what they are, who uses them and why, and giving examples of five types of indicator that often contribute to the evaluation of environmental health services.

DATA

Data can be defined as individual points of observation that are collected on a particular subject. Collecting data on environmental health services is not an evaluation goal, but is instead a means to gain an understanding of these services. Although critical to evaluation, data are only part of the evaluation process. By themselves, data are a useless mass of figures (for example, on health status); but when they are put into a proper context and interpreted, they become information that *is* useful to managers and decision-makers.

INDICATORS: DEFINITION AND PURPOSE

Indicators measure change. They are variables and are used as surrogates for measuring a parameter of interest, when practical difficulties prevent the exact measurement of that parameter. In a sense, an indicator is an empirical model that accurately reflects an event, even though it is only an indirect or partial measure of a complex situation. For example, the presence of high concentrations of sulfur dioxide in air alone is not necessarily a health risk, but sulfur dioxide concentrations are often used as an indicator of overall air quality.

Indicators are particularly useful when measured over a period of time, so that they track direction, magnitude and rate of change. They are also useful for comparing different areas (or groups of people) at the same moment in time. Though indicators are usually indirect measures, they can assist managers in making inferences and projections that can facilitate decision-making and other management functions.

Three major applications for indicators can be identified: decision-making, communication and policy follow-up.

Indicators support decision-making and comparisons by providing information about efficiency, effectiveness and problem situations. Decisions about priority of services, sequence of activities and allocation of resources are often based on a series of indicators.

Indicators are critical for productive communication because they promote a common understanding through the use of a consistent framework for measurement. They allow international organizations and national and local authorities to communicate with each other and with their many partners (or stakeholders), including communities, institutes and NGOs.

Indicators also help determine the degree to which goals are met and policies followed. In particular, performance indicators are being used increasingly to monitor implementation. For example, the Protocol on Water and Health, signed by the Member States of the

European Region at the Third Ministerial Conference on Environment and Health in London, United Kingdom, in 1999 *(1)* mandates that the signing parties will:

> Collect and evaluate data on:
>
> *(a)* their progress towards the achievement of the targets [set forth in the protocol]; and
>
> (*b*) indicators that are designed to show how far that progress has contributed towards preventing, controlling or reducing water-related disease.

OBJECTIVES FOR INDICATORS

This section presents a set of qualities (or objectives) that evaluators should seek for indicators *(2)*. Only some of these qualities can be maximized simultaneously, because no single indicator can posses them all. A suite of indicators is commonly used to avoid the limitations of any one indicator.

Validity

An indicator should accurately measure what it is supposed to measure. If the data from which the indicator is calculated are inaccurate or are subject to unforeseen variations, the indicator will not be valid. For instance, the validity of past data from the CCEE has been questioned because the Soviet system fostered inaccurate record keeping. An example of this is discussed in Chapter 6 in a case study entitled Assessment of environmental monitoring in Estonia (page 145). Compliance with international standards (such as those recommended by the International Organization for Standardization (ISO)) helps secure data validity.

Internal reliability

When an indicator is reliable, it means that under similar conditions it allows the same inferences to be made by different people. A distinction can be made between internal and external reliability. Internal reliability means that an indicator should provide the same basis for conclusions within one population or geographical area. For example, the number of telephone complaints received by a local authority may not be a reliable indicator in some underdeveloped or

impoverished areas because it presumes that citizens who wish to make complaints have access to a telephone.

External reliability

External reliability demands that the same conclusions be drawn from indicators, irrespective of the population's size or location – that is, generalizations can be made with these indicators. For example, using the number of students per 100 inhabitants as an indicator of the level of training of the inhabitants in a particular city could be highly misleading, either because of the existence (or lack of) a university in the city or because of the degree of prestige and popularity of the universities in the city. So, a city of the size of Oxford (home of a university) but situated 50 km away will have many fewer students per 100 inhabitants than does Oxford, although the overall level of training of the inhabitants may not be very different. Another indicator would probably be required to measure the average training level of the population.

Specificity

An indicator is specific if its value remains stable when other data with a similar context change – that is, if it reflects only the parameter in question. The indicator must change when the parameter changes and must remain constant when the parameter remains constant. Being assured of specificity is difficult, mainly because so many factors (such as socioeconomic status and unemployment rate) interact with one another and are difficult to separate. For instance, life expectancy is not a specific indicator of good health or of long life. Life can be long, but very unhealthy. A more specific indicator would be the average life expectancy at the age of 40 and might include a list of disabilities.

Sensitivity

An indicator is sensitive if small fluctuations in the parameter are reflected by small fluctuations in the indicator itself. Again, life expectancy is not a particularly sensitive indicator of health status because it is unlikely that small gains or fluctuations in overall health status are reflected accurately.

Relevance

Indicators are said to be relevant if they relate to the appropriate data or phenomenon studied. Relevance is not as much a property of an indicator as a property of a group of indicators within a given

framework. Some indicators are thought to indicate ideas, which they in fact may not. For instance, the percentage of solid waste recycled in a city is certainly not an indicator of sustainability, although it might be argued that more recycling implies more sustainability; this is not the case because recycling by itself is not a particularly relevant indicator of sustainability. Nevertheless, combining recycling with the level of waste produced can provide a good measure of sustainability (less waste *and* more recycling is more sustainable).

Easily obtainable

Minimizing the burden on those providing data is desirable. Measurements are limited by such practicalities as cost and ease of collection. When the choice is available, it is better to collect data that are more easily obtainable than not. Sometimes "easily obtainable" is translated to "already collected," but such an approach is too simple. In order to follow the new development model and promote overall sustainability, simply relying on existing data by default is problematic. As mentioned earlier, sulfur dioxide is often used to indicate air quality because most localities, if they measure any air pollutants, measure sulfur dioxide. But just because data for sulfur dioxide are very common does not necessarily mean that they are the best indicator of air quality. Evaluators must make trade-offs among indicators that are readily available and those that are most desirable. The available indicators may not be exactly suitable for what is desired, but collecting additional information is not always feasible, owing to expense, political will and other factors.

COMPLEXITY OF INDICATORS

Another important aspect to consider is the complexity of an indicator. Different categories of indicator with increasing complexity have been identified: simple numerical, complex numerical and qualitative indicators. Several examples of these indicators are provided in the sections that follow.

Simple numerical indicators

The simplest type of indicator is raw data expressed either in basic numbers (such as counts) or in rates of occurrence. Examples of basic numbers are the number of food inspections by a service, the

number of telephone complaints and the number of staff trained. Such raw data, however, are not as informative as rates of occurrence, which combine different data sets. Examples of these rates include the number of service inspections per month, the number of fines issued per inspection, the percentage of families living below the poverty line and the amount of money spent per telephone complaint handled.

Complex numerical indicators

Lists or indices of indicators are appropriate for measuring more complex issues. For example, many indices have been developed to gain insight into how people value quality of life, measure physical impairment and assess psychological wellbeing. These are generally derived from surveys and questionnaires administered in a formal way. Answers can occasionally be combined into a single measure, such as the overall value of wellbeing. Sometimes the questions in such questionnaires and surveys are weighted differently, according to different criteria. An example of a complex indicator is promoted by the WHO Healthy Cities project (see also Table 6, page 75). A set of 53 indicators covering health, health services, environment, and sociodemographic characteristics is regularly reported by nearly 50 European cities *(3)*.

Qualitative indicators

Qualitative indicators are narrative descriptions collected from discussions with small groups of people (focus groups), from key informants (politicians, service staff) and from professional observations. Examples of qualitative indicators include not only perceptions by health professionals of their job satisfaction (or of their usefulness) in completing given tasks, but also general perceptions by people of how well a service meets their needs and demands. Qualitative evaluation tools are discussed further in Chapter 4.

WHO USES INDICATORS?

People from different sectors, administrative levels and countries may approach indicators very differently. Experience has shown that an indicator can assume a different meaning, according to who requests or develops it. Technicians, researchers and other specialists

may request accurate, detailed and focused indicators related to their own field of interest. Each group interprets the indicator in terms of its own speciality or background. If, for instance, we take the number of kilometres of bicycle paths in a city, the department that promotes cycling (as opposed to car transport) is likely to be interested in the absolute figure, because the more paths there are, the more likely they are to be used. The department in charge of traffic safety, however, may be interested in the percentage of bicycle paths that are separated from other traffic. Furthermore, the department in charge of promoting tourism in the city may be interested in the number of kilometres of bicycle paths that go through natural areas and in the number of monuments of historical interest that can be reached by bicycle. Each of the following groups may need different indicators or may implement the same indicator in a different way.

Local authorities

Local authorities use indicators to demonstrate progress and provide accountability to the local community, and to report to regional and national authorities. Indicators are often unique to a particular locality, though efforts to standardize indicators at national and regional levels are being advocated across the European Region by national governments and international bodies (such as the European Environment Agency (EEA)). An example of how local authorities are using indicators is provided in the final case study in Chapter 6: Performance indicators in the United Kingdom (page 158).

National authorities and international organizations

National authorities and international organizations often view indicators in a similar way, and many of these organizations provide funds to local authorities through various mechanisms. Indicators are used to compare similar aspects of different cities or areas and help these organizations prioritize them for assistance. National authorities and international organizations also use indicators as a tool for orienting policies and advice, and as a warning system that signals when a situation is evolving in a specific direction.

Networks and groups

Groups of people who communicate with one another for a common purpose are often referred to as a network. City networks, international health networks and networks of NGOs also use indicators

for at least two reasons: to measure the success of their advice and to provide members with tools to measure the efficiency of their recommendations. Indicators from networks are commonly sectoral, although some networks have a very broad scope.

The community

The community itself is also interested in indicators. Very simple figures, such as the inflation rate and the number of people unemployed, can have a large impact on the community. Some newspapers have tried to classify cities in the world (or in different countries) by using a mixture of life expectancy, surface area of green space available, gross national product (GNP) and level of pollution of the rivers as an indicator. This type of mixture may have little scientific meaning, but it appeals to communities – who prefer to live in a city at the top of the list than in one at the bottom. Although it is not their primary mission, international organizations could reduce the use of scientifically less valid indicators by providing the press with some good indicators that speak well to the layman.

CATEGORIES OF INDICATOR

Indicators can be categorized in many ways. Jones *(4)*, for example, recommends categorizing indicators on the basis of how closely they reflect the values that drive environmental policy (see Box 6). The categories used in this volume are based on substantive areas of focus. Of the many broad categories of indicator now in use, five will be discussed here: process indicators, environmental indicators, health indicators, socioeconomic indicators and urban indicators. Some practical examples of indicators now in use will be given. It must be noted that this list is far from being complete, but it does give the reader an understanding of the breadth of indicators available.

Process indicators

An evaluation may focus on the way a service works – the process of transforming inputs into outputs (see Fig. 5). Process indicators have been developed for several purposes, varying from recurrent indicators used on a regular basis, such as those used for management information systems, to incidental ratios developed within a specific evaluation framework.

Box 6. Primary, secondary and tertiary indicators

Primary indicators report directly the changing condition of environmental quality in terms of something that we value. A primary indicator immediately communicates the status of an environmental attribute without extensive technical interpretation.

Secondary indicators provide information about a stressor that affects environmental conditions. A secondary indicator may not communicate the condition of the environment unless it is accompanied by information explaining the link between the stressor and the magnitude of its impact.

Tertiary indicators measure management activities that address an environmental problem. By themselves, tertiary indicators do not provide any information about the environmental conditions, but they may address particular concerns about the response of a government to an environmental problem or they may provide information about the costs of different management strategies.

Source: Jones *(4)*.

In general, every type of indicator (single numerical, complex numerical and qualitative) can be used as a process indicator. Common process indicators are those that relate to process inputs, outputs and features.

Input indicators focus on what goes "into" a service. Information on input, such as funds or personnel (number of staff), is usually easily obtainable. Where inputs cannot be expressed in monetary units, qualitative measures for developing indicators may be appropriate.

Usually outputs are described in terms of certain activities and tasks, such as activities performed, direct tangible results, or products of a service. Outputs should not be confused with more indirect results, such as the impact of a service. Again, both quantitative and qualitative approaches are useful here. For example, the output of a service could be a certain level of satisfaction of people using the service; such outputs are especially suitable for qualitative analysis.

Process feature indicators provide information on how a service actually works. In some cases indicators are developed by combining input and output information (such as costs and benefits, and sometimes they focus on specific procedures within a service or on accounts of how service staff work together. Again, both quantitative and qualitative approaches are useful.

Process indicators are useful tools for managers, because they provide valuable information about the way services work. This is especially true when an evaluation compares the actual process with the planned process or when process features are compared to specific standards. Since services have a role to play in communicating with the public, the way a service operates in relation to the community is of increasing relevance in evaluations. Process indicators are highly useful for answering such questions as:

- How does the community or the individual feel about the services provided?
- Does the service meet the demands of the community?
- Are community and individual concerns handled properly?

Several examples of process indicators can be identified. For example, in the United Kingdom the Audit Commission acts as a watchdog for fiscal accountability at the local level. Performance indicators for local services have been developed, and many of these could also be considered process indicators. The fifth case study in Chapter 6 of this volume discusses the United Kingdom Audit Commission performance indicators in some detail. Several examples of process indicators appear there in Box 27 (page 162).

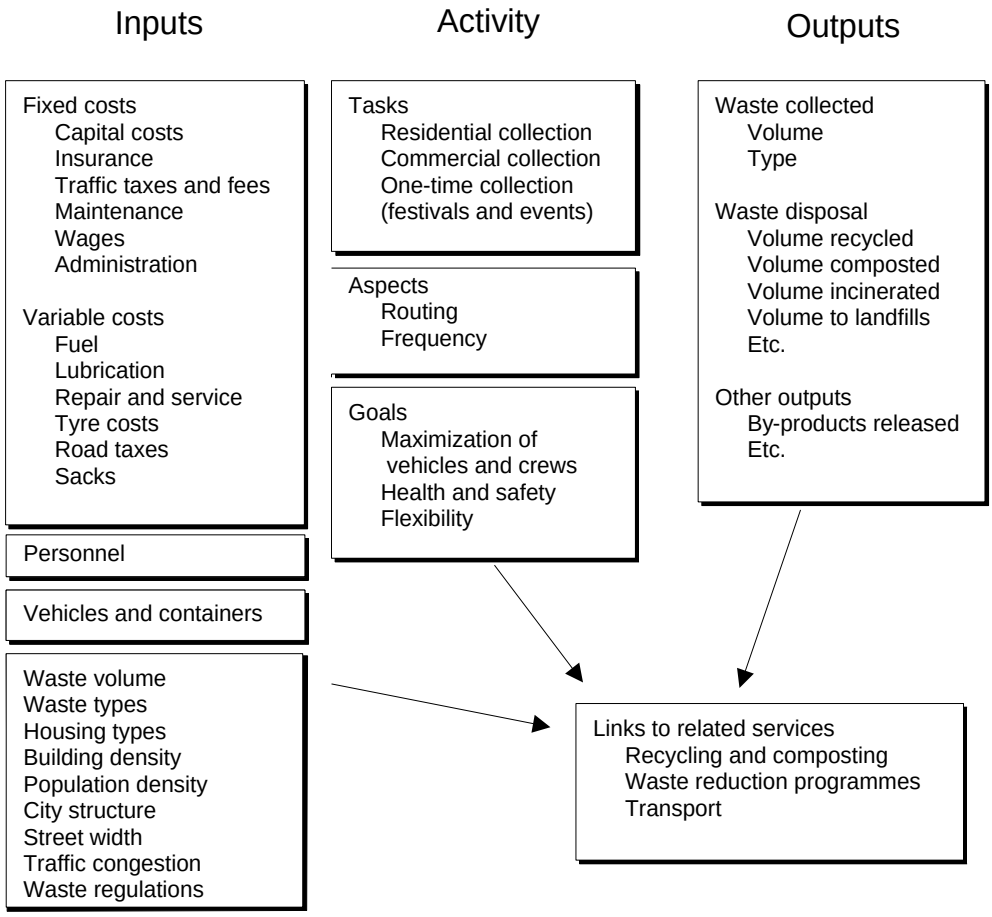
Process indicators vary widely with the type of service performed. To develop project-specific process indicators, evaluators may rely on conceptual models of the service implementation. A simple model for a waste collection service is provided in Fig. 11. Based on this model, many different process indicators could be developed, including (note this list is far from exhaustive):

- volume of wastes (by type) collected;
- average time spent by crews at collection points;
- number of days refuse not collected on schedule;
- cost per citizen;
- person-hours required for different aspects of the service; and
- frequency of collection points per neighbourhood.

Environmental indicators

Hundreds of environmental parameters are routinely collected across the European Region. Monitoring environmental conditions is

Fig. 11. Simplified waste collection process model



Source: WHO Regional Office for Europe *(5)*.

particularly useful for identifying areas of concern, measuring change and setting priorities, but is also useful for evaluating progress, efficiency and effectiveness.

Many groups conduct environmental monitoring. It is conducted at national, district and local levels by environment agencies, citizens' groups, non-profit organizations and private companies. In addition, many international organizations monitor the environment at the international level, including WHO, EEA, the World Bank, the Organisation for Economic Co-operation and Development (OECD), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). Many of these international groups are developing indicators to translate environmental data into useful information and to better understand the

interactions among environmental, institutional, health, social and economic variables.

Environmental indicators are often measured in more than one way at different scales. OECD, for example, recommends that data be tracked from both a regional and a city perspective for certain air pollutants (Table 1).

Environmental indicators are commonly divided into three types: those that characterize a stressor or pressure upon the environment, those that measure the current state or magnitude of the problem, and those that measure human responses or management activities undertaken to address an environmental problem. These categories correspond loosely to Jones's *(4)* classification of primary, secondary and tertiary indicators (Box 6).

Some organizations focus on only one of these types, while others focus on several types. The TEPI (Towards Environmental Pressure Indicators for the European Union (EU)) project is an example of the former. TEPI is a long-term monitoring project coordinated by the Statistical Office of the European Communities (EUROSTAT). This project has identified six major pressure indicators for each of

Table 1. OECD air quality indicators

Pollutant	Unit	Regional status and trends	City peak statistics
Carbon monoxide	mg/m^3	Annual max. 8-hour running average	Annual max. 8-hour running average
Lead	mg/m^3	Annual average	Annual average
Nitrogen dioxide	mg/m^3	Annual max. 24-hour average Annual average	Annual max. 1-hour average Annual max. 24-hour average
Ozone	mg/m^3	Annual max. 1-hour average Annual max. 8-hour running average	Annual max. 1-hour average Annual max. 8-hour running average
Particulate matter	mg/m^3	Annual max. 24-hour average Annual average	Annual max. 24-hour average
Sulfur dioxide	mg/m^3	Annual max. 24-hour average Annual average	Annual max. 1-hour average Annual max. 24-hour average

Source: OECD *(6)*.

the EU's ten core environmental policy fields. A sample of these is shown in Table 2.

Other groups use more complicated models that look at many aspects of the environment. For example, several United Nations groups and EEA follow the "DPSIR model" because it distinguishes among driving forces, pressures, states, impacts and responses (Fig. 12). According to EEA *(8)*:

> The DPSIR Framework provides an overall framework for analysing environmental problems. It shows how **D**riving forces, such as industry and transport, produce **P**ressures on the environment, such as polluting emissions, which then degrade the **S**tate of the environment, which then **I**mpacts on human health and eco-systems, causing society to **R**espond with various policy measures, such as regulations, information and taxes, which can be directed at any other part of the system.

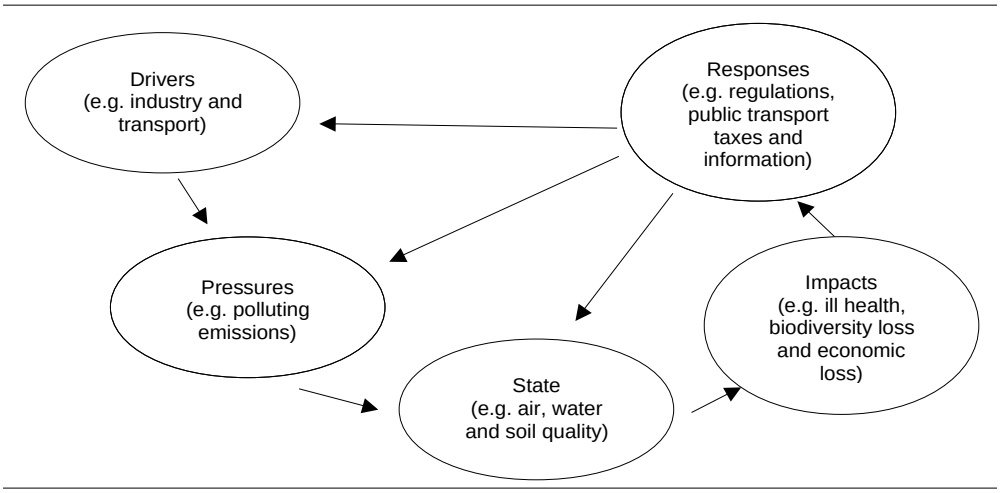
Table 2. TEPI project indicators focusing on environmental pressures (selected samples)

Policy field[a]	Name
Climate change	Emissions of carbon dioxide
	Emissions of methane
	Emissions of nitrous oxide
	Emissions of hydrofluorocarbons
	Emissions of perfluorocarbons
	Emissions of sulfur hexafluoride
Ozone layer depletion	Emissions of bromofluorocarbons (halons)
	Emissions of chlorofluorocarbons
	Emissions of hydrochlorofluorocarbons
	Emissions of nitrogen oxides by aircraft
	Emissions of chlorinated carbons
	Emissions of methyl bromide
Dispersion of toxic substances	Consumption of pesticides by agriculture
	Emissions of persistent organic pollutants
	Consumption of toxic chemicals
	Index of heavy metal emissions to water
	Index of heavy metal emissions to air
	Emissions of radioactive material

[a] Indicators for the following environmental policy areas are not shown: air pollution, loss of biodiversity, resource depletion, urban environment problems, marine environment and coastal zones, water pollution, and waste.

Source: EUROSTAT (7).

Fig. 12. The DPSIR model



Source: EEA *(8)*.

The health and environmental analysis for decision-making (HEADLAMP) project (Box 7) is an example of a joint international programme that has adapted the DPSIR model to explore possible links between environment and health. The project combines environmental indicators with socioeconomic and demographic data and dimensions of health impacts (Fig. 13).

Box 7. The HEADLAMP project

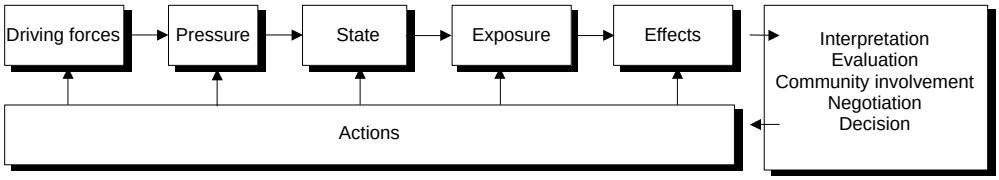
HEADLAMP is a joint project of the United States Environmental Protection Agency, UNEP and WHO. The project's main objective is to provide decision-makers, environmental health professionals and the community with valid and useful information on the local and national health impacts of environmental hazards.

Local HEADLAMP applications are envisaged for monitoring progress towards sustainable development. One of the project's most important activities is the development of environmental health indicators to be used to quantify and monitor local situations.

Within the HEADLAMP framework, environmental health indicators are defined as synthesized information about known environment-related diseases or contaminants with known adverse health effects. In order to identify indicators appropriate to a specific setting, environmental and health data already available are used, and are linked together. In addition, the project developed the driving forces, pressure, state, exposure, effects, actions (DPSEEA) model, based on the pressure–state–response model developed by OECD. Adjusted for environmental health, the DPSEEA model categorizes the different possible indicators in five stages (see Fig. 13).

Sources: Corvalán & Kjellström *(9)*; Pastides *(10)*; Kjellström & Corvalán *(11);* Schwartz & Corvalán *(12)*; World Health Organization *(13).*

Fig. 13. The conceptual framework for the development and identification of the HEADLAMP environmental health indicators



Source: Kjellström & Corvalán *(11).*

Each of the boxes in Fig. 13 can be paired with an environmental problem to develop a matrix of indicators. Two simple examples are provided in Table 3.

Table 3. Examples of the HEADLAMP indicators

Indicator type	Definition	Examples	
Driving forces	The basic socio-economic activities relevant to a specific area within environmental health	Use of lead as an additive in petrol used in cars	Production of sewage
Pressure	Consequences of the driving forces in terms of environmental change	Concentration of lead found in petrol	Quantity of sewage
State	The environmental quality resulting from the pressures exerted	Concentration of lead found in ambient air	Presence of faecal coliforms in surface water
Exposure	The nature and level of interaction between humans (or other receptors) and the environmental state	Number of houses estimated to contain lead paint	Presence of faecal coliforms in drinking-water
Effects	The results (usually in human terms) of changes to the environmental state, based on the exposure	Raised levels of lead in children Neurological impairment	Gastrointestinal disorders
Actions	The wide range of possible responses to prevent any of the above	Number of cars using leaded petrol Percentage of area banning leaded petrol	Expenditure on waste management activities Percentage of population with access to treated drinking-water

Lead as a fuel additive is a useful example, because it has been well studied and because sufficient evidence for causal links is available. In addition, Needleman and Kim et al. *(14,15)* have linked neurological impairment with certain levels of lead in human blood. Unfortunately, most environmental health issues are less well understood – causal links are less direct, exposures are based on models and default assumptions, or effective biomarkers (such as the level of lead in blood) are unavailable – making it difficult to develop the full matrix of indicators.

Access to appropriate facilities and the ability to collect data over time are prerequisites for using environmental indicators in evaluations. Monitoring should be carried out over a sufficient period of time to identify and follow changes in environmental conditions. This requires a stable resource base and access to facilities and techniques. Facilities for collecting and analysing data are often located away from environmental health services themselves, in private laboratories or central environmental agencies. Such institutional arrangements complicate data collection and analysis efforts and lead to inconsistencies in data quality. Consistency and quality of data are influenced by financial resources, equipment and staff expertise, which vary widely across the Region.

The use of environmental indicators is occasionally unnecessary for environmental health service evaluation because environmental and health impacts are only some of the possible evaluation subjects. When evaluating efficiency or relevance, for instance, process indicators may be more favourable than environmental monitoring indicators. Also, environmental indicators are of little value in evaluating services addressing environmental health promotion.

Health indicators

There are also a multitude of health indicators available. Because health is multidimensional, many indicators have been developed that reflect various facets of health. Morbidity, mortality and life expectancy are among the most well known health indicators. These three indicators, however, may prove to be of little use in making decisions about environmental health services, because conclusions about the influence of environmental factors on morbidity, mortality and life expectancy can be drawn only in the rare cases when

sufficient data are available and when causal relationships are straightforward.

Other health indicators are becoming more useful. For example, health science has been focusing more and more on such measures as functional disability, which deals with the consequences of disease on the individual and on a social level. Psychologists are developing measures that reflect the personal perception of health as a multifaceted state, involving much more than disease and death alone. The social impacts of bad health can also be measured – for example, as the extent to which medical services are used or the average annual sick leave taken in a company. Predictors of health are used in preventive strategies – for instance, by identifying such risk groups as pregnant women, infants and the elderly. Though it is hard to avoid classic mortality figures, doing so is essential if all facets of health are to be covered when evaluating environmental health services.

Among health indicators, we find both the traditional measures of ill health and the more recently introduced measures of health status. Donaldson & Donaldson *(16)* summarized six types of health indicator as critical elements in a comprehensive framework for health needs assessment. The six categories cover health status, people, health services, population, disease and mortality (Table 4).

Health indicators are collected by international, national and local organizations. On an international scale, the WHO Regional Office for Europe collects health statistics from around the Region. National ministries of health also collect and maintain disease registers and relevant statistics. Local health offices, hospitals, health management organizations, occupational health clinics and private health care facilities are additional sources of health data. When health data are obtained from local sources, confidentiality is an important consideration. A patient's privacy should be protected by structuring health information so as to prevent the identification of a specific individual.

Analysing behavioural patterns (such as the number of people who take public transport or the solid waste produced per household) is an important way to find relationships between environment

Table 4. Health indicator categories

Issue	Description	Examples
Health status (see also Box 14, page 99)	Indicators that relate to health status do not focus on such things as disease, but do focus more on aspects of wellbeing, quality of life and the individual's perception of his or her own health.	Pain/wellbeing Social functioning QALYs (quality-adjusted life-years)
People	By gathering information on lifestyles and other individual features, one can acquire a better understanding of the factors that determine health and wellbeing.	Lifestyles Risk factors Views/experiences Drug consumption
Health services	Information on (environmental) health service activity is also relevant to acquiring a better insight into the health of people. Health problems, however, do not always extend to the level where care or treatment is needed.	Treatment thresholds Uptake Access
Population	As a baseline measurement of the health of a specific population, it is essential to have information on the specific population structure.	Size Composition Changes
Disease	The traditional measures of ill health and disease are still valid, though it is commonly agreed that they only present one dimension of the nature of health and wellbeing.	Incidence/prevalence Incapacity Survival
Mortality	As with disease indicators, mortality only presents a limited picture of actual ill health status. More elaborate indicators of disease and death can be useful in some instances.	Mortality rates by cause Avoidable deaths

Source: Donaldson & Donaldson *(16).*

and health. These examples of behavioural patterns may not measure direct impacts on health, but they can indicate positive (or negative) momentum. A mix of quantitative and qualitative approaches may be useful for reaching a better understanding of the links between environment and health and the influence of an environmental health service.

Socioeconomic indicators

Organizations are increasingly using socioeconomic indicators because environmental health also consists of the social and economic circumstances that affect health. Relying on data from WHO, the World Bank, UNDP and the United Nations Economic Commission for Europe (ECE), WHO used the following socioeconomic indicators in its report *Health in Europe 1997 (17)*:

- midyear estimated population (millions)
- GNP per person
- gross domestic product (GDP) per person
- total health expenditure as a percentage of GDP
- mortality per 1000 live births
- life expectancy at birth (in years)
- human development index[3]
- immunization coverage[4]
- unemployment as a percentage of the labour force.

Indicators that relate social or economic developments directly to health status (for example, Box 8) are especially interesting, although much work in this area remains to be completed.

The United Nations has been developing indicators that relate socioeconomic indicators to health and environmental concerns. The United Nations has used a simplified version of the DPSIR model (see Fig. 12) to develop a matrix of indicators for sustainable development *(19)*. For each major category, three types of indicator are presented (whenever possible), including:

- driving force indicators – to capture information about human activities, processes and patterns;
- state indicators – to capture information about the state of human development; and

[3] The human development index measures the average achievements of a country in three basic areas of human development: longevity, knowledge and standard of living. It is a composite index of three variables: life expectancy, educational attainment (adult literacy and combined primary, secondary and tertiary enrolment) and real GDP per person.

[4] Percentage of children at 12 months of age who received their third dose of oral poliomyelitis vaccine.

Box 8. Social status and asthma

In 1995, a group of Canadian researchers set out to study the relationship between socioeconomic status and indicators of asthma in children. The socioeconomic status was assessed by studying the occupation of the parents. Asthma was analysed by using exercise-induced bronchospasm (EIB). Data on this condition were available for 989 children. In addition, information on home exposure to tobacco smoke, demographics and respiratory symptoms was gathered through a questionnaire.

The results were presented using odds ratios, complex indicators that estimate the relative risk that results from various factors. An odds ratio (OR) of < 1 implies that, under the conditions of the analysis, the researchers were unable to observe a difference in the two groups. Compared to children from the most advantaged homes, children from the least advantaged homes were more likely to have EIB and to report night cough and cough with mucus (see odds ratios below).

Odds ratios for the children from the least advantaged homes compared to those from the most advantaged homes

EIB	OR = 2.26
Reporting night cough	OR = 2.30

An OR of > 2 means that children from poorer homes were more than twice as likely to have EIB and report night coughs, under the conditions of analysis.

Odds ratios for EIB in relation to other exposure factors

Excess EIB related to the presence of a cat at home	OR = 1.63
Excess EIB related to respiratory infection during infancy	OR = 1.71

The results did not show significant reporting of wheeze or diagnosed asthma among disadvantaged children but the researchers demonstrated that, through the use of social and health indicators, a clearer picture of the social dimension of health can be produced. Based on the results, the researchers suggested that unidentified environmental factors contribute to the excess asthma morbidity in poor children.

Source: Ernst et al. *(18).*

- response indicators – to capture information about policy options and other human responses.

A selected set of the United Nations' working list of indicators for sustainable development is presented in Table 5.

Urban indicators

Since the majority of the world's population now resides in urban areas, our final area of focus is urban indicators. Both national and international organizations (such as WHO and OECD) are increasingly

Table 5. Working list of United Nations sustainable development indicators (selected examples)

Chapters of Agenda 21	Driving force indicators	State indicators	Response indicators
Demographic dynamics and sustainability (Chapter 5)	Population growth rate Net migration rate Total fertility rate	Population density	
Promoting education, public awareness and training (Chapter 36)	Rate of change of school-age population Primary and secondary school enrolment ratio (gross and net) Adult literacy rate	Children reaching grade 5 of primary education School life expectancy Difference between male and female school enrolment ratios Women per hundred men in the labour force	GDP spent on education
Protecting and promoting human health (Chapter 6)		Basic sanitation Percent of population with adequate excreta disposal facilities Access to safe drinking-water Life expectancy at birth	Immunization against infectious childhood diseases Contraceptive prevalence Proportion of potentially hazardous chemicals monitored in food
Changing consumption patterns (Chapter 4)	Annual energy consumption Share of natural-resource-intensive industries in value-added manufacturing	Lifetime of proven energy reserves Intensity of material use Share of manufacturing value-added in GDP Share of consumption of renewable energy resources	
Financial resources and mechanisms (Chapter 33)	Net resource transfer/ GNP Total overseas development assistance given or received as a percentage of GNP	Debt/GNP Debt service/export	Environmental protection expenditures as a percentage of GDP Amount of new or additional funding for sustainable development
Transfer of environmentally sound technology, cooperation and capacity-building (Chapter 34)	Capital goods imports Direct foreign investments	Share of environmentally sound capital goods imports	Technical cooperation grants

Source: United Nations *(19).*

developing and using urban indicators to gain a better understanding of urbanization and its effects. Indicators that relate urban conditions to health status may prove to be especially useful: they include indicators that account for urban issues, such as social conditions (employment, crime, violence), housing, mobility and sustainability at the city level. Urban indicators, however, are particularly difficult to develop, as the complex system of a city is hard to translate into (a group of) numbers or indicators. In addition, indicators are sometimes vastly different from one city to another, which complicates efforts to compare them. There is a clear need for a common denominator for indicators – a standard set used by a wide range of cities – to improve the comparability and possibilities for evaluation. An example of sustainability indicators at the city level is provided by the Sustainable Cities project of the European Commission *(20)*.

The WHO Healthy Cities project has developed a number of indicators to measure different aspects of urban health. A selection of these is presented in Table 6.

The sample indicators provided in this chapter vary in their format and presentation. Some are rather vague (such as those found in Table 4) and others are more specific (such as those found in Table 5). Others, such as those in Table 6, are quite explicit and include not only the name of the indicator and a description, but also an exact formula that can be used to perform any calculations required and the units to be used for its expression. Providing this level of detail enhances the internal reliability of a data set; having clear data definitions helps to ensure that the data are consistent across respondents. Such standardization is important if indicators are to be meaningful.

DATA AVAILABILITY

The absence of data can present a formidable challenge to evaluators – without data, change cannot be measured and comparisons cannot be made. Appropriate data may be unavailable for a variety of reasons; for example, comprehensive monitoring methods may not be feasible in some locations due to insufficient resources, and questionnaires may generate only limited responses. Also, data may

Table 6. WHO Healthy Cities project urban indicators (selected sample)

Indicator	Description	Calculation	Units
Public access to green spaces	This indicator shows the surface area of green spaces per inhabitant open to the public	$\frac{\text{Total number of m}^2\text{ of green spaces with public access}}{\text{Number of inhabitants}}$	m^2 per inhabitant
Derelict industrial sites	This indicator shows the percentage of derelict industrial sites compared to the total surface area of the city	$\frac{\text{Surface area of derelict industrial sites x 100}}{\text{Total surface area of the city}}$	Percentage
Pedestrian streets	This indicator shows the importance accorded to pedestrian streets	$\frac{\text{Total length of pedestrian streets}}{\text{Surface area of city}}$	km/km^2
Cycling in city	This indicator shows the importance accorded to bicycle paths	$\frac{\text{Total length of paths reserved for cyclists}}{\text{Surface area of city}}$	km/km^2
Public transport	This indicator shows the number of seats on public transport per 1000 inhabitants.	$\frac{\text{Average daily number of seats x 1000}}{\text{Total population}}$	Seats per 1000 people
Public transport network cover	This indicator shows the number of kilometres served by public transport compared to the total number of kilometres of streets in the city	$\frac{\text{Total number of kilometres served by public transport x 100}}{\text{Total number of kilometres of streets}}$	Percentage
Living space	This indicator shows the average number of rooms per inhabitant The rooms are counted if they have a distinct purpose or if they are > 4 m^2 , e.g. kitchen, dining room and bedrooms. Bathrooms, laundry rooms, hallways, etc. are not counted as rooms	$\frac{\text{Total number of rooms}}{\text{Number of inhabitants}}$	Number of rooms per inhabitant

Source: Webster & Price *(3)*.

be inadequate when scientific theories evolve; for example, it is widely accepted that a new development model is required to integrate environmental, health and economic sectors, and to incorporate new sets of values, perceptions and indicators. The data and corresponding organizational structure available today may not reflect these new ideas and values. Existing data, which reflect the ideas of the past 10–20 years, should be examined carefully to ensure that new data and structures are developed (when necessary) to keep pace with changing values and ideas.

Ideally, evaluators tailor data collection and analysis specifically to each evaluation. Data collection, however, can be very expensive, and environmental health service decision-makers commonly rely on data sets that have been collected for other purposes. For example, managers in a local district may use data sets that have been collected separately by individual towns or cities in the district. This is a strategy that should be used with caution because data may not be comparable from one place to another. Efforts to fully define the problems and uncertainties inherent in the data are particularly important when they are used for purposes other than those originally intended.

Another way to handle a lack of data is to generate information with models. Extrapolation models can be developed to extend empirical data, and to make predictions when no data are available. Using models adds uncertainty, but they are important tools for filling gaps in the available data.

When data are particularly difficult or expensive to collect, proxies or surrogates can be used. Proxies are essentially indicators of other indicators *(21)*. For example, traffic density or city petrol consumption could be used as proxies for air quality. Although characteristics of the air itself are not measured directly, a major cause of poor air quality (driving cars) is measured. Another example of a proxy indicator is monitoring cigarette sales to approximate tobacco smoke exposure.

Even when a large body of knowledge exists, data might not facilitate decision-making. Data may be overwhelming, too technical, contradictory, or presented in a format that does not allow the straightforward conclusions that decision-makers prefer. Collecting

additional data is sometimes the best course of action. Chapter 4 deals with the tools used to gather data and measure change.

RECOMMENDATIONS AND PRECAUTIONS

Indicators are developed to indicate; they are not exact measures of change. Evaluators must recognize that indicators are at least partly inaccurate. It is almost impossible to develop an indicator that has all of the desirable objectives mentioned in this chapter. Those who use and develop indicators should clearly identify the aspects of an indicator that are less accurate – that is, define uncertainty as clearly as possible. This will help prevent organizations or individuals from erroneously using indicators as exact measures.

Avoid heavy reliance on single figures to summarize complex situations. In the past, there has been a tendency to present the health status of a population by using mortality or life expectancy figures alone. Such rough indicators can mask important details. (For example, increasing the quality of life for elderly people in the years just before death is not reflected in life expectancy statistics.) Thus, it is recommended that a series of indicators be used to characterize the rich and complex concepts of sustainability and quality of life.

Similarly, avoid simple designations for programme success or programme failure. Such conclusions are unsatisfactory, because not enough detail is available to provide the feedback needed to make a decision or to implement and improve future services. More detail can be presented by developing accurate groups of indicators.

A team of involved parties should decide which indicators are to be used in a particular situation. Although involving interested and affected parties (stakeholders) in the selection of indicators may initially require more effort, the process is likely to be fairer because more points of view are considered. For example, a management team assisted by technical experts and citizens' representatives might agree on a core set of indicators for tracking air pollution in a local district. The process of agreement might be difficult because of conflicts of interest over many issues, such as the purpose of the indicators, the number of indicators to use, the best type to use, whether to

use existing information or to collect new data, and the cost of the indicators. Once a balance among the interests is sought and a general consensus about the indicators is reached, the management process should improve.

A multidisciplinary approach to choosing appropriate indicators is often necessary because the systems and elements to be measured are often highly complex. Epidemiologists, economists, statisticians and social scientists can be vital to the process of developing and interpreting indicators.

The primary purpose of developing and using indicators is to allow environmental health service managers to move towards overall sustainability in a healthy way. Complete data are never available and policy-makers often have to make decisions based on insufficient evidence. The absence of data, however, should never be used as an excuse for inaction.

Developing indicators to track service performance can lead to unintended results. For example, once indicators have been established, service managers and staff may be tempted to direct their efforts towards improving the outcomes for that particular indicator, rather than towards the overall improvement of service delivery or outcome.

The power of indicators is limited because they may be interpreted differently and, so, do not oblige managers and decision-makers to act.

Box 9 summarizes the key recommendations of this chapter.

Box 9. Key recommendations from Chapter 3

Assess the quality of data available; assess the need for more data for evaluation; and always state clearly the limitations of data used

State (explicitly) how to deal with uncertainties – despite the usefulness and necessity of models, estimates and projections in supplementing data

Consider using indicators in the evaluation process; be aware that their quality depends on a number of basic properties

Consider using different indicators to describe different phenomena at the same time because indicators indicate – they are not exact measures

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4

Instruments of Evaluation

Previous chapters describe evaluation as a process for comparing information about programmes, geographical areas, people and time, so that improvements in environmental health services can be implemented. Information is essential for measuring change, making comparisons and drawing conclusions, as part of evaluation activities. This chapter addresses several methods and tools for gathering data, translating it into useful information and drawing conclusions. Particular attention is paid to economic evaluation and qualitative evaluation tools.

MAKING COMPARISONS

The third major step in the evaluation plan (Fig. 4) is to conduct the evaluation. Three separate but interrelated activities are identified: choosing a methodology, assessing the situation and drawing conclusions. Underpinning these activities is the need to make comparisons. Commonly these comparisons are based on indicators (see Chapter 3), which provide standard measures upon which to make judgements, set goals and measure progress towards those goals. Three types of comparison have been introduced earlier (Fig. 2):

- the present situation is compared with the past situation;
- the present situation is compared with another similar situation; and

- the present situation is compared with a predetermined standard.

The first type of comparison, comparing the present situation with a situation(s) in the past, generally means that similar data points are collected and observed over a period of time. This strategy is essential for understanding changes over a period of time (trends). Trend analysis can involve both quantitative and qualitative data. Time-series analysis is used increasingly in such applications as measuring peaks and trends in pollutant levels, predicting health effects and exposures, and evaluating new monitoring equipment *(1)*. Trend analysis, however, is limited because data need to be collected consistently over a period of time and because situations need to be fairly similar for comparisons to be valid. These requirements are difficult to ensure over a span of time. For instance, monitoring techniques and equipment evolve with time and calibration of these devices can be difficult (see also Box 10).

The second type of comparison measures one situation and compares it with another situation. This practice is quite common: data from one area are compared with those from another area, or service agencies working towards the same goal are compared to each other (also known as benchmarking, see Box 11). An important obstacle to this

Box 10. Comparisons over long periods of time

Comparison is an essential component of any evaluation, but evaluators should exercise caution. In order to make meaningful judgements, it is important to look at the context of the situations being compared, to understand the degree of similarity or dissimilarity. In particular, changes with time may be difficult to compare because strategies for data collection evolve with time. When major evolutions occur, comparisons may be more difficult.

Restructuring the International Classification of Diseases (ICD) is an example of a major change that could invalidate a comparison over a span of time. The ICD is used by medical professionals on death certificates to classify a patient's primary cause of death. Periodically, the ICD is updated to reflect emerging medical knowledge. New categories are added, others are renumbered and still others are removed altogether.

When changes are made, previous records are not reviewed or recoded. The resulting incompatibilities prevent straightforward comparisons of death statistics over long periods of time. Although this example comes from the medical discipline, it serves to illustrate a problem that is also common in environmental health codes and statistics.

type of comparison is that specific circumstances can differ markedly from one geographical area to another (and over time), which potentially makes comparison less valid or fair. For example, it would probably be unwise to compare regional service activities directly with activities at the local level, because levels of financial resources, personnel and other factors would be too dissimilar.

The third type of comparison uses the data and information gathered and compares them with predetermined standards. For example, data are often compared with specific quality standards, such as those put forth by ISO, by engineering institutions in codes of practice and by legislation. Standards are often set as targets (or goals) for a policy when it is written. These might include, among others, political, social, economic and moral standards. When predetermined standards are used to evaluate policies, there is a risk of ignoring unexpected and unwanted effects of that policy. "Goal-free evaluation" *(3,4)* is proposed as an alternative strategy to circumvent such problems. The goal-free approach advocates comparing results with an expressed set of needs, as opposed to limiting the evaluation to examining the intended impacts.

Developing conclusions

The final activity in an evaluation is to interpret the results. Conclusions are often developed by answering the questions raised before and during an evaluation process. Evaluators should be particularly

Box 11. Benchmarking

Originally, benchmarking was an approach developed within large companies to improve business performance, but it can also be tailored to environmental health services. The approach is relatively simple.

To begin, a "benchmark performance" – a standard for certain aspects of service delivery (such as the maximum number of complaints received from the public per month) – is defined, based on existing performance. This benchmark can be derived from various sources, such as the local government, the community (the service clients) and a number of similar services.

Once a benchmark is set, other services try to implement the practices needed to achieve the benchmark, or go beyond it. The goal behind benchmarking is to improve service delivery, by learning from other experiences, and to build on knowledge already available.

Source: United Kingdom Department of Trade and Industry *(2)*.

careful when extrapolating or generalizing, and when thinking about causality. Because evaluations are designed uniquely for the purpose at hand, no single strategy for developing conclusions can be provided. The techniques that will be discussed involve different strategies for developing valid conclusions, and each has its own strengths and weaknesses.

EVALUATION METHODOLOGY

Once the type of comparison has been identified, the evaluation methodology can be selected. Four broad categories of methods are particularly important for evaluating environmental health services: environmental monitoring, health monitoring, economic evaluation and qualitative evaluation. In the past, these have often been classified either as quantitative or as qualitative (the former being associated with numerical or statistical analyses and deductive reasoning, and the latter being associated with narrative description and inductive reasoning). Such distinctions are simplistic and, generally, should be avoided. The terms qualitative and quantitative should not be seen as opposites, but should instead be seen as complementary approaches that rely on different kinds of information and reasoning techniques.

In the sections that follow, environmental monitoring, health monitoring, economic evaluation and qualitative evaluation are discussed. This volume places a major emphasis on economic and qualitative evaluation methods because the literature on the subject has not connected these topics to environmental health services evaluation. In contrast, much has been written on environmental monitoring *(5)* and health monitoring *(6,7)*, so these issues are covered only briefly in the sections that follow. All the methods discussed in this chapter have unique strengths and weaknesses. Thus, no single method alone is appropriate for evaluation. A combination of the methods presented here is recommended for robust evaluation of environmental health services.

Environmental monitoring

Environmental monitoring is the practice of measuring aspects of the physical environment on a regular basis (see also Chapter 3 for a

discussion of environmental indicators used in monitoring). Many environmental factors are not yet measurable in a reliable manner or at an affordable cost, so the number of environmental parameters, substances and compounds monitored (for example, sulfur dioxide in the air or nitrates in the water) is limited. Generally, monitoring is also limited to a specific area, for example, a community, a metropolitan area, a country or a region. Nevertheless, environmental monitoring can be used to measure several important aspects of the environment, such as those that follow.

- Change: Are environmental parameters changing with time?
- Progress: Is environmental quality improving?
- Impacts: What are the changes in environmental quality that result from policies or service activities?

For several reasons, environmental monitoring alone may be insufficient for evaluating complex environmental health services and actions. First, many evaluations are concerned with the process of service delivery, or the relevance of the service to the needs of the population – environmental monitoring is unlikely to contribute significantly to such analyses. Even when impact analysis is the subject of an evaluation, weak causal relationships between environmental parameters and health effects prevent the prediction of exact population outcomes based only on contaminant concentrations.

Second, consistency can be difficult to achieve because data from different organizations and countries (or even from different areas within the same country) can vary widely. A wide range of organizations, including local authorities, national agencies and international networks, monitor the environment (see also Fig. 10). Each of these groups is a potential source of environmental data. Among other factors, inconsistencies result from differences in the kind of data collected, the information systems used to store data, and the techniques used for data collection, measurement and analysis.

Third, the reliability of environmental monitoring data is also difficult to ensure. Data can be unreliable if standards for laboratory practices and data collection processes are not followed, and if equipment is old or poorly maintained.

These limitations can be overcome to a certain extent by:

- developing a minimum set of commonly used indicators;
- linking environmental and health monitoring data together (see, for example, Box 7, which discusses a model being used to link data about health and the environment);
- setting and meeting international standards (such as ISO standards); and
- developing close international and interorganizational cooperation and harmonization.

It is also recommended that during evaluations other tools and data be used simultaneously with environmental monitoring techniques.

Health monitoring

Health monitoring is the process by which different aspects of the health status of individuals (or a population) are measured on a regular basis. As the promotion of a healthy general population is the basic objective of virtually all environmental health services, in many cases it makes sense to use health monitoring as a tool for evaluating these services.

There are numerous ways to gain insight into health status (see also Chapter 3 for a discussion of health indicators used for monitoring). Traditionally, the field of epidemiology has been the source of data collected for such indicators as morbidity and mortality. Epidemiology has also been useful in identifying risk factors surrounding health problems. Various dimensions of health status, however, may not be measured directly through such techniques, because there is much more to health monitoring than epidemiology. Many other data sources can be used to study (changes in) health status; for instance, registers that store information about individual cases of a disease are often kept by local hospitals and health services. A number of examples of data-collection tools that monitor the health of individuals, groups or populations *(7)* are:

- registration records (of disease, death, hospitalization, birth)
- event (disease outbreak, accidents, sick leave) records
- medical and pharmaceutical consumption records
- environmental health service records

- notification registers
- questionnaires
- sentinel health event registers (see Box 12).

When health monitoring is of sufficient quality, it is particularly useful in assessing evaluation areas oriented towards service outputs, such as impact, efficiency, effectiveness, adequacy and sustainability. Combining health data with other types of information (such as demographics, costs, geographical distribution and social factors) can enhance the usefulness of health data in assessing more complicated subjects, such as equity and effectiveness.

The use of health data for the evaluation of environmental health services is, however, limited. Health monitoring data are less useful, for example, when the subject of an evaluation is process, relevance or equity, because the population outcome is not the main concern. In addition, health monitoring data can sometimes be of poor quality, just as environmental data can be of poor quality. Health data may be biased (for example, by social or economic differences), or they may simply be insufficient (for example, collected over periods too short to observe change).

Furthermore, health status may not always reflect specifically and reliably the performance of services. Many causes and effects precede changes in health status, both for individuals and the general

Box 12. Occupational sentinel health events

An occupational sentinel health event can be defined as a disease, disability or untimely death that is occupationally related and whose occurrence may:

- provide a stimulus for epidemiological or industrial hygiene studies; and
- serve as a warning signal that material substitution, engineering control or medical care may be required.

When such events are registered in centralized locations, large amounts of information on possible occupation-related diseases and other health effects can be gathered and stored. The resulting lists of relevant occupational sentinel health events (registers) are extremely helpful in monitoring occupational health and identifying priorities or problem areas.

Source: Mullan & Murthy *(8)*.

population. Since the relationship between environment and health is complex, it is difficult to model and predict. Adding the actions of a service to the equation further complicates the relationships. For instance, many environmental health services try to prevent negative health outcomes or, in other words, to produce a non-event (see also Chapter 2). An example of this is the prevention of food poisoning, where the absence of food poisoning cases is considered a success. How are evaluators to know whether a low number of food poisoning incidents results from protective environmental health services or from other conditions over which the service managers have no control (such as unseasonably low temperatures that prevent microbial growth)?

Economic evaluation

Economic evaluation can be defined as the comparative analysis of alternative courses of action in terms of both their costs and consequences. The aim of an economic evaluation is to provide stakeholders (such as policy-makers, service staff, affiliated organizations and the community as a whole) with information about the issues of efficiency and effectiveness of a service. Economic evaluations are typically categorized as either partial or full economic evaluations (see also Table 7).

Partial evaluations look only at either inputs or outputs.

- ***Inputs***. Some analyses may simply include the inputs of a service, such as the funding. This is called cost analysis (when using quantitative data) or cost description (when using more qualitative data). Strictly speaking, this is not a type of economic evaluation, but is instead a financial analysis. Different input alternatives, however, are compared to each other, and an evaluation component is introduced. The aim is then to pick the alternative with the most appropriate cost.

- ***Outputs***. Benefit analysis (or description) is an account of the effects of a service, and is thus only a partial economic evaluation for comparing different outputs.

Analysing only inputs or outputs does not tell whether services are efficient or effective, but partial evaluations are still often useful to decision-makers.

Table 7. Forms of economic evaluation

	Evaluation of:		
	costs *or* benefits		costs *and* benefits
	Costs	**Benefits**	
One alternative	*Partial evaluation*		*Partial evaluation*
	Cost analysis or description	Benefit analysis or description	Cost–benefit description
More alternatives	*Partial evaluation*		*Full evaluation*
	Cost evaluation	Benefit evaluation	Cost–effectiveness analysis Cost–benefit analysis Cost–minimization analysis Cost–utility analysis

Source: Drummond et al. *(9)*.

Full economic analyses focus on inputs compared to outputs (or outcomes). They result in a conclusion about the efficiency of a service – that is, whether the outputs are reached at a reasonable expense. Complete evaluations can be used to assess a single type of input and output, or they can be used to assess several alternative courses of action.

Three key aspects are important in evaluating costs and benefits *(9)*.

1. ***Time***. An economic evaluation can be performed before a project or plan is completed; this often assists decision-makers in picking the most efficient alternative course of action. An economic evaluation is also used after a project or activity so decision-makers can decide whether the activity is worth continuing, or where adjustments should be made. Moreover, an economic evaluation is often conducted during an activity, when its goal may be to further improve the activity or reallocate resources.

2. ***Information included in the analysis***. As described earlier, different information can be brought into the analysis to reach a

conclusion. More specifically, it is necessary to identify which inputs and outputs are taken into account. The sections that follow focus on the evaluation tools that simultaneously take inputs and outputs into account.

3. ***Type of comparison***. Economic evaluation can compare several alternative courses of action as well as compare a case in the present with one in the past. Sometimes a predetermined standard can be used to assess whether a service is working efficiently.

General limitations to economic analysis

Economic analyses are often used to evaluate services because a common, comparable and easily understood metric (money) is used as the basis for comparison. The use of economic evaluation tools, however, is limited by several factors.

First, health as such has no monetary value (or price). Some aspects of life can be given a monetary value – including a person's projected earnings through labour, the cost of treatment, the cost of personal suffering, and the cost of suffering to family or friends – but even so, individual preferences for certain aspects of health may vary widely. Second, people may value money differently, depending on their individual circumstances (for example, the value of a dollar saved may not be the same as that of a dollar spent). Third, natural resources (clean air, soil and water) are distinct from many other economic goods. Not only are they often limited and irreplaceable, but they are also without a market that treats them like a commodity. Therefore, they are particularly hard to value in monetary terms.

Furthermore, promoting environmental health implies that health promotion activities and environmental protection activities be put in place at the same time. These activities may not be compatible. For example, insecticides may be sprayed on marshlands to keep mosquitos from breeding and transmitting malaria. This practice is clearly advantageous from a public health perspective, but it may also produce a negative impact on the environment. Careful attention is needed to trade-offs among environmental and health-related costs and benefits.

Steps in the economic evaluation process

Five important steps in an economic evaluation can be distinguished *(9)*:

1. identification of alternatives
2. identification and measurement of inputs
3. identification and measurement of outputs
4. dealing with uncertainty and time preference
5. reaching a conclusion.

1. Identification of alternatives

Ideally, an economic evaluation starts with identifying the possible alternatives, such as programmes, interventions or other activities. Developing a clear idea of which parts of a project are to be evaluated is critical. This step addresses the question: What should be evaluated? Problems may occur at this stage, as it is not always obvious what alternatives are available or what (expected) costs and benefits are associated with each alternative. Sometimes one course of action is compared to taking no action at all, in order to show how an activity may impact the current situation and whether it is worth while starting or continuing that activity.

2. Identification and measurement of inputs

The next step in the process is to identify and measure inputs, very often costs. Costs involve a wide range of possibilities, including:

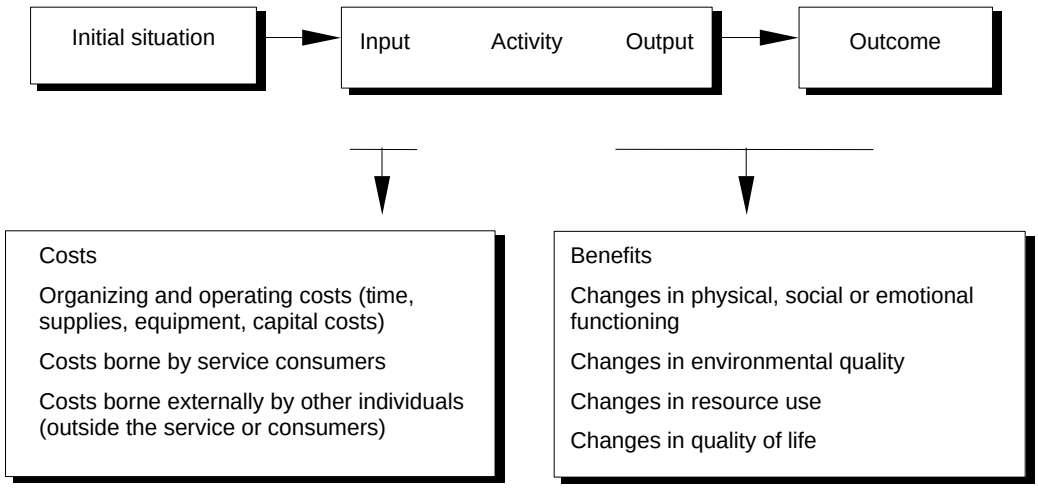
- direct costs, such as costs for the service in question;
- indirect costs, such as the costs to patients, their families, employees, tax payers or the community as a whole; and
- opportunity costs, resulting from not investing money in other activities.

Costs should not simply be limited to direct costs in monetary terms. Some service inputs, such as the use of volunteer staff, may be hard to estimate but are highly valuable.

3. Identification and measurement of outputs

The next (and probably most complicated) step is identifying and measuring benefits or outputs. Fig. 14 gives some examples of the inputs and outputs relevant to environmental health services.

Fig. 14. Costs and benefits of an environmental health service



Source: Drummond et al. *(9)*.

Methods for identifying and measuring benefits are discussed further below in the sections on cost–effectiveness analysis and cost–benefit analysis.

4. Dealing with uncertainty and time preference

Whatever the method of evaluation used to economically appraise an environmental health service, the results still depend on various estimates. This is especially true when an economic evaluation is performed prior to conducting programme activities – for example when comparing the costs or economic effects of alternatives. In such cases, when data may not be available, gaps in knowledge need to be filled with default assumptions or through the use of models.

Extensive reliance on default assumptions may prompt a sensitivity analysis, which determines the extent to which assumptions have influenced the results of the analysis. Sensitivity analyses also help in assessing which elements of an intervention (or a project) are most important to the final result. For example, a health service may display some astounding results, but these may be caused by factors not included in their tasks. Then, a sensitivity analysis can help uncover the actual links between inputs and outputs. It may indicate which variables in an analysis are most important, and which estimations affect the final results the most.

Another way to address the uncertainties involved in an economic evaluation is to organize meetings with key stakeholders (including experts and representatives of the public) to agree on the estimates and assumptions to be used in the evaluation process. When changes are recommended, the economic models must subsequently be altered to reflect the new estimates.

Use of the discounting ratio is common in economic calculations. Where costs and benefits are an issue, society generally prefers the present over the future. Benefits are desired in the present, while it is desirable that costs be postponed for the future. Thus, in long-term, large-scale programmes, especially, future costs and benefits are discounted (given less weight) to account for the time preference. The discounting procedure itself is relatively simple (see Box 13). Choosing the discounting ratio, however, is an important decision that affects the outcome of the calculations. Choosing the ratio often requires a good deal of discussion, because preferences may differ widely across groups. For example, a funding organization and the individuals who are affected by the interventions may prefer a different ratio. When disputes occur, a sensitivity analysis can help determine whether (and to what extent) the ratio affects the outcome of the evaluation. Whatever ratio is chosen, evaluators should be prepared to defend their choice (for example, it was based on a national standard, stakeholder consensus or historical precedent).

5. Reaching a conclusion

The final step is to apply a decision rule to reach a conclusion, by asking: Does (or will) the service work efficiently? There are various decision rules for each of the economic evaluation tools. For example, the benefit-to-cost ratio can be calculated by dividing the value of the benefits by the value of the costs. If the result is greater than 1, the investment is (economically) worthwhile. But this is just one example; in the discussion of four economic evaluation tools that follows, more attention is given to other decision rules.

Four economic evaluation tools

Table 7 identifies four economic evaluation tools: cost–effectiveness analysis, cost–benefit analysis, cost–minimization analysis and cost–utility analysis. All four will be discussed in further detail. Particular

Box 13. Discounting procedure

The discounting procedure tries to identify the present value (*PV*) of costs or benefits. This is done by using the following formula:

$$PV = \frac{C}{(1 + i)^n}$$

where *C* is the amount of money to be spent or gained in the future, *i* is the discount rate, and *n* is the number of years before the money is spent or the economic benefit realized.

For example, an investment in a small environmental health service is expected to have a benefit of US $100 000 over 30 years, and a cost of US $20 000 in 10 years. If the discount rate is assumed to be 5%, the present value (costs) is US $12 278 and the present value (benefit) is US $23 138.

PV_{cost} = US $20 000 / $(1 + 0.05)^{10}$ = US $12 278
$PV_{benefit}$ = US $100 000 / $(1 + 0.05)^{30}$ = US $23 138

A benefit-to-cost ratio can be calculated by dividing the present value of costs into the present value of benefits.

$PV_{benefit} / PV_{cost}$ = (US $23 138) / (US $12 278) = 1.88

If we choose to use the decision rule of recommending investments with benefit-to-cost ratios greater than 1, this investment would be recommended for approval because the benefit-to-cost ratio is 1.88.

We can perform a sensitivity analysis by changing the discount rate and viewing the results. For example, we make calculations that use discount rates of 8% and 3%.

8% discount rate:
PV_{cost} = US $20 000 / $(1+ 0.08)^{10}$ = US $9264
$PV_{benefit}$ = US $100 000 / $(1 + 0.08)^{30}$ = US $9338
$PV_{benefit} / PV_{cost}$ = (US $9338) / (US $9264) = 1.07

3% discount rate:
PV_{cost} = US $20 000 / $(1+ 0.03)^{10}$ = US $14 882
$PV_{benefit}$ = US $100 000 / $(1 + 0.03)^{30}$ = US $41 199
$PV_{benefit} / PV_{cost}$ = (US $41 199) / (US $14 882) = 2.77

Notice how the use of a discount rate of 8% reduces the benefit-to-cost ratio to just above 1, while the use of a 3% discount rate pushes the ratio to nearly 3. These calculations are very sensitive to the discount rate chosen, and it should, therefore, be selected carefully.

emphasis is placed on cost–effectiveness analysis and cost–benefit analysis, as these are the tools used most often in (environmental) health service evaluation. Both tools compare inputs to outputs, but there are some clear differences between them.

Cost–effectiveness analysis

Cost–effectiveness analysis tries to identify the intervention that minimizes the inputs or costs, given a specific objective. Inputs or costs (on one side) are compared to outputs or health effects (on the other side). When using such an analysis, aspects that may be of interest to the evaluator may be difficult to measure or simply unavailable. In such cases, effects are often expressed as intermediate outputs. For example, instead of measuring the exact change in health status that results from air pollution control, which is very hard to quantify, it might be easier to measure changes in environmental parameters (for example, the concentration of sulfur dioxide) as an intermediate effect.

When identifying costs and effects of environmental health services, an evaluator is faced with a number of difficult questions that should be taken into account during and after the evaluation.

- Are there any other factors besides the environmental health service that affect the health, wellbeing, or productivity of people or groups?
- Are there any negative costs, such as health expenditures saved because of a specific intervention, that can be considered as benefits of the service?
- Are there additional costs and benefits generated by extended life (measured in life-years) that should be taken into account?

Cost–effectiveness analysis is especially useful in comparing different courses of action within one project. Because benefits are defined through an objective (such as life-years saved), alternative courses of action must aim at the same objective. For example, an alternative that strives to maximize the number of life-years saved should not be compared to an alternative that prevents occupational hazards. An important assumption made in cost–effectiveness analysis is that the objective (change in health status or in environmental parameters) is worth achieving.

In general, we can distinguish two ways in which cost–effectiveness can be used.

1. Select an alternative course of action, given a specific objective. This strategy is also called cost–minimization, and is discussed further.

2. Maximize a particular objective, given a specific budget. For example, cost–effectiveness analysis could help answer the question: Which of the following activities will result in the highest reduction in cases of food poisoning for, say, an amount of US $200 000?

Furthermore, cost–effectiveness analysis is especially useful in cases where:

- different alternatives are aimed at one objective;
- the objective is defined clearly and given from the outset of the evaluation; and
- reaching the objective defined has little effect other than direct effects on the individual or the environment, such as on specific socioeconomic developments or activities by other organizations.

Cost–effectiveness analysis is limited for several reasons. First, the objective chosen should be reliable and valid (see the section on objectives for indicators (page 55) for definitions of these terms) and should allow for a fair comparison between alternatives. Second, benefits tend to be defined narrowly, as health effects or intermediate outputs, which means that wider effects of the environmental health service may not be taken into account. This may include such issues as the effects on productivity of individuals or the equitable distribution of benefits across the population. Finally, cost–effectiveness analysis does not allow a comparison between different objectives. Thus, it cannot be used to decide which objectives are worth achieving.

The most important and difficult step in performing a cost–effectiveness analysis is not so much the identification of alternatives or the measurement of costs, but the measurement or estimation of effects or benefits. How, for example, do we measure improved quality of life, changes in health status, or changes in environmental conditions? This is an important question and answering

it forms the key to a sound economic evaluation. The indicators discussed in Chapter 3 are the instruments used to determine changes in health status and environmental conditions. In general, health status indicators (see also Box 14) are most useful in cost–effectiveness analysis because the primary objective of many environmental health services is usually to promote or prevent an effect in humans. In many cases, however, environmental, process, socioeconomic and urban indicators are also used.

Cost–effectiveness analysis generally relies on a single decision rule: costs divided by effects. The result is expressed as the cost in monetary units per effect unit. Examples of cost–effectiveness analyses are presented in Boxes 15 and 16.

It is one thing to measure health or environmental changes, but it is something else to value and appraise them in monetary terms. Cost–effectiveness analysis does not assign monetary values to the

Box 14. Measuring health status

In evaluating cost–effectiveness a number of tools can be used to quantify changes in health status.

Health indices
Health indices are derived from validating and ranking (for example, between 0 and 100) health statuses. Thus, various health statuses are given different values, which can be used in cost–effectiveness analysis. The indices may involve different dimensions of health. (See, for example, Kind et al. *(10)*.)

Health profiles
These profiles take into account the multidimensional nature of health and, thus, provide a comprehensive picture of health status. This is done by using questionnaires on a number of topics, such as mobility, emotional reaction and pain. The use of this type of instrument is sometimes limited in cost–effectiveness analysis. (See, for example, McEwan *(11)*.)

Disability scales
These scales are used to assess the extent to which individuals are able to perform basic daily activities. They usually reflect only one dimension of health. Most of these scales are not directly applicable to environmental health services, but there are some scales that focus on psychological aspects of health and wellbeing. These might be useful. (See, for example, World Health Organization *(12)*.)

Information on health status is also available through the sources mentioned in the section on health indicators (page 69).

Box 15. Cost–effectiveness of noise complaint handling

Three different scenarios that use cost–effectiveness analysis are presented, based on a hypothetical programme (A) that handles noise complaints on a yearly basis. This programme costs US $30 000 and the final result is an annual number of 4900 complaints handled.

1. Cost–effectiveness of programme A can be calculated as:

   costs / total number of complaints = cost per complaint handled; or

   US $30 000 / 4900 = US $6.12 per complaint handled

2. Sometimes a variation of this calculation, the excess cost per complaint, is useful. Excess costs are calculated by subtracting any known monetary benefits from the costs, thus giving a more complete picture of the situation. For example, suppose that 290 of the 4900 complaints are considered justified by programme A's service managers. Furthermore, assume that each of these justified complaints is valued (before carrying out the evaluation) at about US $100 each. The excess cost can be calculated as follows:

   US $30 000 – (290 × 100) = US $1000 excess cost

   Using the excess cost as the numerator in the first equation yields the excess cost per complaint:

   US $1000 / 4900 = US $0.20 excess cost per complaint

3. It is also possible to compare programme A to other programmes. Take, for example, programme B, which operated a few years ago on a smaller scale. Programme B handled 500 complaints during the year it operated at a cost of US $2500. Fifty complaints were considered justified, and the value of the justified complaints is the same as for programme A. This means that the excess cost was:

   US $2500 – (US $50 × 100) = – US $2500

   In other words, when only the excess costs are considered, programme B was more cost-effective than programme A. The reason for this can, in part, be found in the "hit ratio" of each programme. Of all the complaints handled by programme A, only 6% (290 of 4900) are justified, whereas in programme B, 10% (50 of 500) are justified.

This example shows that evaluators should carefully consider the values used as inputs in cost–effectiveness equations, even though the calculations themselves may be fairly simple.

effects, but instead incorporates the effect itself in the equation (that is, cost per complaint, as in Box 15, or cost per life-year saved, as in Box 16). Cost–utility analysis (discussed below in further detail) deals with the issues of appraisal.

Box 16. Cost–effectiveness of life-saving interventions

In 1995, a team of seven American researchers published the results of a comprehensive study on the cost–effectiveness of life-saving interventions. These interventions included behavioural and technological changes that reduced the risk of premature death. Cost–effectiveness was defined as the net resource cost of an intervention per year of life saved. In total, 587 interventions were studied. Some examples of the results are:

Life-saving intervention	Cost per life-year saved
Mandatory seat belt use law	US $69
Airbags in cars	US $120 000
Arsenic emission standard at copper smelters	US $36 000
Arsenic emission control at glass manufacturing plants	US $51 000 000
Chlorination of drinking-water	US $3100
Ban on amitraz pesticide on pears	US $350 000

Source: Tengs et al. *(13)*.

Cost–benefit analysis

While cost–effectiveness analysis presents effects in terms of objectives, cost–benefit analysis focuses strictly on both costs and benefits in monetary terms. Cost–benefit analysis aims at developing measures that assist in decision-making, in order to make choices among different intervention alternatives. A crucial distinction between cost–benefit analysis and cost–effectiveness analysis is that the alternatives evaluated in a cost–benefit analysis need not be from the same project or objective, because the method translates all costs and benefits into simple monetary terms.

Cost–benefit analysis is, therefore, especially useful in comparing different actions, which may have differing and multiple outputs (or outcomes). Furthermore, it is an important tool for assessing whether the objectives chosen are worth achieving from a financial point of view (which is not possible directly using cost–effectiveness analysis). Finally, cost–benefit analysis can be useful when the evaluation needs to account for widespread effects of environmental health service activity. These widespread effects (such as those on productivity) are especially relevant in large-scale, long-term interventions, such as securing safe and sufficient water supplies or industrial pollution-control measures.

Although cost–benefit analysis may seem to offer solutions to many problems, it is far from a perfect tool. The main problem is the valuation of benefits in monetary terms. This is not always possible, and it relies on a number of assumptions. More attention to the issue of measuring benefits is given later. There is also a debate on whether benefits should always be translated into monetary terms. Numerous situations exist where monetary valuation seems inappropriate – or highly impractical. How do we, for example, appraise in dollars the value of noise complaints, or the ability of a child to live without suffering the effects of asthma?

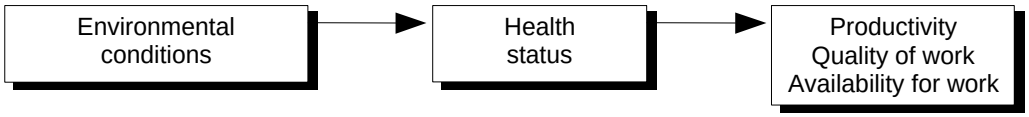
Cost–benefit analysis is based on estimating the net economic flux (change). This quantity is the difference between economic benefits and costs generated by a service. While measurement of costs is generally easy, measurement of benefits can be difficult. Over the years many approaches have been developed to make it possible to put monetary values on such entities as environment and health. We will discuss two of them: the human–capital approach and the contingent valuation methods.

Human–capital approach. The human–capital approach puts a value on the benefits of a particular service by estimating the additional productivity of the people (during their productive years) affected by the service. It requires a knowledge of the effects of environmental diseases on absenteeism (lost work days) and on the quality of work, and assumes that environmental conditions affect health status. Health status subsequently determines the quality of work performed, the productivity of labour and the availability of labour for work (Fig. 15). Improvements in health status can thus be appraised in terms of increased and improved production and then translated into monetary values *(14)*.

To evaluate the effects of productivity loss in physical terms, evaluators must start with the existing labour market and calculate employees' productivity over the duration of their careers. Producing outcomes based only on productivity have a limited scope because certain groups (such as the long-term unemployed, the elderly and volunteers) may be systematically overlooked.

Contingent valuation methods. Contingent valuation simulates a market price for goods that are not traded on the open market. Surveys

Fig. 15. Human-capital approach



Source: Johannesson *(14)*.

and interviews are generally used to estimate "willingness to pay," a measure of how much consumers are willing to pay to profit from an environmental health service. Contingent valuation can also be used to determine "willingness to accept", the financial compensation customers require to accept negative consequences. (Survey and interview techniques are discussed in greater detail on page 110).

Contingent valuation methods have been used for both health economics and environmental economics. Methods to assess willingness to pay or willingness to accept are considered especially useful in the following applications:

- environmental noise and stench
- visibility benefits
- recreation
- physical planning
- water quality
- health benefits.

Studies using contingent valuation methods are generally applied to small populations and are mostly related to local or regional environmental problems. An example of willingness to pay for safe food is presented in Box 17.

Contingent valuation has problems that limit its usefulness. Techniques used to gather data on individual preferences are sometimes subject to several forms of bias: responses may be influenced by the wording of the questions, scenarios may be interpreted differently and respondents may be intentionally dishonest. The information supplied to individuals is never perfect, which further complicates estimates of willingness to pay. Also, respondents generally do not have experience in valuing the items of interest, and they may provide implausible answers (for example, willingness to pay thousands

Box 17. Willingness to pay for safe food

In Scotland, infected poultry accounts for about 42% of all recorded outbreaks of foodborne illness. One measure to secure safe poultry is to expose it to doses of ionizing radiation, a process called irradiation. Though the process is considered safe by WHO and the United Kingdom Government's Food Advisory Committee, both consumers and food retailers are not convinced of its safety. To measure the actual benefits of preventing poultry-borne risks, researchers at Aberdeen University completed a feasibility study to estimate the willingness to pay for such benefits. This was done by asking a small group of people how much (as a percentage of the amount already spent for poultry and meat on a weekly basis) extra they would be willing to pay for:

1. poultry meat treated by irradiation
2. poultry meat treated by a hypothetical preventive measure
3. poultry meat not treated by irradiation.

Individuals were provided with a questionnaire, including such questions as:

What is the maximum additional amount you would be willing to pay, as a percentage of the amount you already spend each week, for poultry meat that had been irradiated and carried no risk of illness?

The results, based on the questionnaire, were as follows.

Mean willingness to pay for:

irradiated meat	10.8% more
meat treated by a hypothetical preventive measure	9.1% more
meat not irradiated	3.6% more

An aggregate (total) measure of the willingness to pay to avoid pain and suffering associated with poultry-borne illnesses was estimated to be £6.5 million (based on the results of the study and such figures as the total United Kingdom spending on poultry meat). This figure far exceeds the total cost of irradiation, estimated at £2.5 million.

Though this was a feasibility study carried out with a small population, it shows the possibilities of willingness to pay as an approach to estimate the individual benefits of preventive food safety measures.

Source: Donaldson et al. *(15)*.

of dollars even when they are not likely to be able to afford such a sum). Another difficulty is that results may be highly specific to individuals, preventing generalization of results to wider audiences. In addition, because scenarios are hypothetical (no real money changes hands), there may be wide discrepancies between what respondents say they would do, and what they would actually do in a real life situation. Finally, the approach tends to favour the preferences of individuals or groups that have more monetary power, raising issues of equity for other segments of the population.

Box 18. Example of cost–benefit comparison

The Ministry of Health demands an evaluation of the costs and benefits of health service activities. An external evaluation office focuses on environmental health promotion and estimates the costs and benefits of that element in three different local services. The costs and benefits of three service elements are compared, and both the ratios and differences calculated in arbitrary monetary units.

Service	*Costs*	*Benefits*	*Benefit-to-cost ratio*	*Difference (net present value)*
	C	B	B / C	B – C
I	10 000	45 000	4.5	35 000
II	40 000	120 000	3.0	80 000
III	5 000	30 000	6.0	25 000

Based on the benefit-to-cost ratio, one might conclude that service III is the most efficient (the value 6.0 is higher than 3.0 or 4.5). The ratio, however, does not indicate the size of the programme; therefore, the cost–benefit difference, or net present value, is often chosen as the decision rule. In this case, service II would most likely be labelled as most efficient. Since these calculations explore different aspects of service costs and benefits, it is recommended that they be used together to assess services.

Two decision rules are available for comparing alternatives using cost–benefit analysis. The first is to calculate the benefit-to-cost ratio, where benefits are divided by costs. If the result is more than one, the activity is (potentially) determined to be worth while. A second option is to calculate the net present value by subtracting the costs from the benefits. This is often the preferred rule. If the result is larger than zero, the action is judged to be worth considering. Box 18 illustrates a cost–benefit comparison using both these rules.

Cost–utility analysis

Cost–utility analysis is similar to cost–effectiveness analysis in that both methods calculate the costs involved in implementing different alternatives. Cost–utility analysis, however, allows individuals to place a specific monetary value on the benefits (that is, changes in health status or environmental conditions measured), whereas cost–effectiveness analysis does not. Cost–utility analysis also allows the evaluator to take quality of life into account, while cost–effectiveness analysis does not.

Utility refers to the relative usefulness that an individual assigns to a specific health status or environmental condition. The utility

value is gathered by using questionnaires and survey techniques and, ultimately, results in an adjusted unit of benefit. For example, the number of life-years saved can be valued and adjusted for the quality of those years, resulting in quality-adjusted life-years (QALYs) *(16)*. QALYs thus combine quality of life information with mortality data to measure treatment or policy outcomes. The number of life-years saved can also be adjusted for disability, resulting in disability-adjusted life-years (DALYs) *(17)*. DALYs measure the burden of disease, reflecting the total level of healthy life lost to all causes, including premature mortality and physical or mental disability. Though this form of economic evaluation has some limitations (such as forms of bias in gathering data on utility), it is a common approach used in health economics.

Cost–minimization analysis

This simple tool aims to minimize the costs of a given course of action, under the assumption that the final output is the same in every alternative. This assumption should not be made without sufficient evidence that the alternative courses of action have similar outcomes. Cost–minimization analysis is often combined with studies that analyse programme outputs (or effects). The decision rule for cost–minimization analysis is relatively straightforward: pick the least expensive alternative. Cost–minimization analysis is a technique for saving money, but it is less relevant than the others for evaluating environmental health services and is, therefore, not discussed further here.

Table 8 summarizes the four economic evaluation tools.

Precautions for use of economic evaluation tools

Several final points of advice and precaution are warranted on the subject of economic evaluation tools.

Intersectoral evaluations. Environmental health is a multisectoral endeavour. Environmental quality is not influenced by environmental policy alone. Similarly, health is not affected by environmental quality alone. This calls for an approach to economic evaluation that makes optimal use of the methods described. It is highly recommended that evaluators combine different tools.

Table 8. Summary of economic evaluation tools

Tool	Measure of costs	Measure of consequences	Activities tool considered most useful for:	References
Cost–effectiveness analysis	Costs expressed in monetary units	Outputs measured in a single, common effect Outputs expressed as physical units, e.g. life years saved and cases prevented	• comparing different courses of action to reach a single objective • maximizing an objective, given a specific budget • cases where the objective has little effect outside the direct effect on the individual or the environment	Drummond et al. *(9)* Tengs et al. *(13)* Graham & Vaupel *(18)*
Cost–benefit analysis	Costs expressed in monetary units	Outputs measured by different effects (single or multiple) that may differ from one alternative to another Outputs expressed in monetary units	• comparing different actions, with differing and multiple outputs or outcomes • assessing whether objectives chosen are worth achieving • accounting for more widespread effects of environmental health service activity	Drummond et al. *(9)* Thompson *(19)* Donaldson *(20)*
Cost–utility analysis	Costs expressed in monetary units	Outputs measured by different effects (single or multiple) that may differ from one alternative to another Outputs expressed as healthy days, QALYs or DALYs	• comparing effects of a different nature • accounting for issues of quality	Drummond et al. *(9)* Richardson *(21)*
Cost–minimization analysis	Costs expressed in monetary units	Outputs assumed to be similar No outputs valued	• selecting an alternative course of action, given a specific objective	Drummond et al. *(9)*

For whom? An economic evaluation, like any other, is done for a specific audience with specific goals in mind. This affects both the evaluation design and the data needs.

Economic evaluation is not perfect. Economic evaluation tools have several limitations. Evaluators are faced with a number of uncertainties and, therefore, rely on a number of assumptions. Furthermore, costs and benefits are not the only factors of importance in evaluation and decision-making. Finally, economic criteria are, generally, not the only factors in the decision-making process; they must be balanced with many additional considerations, such as equity and risk.

Equity issues. When dealing with the costs and benefits of a specific activity, evaluators should not neglect the issue of equity. Economic evaluation neither always indicates who benefits from an alternative action nor accounts for the distribution of benefits across the community. For example, a water treatment programme at the local level may be very cost-effective: at a low cost, a large population has access to supplies of safe drinking-water. But it may mean that at the regional level many other individuals lack this opportunity. In such a case, fairness may prevail over strictly economic considerations.

Other economic instruments

This section has primarily focused on economic analysis techniques such as cost–benefit analysis and cost–effectiveness analysis. Other economic instruments, such as tax incentives and pollution permits, have been used in the European Region and elsewhere for setting priorities and for fiscal reforms. Additional information on economic instruments can be found in a recent background paper *(22)*, but it is not discussed in this book.

Qualitative evaluation

Qualitative research and evaluation methods allow evaluators to study a small number of specific issues in great depth and detail. They do not seek answers to such questions as: “How much is X?”, as in quantitative research – but rather “What is X?” and “Why does X occur?” Often qualitative and quantitative approaches are defined as opposites, but they should be seen as complementary rather than

conflicting approaches. Each has its own strengths and limitations, as expressed by Patton *(4)*:

> The advantage of a quantitative approach is that it's possible to measure the reactions of a great many people to a limited set of questions, thus facilitating comparison and statistical aggregation of the data. This gives a broad, generalizable set of findings presented succinctly and parsimoniously. By contrast, qualitative methods typically produce a wealth of detailed information about a much smaller number of people and cases. This increases understanding of the cases and situations studied, but reduces generalizability.

Quantitative research generally involves stating a hypothesis (usually derived or deduced from an existing set of hypotheses or theories), testing it (sometimes using experiments), and using deductive reasoning to come to a conclusion. Qualitative research by its very nature is different: it is more open and uses inductive reasoning to work from hypotheses to develop a set of assumptions and, ultimately, a theory. It is less limited in its initial phases than the preconceived and more regimented approach of experimental inquiry. Qualitative evaluation can tap into areas that quantitative methods cannot reach *(23,24)*.

In the sections that follow, the terms qualitative and quantitative are used as polar opposites, but the distinction between them is not so clear. Often the methods are used together to complement one another. An example of this can be seen in the economic evaluation techniques discussed earlier. Environmental economics is typically thought of as a quantitative enterprise: first, monetary values are placed on goods that are not traded on an open market and, then, mathematical equations are used to compare alternatives. Qualitative methods, however, are commonly used in such techniques as contingent valuation to assign monetary values to inputs and outputs. Again, because they complement each other, qualitative and quantitative approaches are quite often used together.

Overall strengths and weaknesses of qualitative evaluation

The primary strength of qualitative evaluation is that substantial detail (usually written) about a given subject allows a user to make personal judgements about the subject. Validity and realism are strong features of the qualitative approach, because the objective is to assess specific circumstances rather than to make general statements about a broad situation. Another strong feature is that qualitative

evaluation methods allow flexibility, insight and the ability both to build on tacit knowledge (what is known but not stated) and to generate facts that are not directly available through quantitative inquiry. Because qualitative analyses are based on real situations, they can increase the credibility and understanding of a particular perspective. The open-ended nature of questions and inquiries allows an unbounded and, therefore, potentially innovative range of possibilities. Qualitative evaluation, therefore, may foster a dynamic exchange between the data collected and the resulting conclusions (processes that involve two distinct and sequential stages in quantitative inquiry).

The extent to which qualitative evaluations can be used is limited by the degree to which data collected can be generalized to a large population, because these data are dependent on the context in which they are collected. Internal and external reliability are also compromised to a certain degree – that is, conclusions are not necessarily applicable in other circumstances. In addition, because qualitative analyses can vary with the particular individuals who collect, analyse and present the data, they are limited by the skills and abilities of those individuals. For example, observations will vary among data collectors, in either participatory or interview settings. Unintentional biases can be introduced by personal situations (such as fatigue), evolution of the evaluator's knowledge about the situation, and differences in training, skills and experiences. Also, because qualitative methods are more labour intensive, they may sometimes be a more expensive methodology.

Qualitative evaluation tools

Five basic types of qualitative tool are discussed in some detail in the sections that follow: surveys and interviews, focus groups, direct observation, review of written documents, and case studies. Consensus methods, such as the Delphi method and expert panels, are sometimes used in health service research *(25)* to facilitate agreement within a group on a particular topic. Since consensus methods are less likely to be useful in an environmental health service evaluation, they will not be discussed further.

Surveys and interviews

Surveys and interviews are popular techniques used to elicit information directly from people (in their own words) about perceptions,

experiences, opinions, feelings and knowledge of a specific situation. Surveys and interviews are among the most basic forms of qualitative data collection. Two types of question can be asked in either an interview or survey format: open-ended questions and closed questions. Closed questions have a defined set of potential responses, while open-ended questions have no pre-established format (or boundary) on responses. For example, any question that leads to a "yes" or a "no" answer is a closed question.

Example
Have you ever lodged a complaint with your local environmental health service?

Another type of closed question asks respondents to choose from several alternative predefined options. Such answers allow responses to be analysed statistically, but are limited by the preconceived notions of the surveyor or interviewer.

Example
How satisfied are you with the training you have received for this position?

___ Not at all satisfied
___ Somewhat satisfied
___ Satisfied
___ Very satisfied

Another possibility is to allow respondents to choose between answering a question with a predetermined response, or writing or describing their thoughts in their own words. This type of question is more likely to provide new information to the qualitative evaluator than questions with simple "yes" or "no" answers; it also allows the surveyor to categorize several responses and still leave room for additional (unexpected) responses. This type of question is referred to as "mixed".

Example
How did you hear about this environmental health clinic?

___ Newspaper
___ Radio
___ Friend
___ Doctor referral
Other _____

Open-ended questions can be part of written surveys, and interviews. Such questions allow respondents to answer in any way they see fit. While more difficult to analyse across many respondents, responses to open-ended questions can provide significant insight into issues that are seen by the respondent to be important. Open-ended questions are asked both in written (survey) and oral formats.

Survey example

The following space is provided for you to comment on the overall delivery of waste management services in your county. Please feel free to voice other related concerns, or expand on earlier comments.

Oral examples

What would you tell a new employee about working at the ministry?

Describe the most important factors in your decision process.

What is your reaction to the new legislation?

Interviews are usually classified in one of three ways: structured, semi-structured or in-depth. The structured interview is a personal discussion, following a planned, predetermined format. Typically the interviewer has a questionnaire with a series of closed and mixed questions. In a structured interview, each person would be asked the same questions in the same order, and variability across responses would be narrow compared to other interview techniques. Structured interviews differ from surveys in that during an interview, the interviewer captures information, whereas in a survey, the respondent writes his or her own responses.

The semi-structured interview consists of a preplanned, predetermined set of mixed and open-ended questions. All people interviewed are asked the same questions, but not necessarily in the same order. Variability across responses would be larger, but each semi-structured interview is likely to have a similar structure.

The in-depth interview is a detailed (sometimes lengthy) open-ended discussion. In this format, topics are often predetermined, but specific questions may or may not be developed before the interview.

Questions in this type of interview vary with the respondent's experience or expertise, and each question builds on the prior response. Variability across respondents is wide, and most in-depth interviews would have somewhat unique structures.

Semi-structured and in-depth interviews allow personal perspectives to be collected, thereby providing a certain element of credibility that a simple number or statistic is often unable to provide. Listening to (or reading) examples of real situations in the words of the person who experienced them is extremely valuable, and may yield insights that surveys cannot provide. In addition, answers to open-ended questions can lead to hypotheses that can be tested on wider audiences, which is particularly helpful for exploratory research *(26)*.

Surveys are limited by the writing skills of respondents, and by the amount of detail a respondent can provide in the time allotted for a group of questions. Furthermore, it is difficult to go back to a survey respondent for more information, while it is possible to ask additional follow-up questions in an interview. Both surveys and interviews are limited in that they are open to different interpretations and biases of interviewers and readers. Good training and experience can reduce bias, but they are unlikely to eliminate it completely. Box 19 applies each of these formats to examples within the context of environmental health service evaluation.

Several techniques are important to consider when conducting interviews and surveys.

- Asking good questions is an acquired skill; a variety of techniques can be employed, which may differ with each situation (such as individual interviews, informal conversations and group interviews).

- Questions should be structured so that they are as neutral as possible. Questions should not lead respondents to answer in a particular way.

- Questions should be focused and direct, and should clearly reflect the purpose at hand.

Box 19. Examples of types of interview

Structured interviews
A questionnaire could be used to assess public opinion on a range of local issues (such as air pollution, water treatment or soil clean-up) addressed by an environmental health service. The technique is useful: it can be applied to a relatively large group, and clear-cut answers are possible. Similarly, a written survey can be carried out to identify public concerns. Since it requires little manpower, a large group can be surveyed.

Semi-structured interviews
The semi-structured interview puts specific demands on researchers and evaluators, and usually only a limited number of interviews are possible. The technique, however, provides more detail on people's feelings and beliefs on certain issues. It could, for example, be used to analyse people's satisfaction with the way a service works. In the same way, it could be used to assess opinions of service professionals – for example, on service organization and specific priorities set by the service.

In-depth interviews
This technique puts even more demands on researchers and limits the number of people who can be included. Because environmental health services perform tasks for a very diverse audience, this technique is applicable only in specific situations. For example, the evaluator could identify a small group of key informants. These might include spokespeople for relevant organizations, managers, service staff, trade unions and politicians. Presented with broadly worded, open-ended questions, such informants might provide valuable information on processes that relate to services.

- Role playing and simulation questions can also be used to make the interview more natural and less confrontational.

- Using illustrative examples in questions can build rapport between the interviewer and the person being interviewed. Examples can also communicate that an interviewer will not be judgemental about what is said because "it has all been heard before".

- There is a trade-off between breadth and depth – that is, only a few topics can be covered in depth, or a greater number can be covered more broadly.

- Interviews usually involve several means of data collection: questions are asked, observations are made and documents are sometimes collected. It can be useful to videotape or audiotape interviews when such equipment is available.

- Many surveys contain a mixture of question types, so several types of technique can be used during analysis. If results corroborate one another, the findings are strengthened and conclusions may be considered more valid and reliable.

Focus groups

A focus group is a type of group interview. Its most distinguishing feature is that the focus group uses interactions within a group instead of gathering answers to a specific set of questions. A focus group consists of a small number of individuals who embark on a group discussion facilitated by the evaluator or researcher. Discussion topics may vary, but in the past focus groups have been especially useful in elucidating group beliefs, experiences and attitudes. For example, they have been used to assess professional satisfaction with the way a health service works, and also to identify the impact of health promotion messages.

There are few strict rules for conducting a focus group study, but some attention should be given to group size and setting. Groups should not be too large (4–8 people) and the setting should be comfortable, encouraging and familiar to the participants. As with most tools described in this volume, the use of focus groups should be combined with other means of gathering data. For instance, a questionnaire is often used in conjunction with focus groups, and sometimes it is useful to conduct one-on-one interviews either before or after group discussions *(27)*.

Direct observation

Direct observation occurs when an evaluator observes activities in progress and records them. This tool is particularly useful for describing people's activities, their behaviour in certain situations, and the organizational context and process in which they work. The context of activities and situations to be evaluated is very important. In order to produce an evaluation document that allows the reader to make personal judgements about the situation, the evaluator may wish to describe the context as factually as possible, and in great detail.

Objectivity exists in varying degrees, and situations may be interpreted differently by different people. Thus, it is often argued that

qualitative inquiry requires both adequate training and preparation. Not only must an observer be taught to see, hear and record information in a useful way, but he or she must actively prepare to do so *(4)*. As an observer, a researcher (or evaluator) can play different roles, from a complete participant in a special activity or process (a technique seldom applied and often questioned for ethical reasons) to a completely uninvolved observer who embarks on studying activities as an experiment *(28)*. The role an observer plays in a group greatly influences the reliability and validity of the results. Variation and bias in observers are clearly concerns, but they are generally outweighed by the depth and detail provided by directly observing or participating in activities.

Direct observations are valuable for several different reasons *(4,23)*. Participating in an activity, instead of strictly observing it, automatically improves one's understanding of the situation. Firsthand experience reduces the need to rely on preconceived notions. In addition, evaluators who participate in an interview are trained to pick out the things that other participants may overlook because they are accustomed to them. By participating in an activity an evaluator may discover sensitive issues that could be missed during a formal interview. Direct participation can also help the observer (or evaluator) understand and interpret data from interviews and reviews of additional documentation.

Review of written documents

Reviewing and summarizing programme documentation and literature (often called document analysis) is another important tool used in qualitative research and evaluation. A technique called content analysis (see, for example, Weber *(29)*) assigns categories to relevant material in order to find patterns, linkages and common meanings. Documents of interest may include written material available within an environmental health service or other relevant organizations, such as:

- excerpts from books, quotations and entire passages from organizational, clinical, and programme and service records;

- memoranda, organizational charts, personal diaries and correspondence (including electronic mail);

- official publications (such as policy statements), publications in scientific magazines and service reports; and

- posters and pamphlets, draft reports and written responses to questionnaires and surveys.

Document analysis should not be confused with the review of scientific reference material. It is a means of gaining insight into the processes and structures within environmental health services by reviewing material that may be unofficial or unpublished, but that contains information highly relevant to the efficiency, effectiveness and/or equity of a service. Such files can be a rich source of background and process information on an activity, as well as information on how decisions were made.

In most cases, a review of documentation alone is insufficient for understanding the actual events. It is therefore often combined with other tools, such as interviews. The study of written or printed material can help focus interview questions and identify potentially new hypotheses.

Document analysis, though highly useful, is not without problems. In today's world of computers, electronic mail and extensive paper trails, background documentation may be voluminous and, therefore, it may be difficult to know where to start. Also, knowing how to distinguish between important data and useless data is a skill that must be acquired through practice. Furthermore, documents tell only a part of the story and should not be substituted for information obtained from the direct personal contact of interviews and observations.

Case studies

Another tool of particular importance to evaluation is the case study *(30–32)*. Case studies analyse a limited set of cases (or situations) where the researcher expects to find a relevant phenomenon or where a certain hypothesis can be tested. For example, a national evaluation of environmental health services may be too costly to include all services at the outset. By identifying a limited number of cases, the most important strengths and weaknesses can be identified. These can then be used to further focus the broader evaluation.

Case studies are especially helpful in studying complex situations that involve many factors, such as a large number of interested parties. This, for example, is the case with implementation of policies. Studying a distinct number of cases can answer such important questions as: What happened in the course of the implementation? Why did the implementation process fail in this instance? Which factors contributed to success – or failure? Ultimately, case studies provide clues to why things might have happened in a specific situation. Though the approach is limited, in the sense that its results are usually not generalizable on a large scale, it is often used as a somewhat straightforward means of testing implementation processes and is valuable for gaining insight into specific circumstances.

Another example of the use of this particular tool is provided in Box 20.

By itself, the case study approach is neither qualitative nor quantitative. It is, however, a unique way to look at individual situations so that information is gained and knowledge advanced. Thus, case studies often combine a mixture of interviews, surveys and focus groups with participatory, economic and statistical techniques. The case study approach is used in this volume to provide detailed examples of environmental health service evaluations in the European Region, and to explore how they might be improved (see Chapter 6). The case studies employ several evaluation techniques emphasized in this chapter.

The use of qualitative evaluation tools

The qualitative approaches described in this chapter have been used in a wide variety of settings, involving such subjects as the beliefs and perceptions of people, the organization of health services, and professional development and education. When looking at the environment and health, qualitative analysis can be applied to many of the types of evaluation discussed. Process and implementation evaluations, circumstances with individualized outcomes, and the evaluation of prevention activities are of particular interest.

The evaluation of process and programme implementation can be enriched greatly by qualitative data. Quantitative analysis sometimes provides only a yes or no answer (for example, yes the

Box 20. Implementation of Healthy Cities initiatives: three case studies

Three Healthy Cities in the Montreal area of Canada were studied as cases of implementing initiatives for promoting health. The researchers were especially interested in evaluating the implementation of:

- the sharing of common objectives among different interested parties;
- intersectoral action; and
- community participation.

The evaluation included a strongly interactive component. Evaluators were in close contact with those being evaluated through a steering committee and by publishing a newsletter regularly. The interactive approach was used alongside a specific framework for performing the case studies, including the analysis of the following factors.

- ***External environment***. To what extent do things such as laws and overall political and economic context influence the implementation?

- ***Internal environment***. What features of the city or neighbourhood influence the implementation process?

- ***Coherence of objectives***. Are common objectives officially shared between different actors?

- ***Results of implementing initiatives***. What is the level of satisfaction among actors? How are changes perceived?

This approach created awareness among actors of the three initiatives and resulted in useful clues as to how the implementation processes could be improved.

Source: Ouellet *(33)*.

process was carried out or no the implementation was not timely). Qualitative analysis can help answer how and, especially, why certain things did or did not occur. Many believe that in order to study or evaluate a process or implementation it should be experienced. Inductive reasoning in qualitative research can provide this perspective.

Qualitative approaches are also useful for evaluating properties that are expected to produce variable results in different individuals. For example, in a training exercise, individuals may begin with vastly differing skills, so the value added to their expertise will vary among them. The best way to understand the effect of the training thus might be to select a few individuals and complete detailed, yet manageable, case studies of outcomes. Case studies are also appropriate for

innovative interventions and programmes – that is, when outcomes are very unpredictable.

Prevention programmes are also suitable for qualitative evaluation techniques. As mentioned in Chapter 2, the long time-frames required for some environmental health outcomes, the lack of clear causal links between prevention programmes and environmental health outcomes, and the ethical implications of research on humans all reduce the utility and appropriateness of long-term hypothesis testing on human trial and control groups. Furthermore, many programmes aimed at preventing environmental health problems can be linked to behavioural changes; qualitative techniques are particularly suited to gathering details about how people's attitudes and behavioural patterns change during an intervention.

Precautions about qualitative evaluation tools

Qualitative approaches rely on a certain level of flexibility. This element is sometimes difficult to manage. Practical exploratory techniques require the evaluator to have tolerance for ambiguity and uncertainty in the information gathered. Planners and evaluators must have faith that whatever conclusions are reached, there will be an inherent value in using qualitative methods to conduct the evaluation. Designers, however, can never know with certainty what the results will be; they can only look at results from similar studies and evaluations and decide what seems plausible.

Qualitative techniques must be flexible, but they must also be rigorous and systematic. Developing and following a detailed evaluation plan helps to ensure the credibility and validity of the process and information. Other strategies to strengthen credibility and validity include ensuring that representative samples are taken (when selecting individuals as key informants, for interviews and focus groups), recording what is observed as factually as possible, and representing the information found in a structured manner.

DISCUSSION AND RECOMMENDATIONS

The sections in this chapter provide the reader with an introduction to several useful techniques for designing and implementing

environmental health service evaluations. Whatever design is chosen, evaluators should strive to ensure that their work represents reality as closely as possible, that the indicators measure as precisely as possible the issue being studied, and that the evaluation will be as broadly applicable to other situations as possible. These three objectives – realism, precision and generalizability – can never be maximized simultaneously, and trade-offs among them are inevitable *(34)*. Finding the proper balance is more likely when more than a single type of indicator is collected, and when more than a single method of data collection or analysis is used.

Assuring validity and reliability of results should be a fundamental goal of any evaluation or research process. One way to assure scientific credibility during the evaluation process is to use a popular technique called triangulation *(35)*, which is based on taking more than a single perspective to produce a wholly accurate picture of a given situation. Thus, a strategy that presents more than one perspective is desirable. Triangulation can be applied to methods, evaluators, data types and even theories. For example, an optimal mix of methods might include qualitative, experimental and statistical analyses, and would reflect the nature of the evaluation and situation at hand.

This chapter has also pointed out that the tools applicable to environmental health service evaluations have come from several different scientific disciplines. This comes as no surprise, because an evaluation is a multidisciplinary effort. The social sciences (such as political science, anthropology, psychology and economics) have made important theoretical contributions, and statistics, biometrics, epidemiology and psychometrics are central to measurement and analysis. This rich mixture of disciplines suggests that environmental health services should be evaluated by multidisciplinary teams. Evaluators may wish to introduce concepts or methods from any of the disciplines mentioned here, as well as from those not mentioned. Under any given circumstance, the disciplines to be invoked will depend on the knowledge available, the purpose of the evaluation and the questions at hand.

Evaluators should also keep in mind that the multifaceted nature of environmental health services requires different strategies for

evaluating different situations. Because of their training, individuals in a certain discipline may have a limited view of what an "evaluation" should be. Before embarking on any specific evaluation, the strengths and weaknesses of the techniques should be carefully considered in the context of the particular situation.

Box 21 summarizes the key recommendations of this chapter.

Box 21. Key recommendations from Chapter 4

Recognize that all tools are not applicable to all evaluation settings and questions

Review the strengths and weaknesses of specific tools for gathering data before using them, and pick the tools most suitable to reach evaluation goals

Consider using a mixture of evaluation tools simultaneously (triangulation) to strengthen the credibility of the analysis and the reliability of the results

Recognize the complexity of environmental health service activities and the additional skills needed for evaluating such actions; aim for multidisciplinary evaluation teams

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5

Making Evaluations Work

In previous chapters, concepts, principles and tools of evaluation are discussed, along with various features of environmental health services. In this chapter, all these elements are brought together with the aim of producing evaluations that do not just sit on the shelf. Issues relating to dissemination of results, core factors affecting evaluation use, and advantageous evaluation qualities are presented.

General issues of dissemination

The fourth major step in an evaluation (see Fig. 4) is to disseminate results, conclusions and recommendations to the appropriate audiences. Much has been written on this subject (see, for example, *1–5*), so only the most essential points are reviewed.

First and most important, evaluation results should be communicated clearly and succinctly, and should not employ too much scientific or organizational jargon. The structure and logic of reports and presentations must be comprehensible to the intended audiences.

Making the best use of evaluations is an essential goal of this book. Because evaluation results are used in different ways by different groups of people, clearly establishing the purpose of an

evaluation helps to define the appropriate dissemination strategy. Specifically, evaluation results are mainly used to:

- provide information and new knowledge;
- stimulate new actions or adjustments within services, policies and plans;
- stimulate participation, discussion and interaction with others;
- justify expenditures;
- account for actions taken; and
- fulfil legislative requirements.

In more general terms, evaluation results can be used in at least three ways: directly, conceptually or persuasively *(6)*. Evaluations are said to have a direct (or instrumental) effect when the results are used directly to improve service delivery. In such cases, recommendations are taken directly into account during the decision-making process. For example, the evaluation of a chemical registration system may find that personnel spend too much time on data entry as a result of outdated software. If managers then decide to replace the outdated software with newer programs, the evaluation results will have been used directly. Evaluations are used in a conceptual way when the main principles or concepts outlined in an evaluation report are used in future planning but do not have direct effects. For example, an evaluation may find that a particular service is efficient but that little has been done to provide the public with equal access to services, even though equity may not have been a concern at the start of the evaluation. When such results are used to raise questions or stimulate new developments for future evaluations (for example, planning and allocation of funds), then they are being used in the conceptual sense. Finally, evaluation results are also used as tools of persuasion, as arguments for or against certain programmes, policies or political viewpoints. For example, evaluations can be used persuasively to seek additional funding, redirect resources, reorganize activities, and prioritize future actions.

Since different groups use information for different purposes, evaluators should give explicit attention to the intended audience for their results. When evaluations are completed for internal needs, results are usually directed to managers, staff and other organizations responsible for overseeing the services. At other times,

evaluations are completed for broader purposes and the results are disseminated to a wide range of stakeholders.

Goals and objectives for disseminating results should be clearly established during the planning phase of an evaluation. Once the purpose and audience have been identified, evaluators should consider when and how often results should be communicated. For both small- and large-scale evaluations, a final report is often written and released at the end of the process. But communication efforts do not always have to be formal. Communicating preliminary and interim results to interested parties, even when done informally, can create a dynamic feedback loop that allows the evaluators to make adjustments during the course of an evaluation, and can lead to organizational learning.

The message also depends on the purpose and audience. Staff, management and funding organizations often desire an in-depth account of the evaluation, but policy-makers and the general public may be less interested in technical details, preferring reports that focus only on results and conclusions. An evaluation team may choose to produce a technical report only for those interested, but may publish an executive summary for a broader audience. Technical reports, generally, follow the evaluation plan outline and contain detailed accounts of the scope, purpose, methodology, analysis, results and conclusions for an evaluation (see, for example, Box 1).

The format used to communicate results also deserves careful planning. A wide range of formats is available. The results can be published or announced in peer-reviewed journals, at conferences, in newspapers, through electronic media (the Internet, CD-rom) or in trade journals. Oral presentations can be given internally (for example, to staff and management) or externally (for example, to commissioning organizations and the public). When results are provided electronically, attention to software compatibility is important. Early efforts to ensure that data can be imported to word processing, spreadsheet and mapping software can help guarantee that the results of the evaluation are used by the intended audiences.

Evaluators should direct the dissemination strategy by considering who it is they want to reach, where those individuals and organizations are likely to get their information, and in what format

the information will be most useful. Results for practitioners, for instance, may contain methodological and conceptual considerations and be sent to peer-reviewed journals, while results intended for the general public may highlight only the main conclusions of the study and be published on the Internet and in newspapers. Sometimes, providing background or technical information may be required to help lay audiences understand the services being evaluated.

A final issue is who should do the communicating. Some organizations or individuals may have differing levels of authority or credibility with certain audiences. Identifying partners who can assist with the dissemination of results is often an effective component of a communication strategy.

The case studies in Chapter 6 illustrate how evaluation results are communicated across the Region. In addition, the Regional Office produces a series of pamphlets that contain technical and practical advice on health and the environment. The pamphlets themselves are an example of how information is formatted with certain audiences in mind. (In this case, local health authorities are the target audience.) Many of the pamphlets address the dissemination of information. An example of this is provided in Box 22.

MAKING EVALUATIONS WORK

In addition to the issues of communication discussed in the previous section, the pursuit of certain goals is more likely to increase the utilization of evaluations. A single model for an ideal evaluation of environmental health services is, however, impossible to prescribe because of the variety of evaluation purposes and the diversity of ways to organize evaluations. The objective of this section, therefore, is to highlight favourable conditions and factors that are likely to promote better evaluations.

Favourable conditions for evaluation

Previous chapters have emphasized that evaluations should follow a clear plan and rely on a mixture of data, methods and analyses to produce a balanced product. Although each evaluation will have its own characteristics, several conditions (or goals) can be defined to

Box 22. Ten guidelines for communicating electromagnetic field (EMF) issues to a concerned public

1. Never patronize the public.
2. Treat all public concerns seriously, with sympathy and consideration.
3. Be prepared to spend at least 30 minutes on the telephone with a concerned individual, though queries can often be dealt with more quickly when standard information packs can be posted.
4. Take time to explain difficult concepts such as threshold effects, safety factors and guideline exposure limits.
5. Be honest about the reputable scientific studies that initially gave rise to public concern. On the other hand, mention only other equally reputable studies that have failed to demonstrate any adverse consequences.
6. Stress the importance of replicating any important study that has shown possible effects. In general, the public appreciates the fact that standards and guidelines cannot be changed every time a single study suggests some ill effect.
7. With regard to concerns about cancer, emphasize that health advisory authorities and governments across the world are funding research, assembling expert groups and issuing statements on their assessment of the latest scientific information.
8. Explain that none of the statements issued, or any government, national or international health advisory body, is suggesting that EMF from power lines, phone towers, mobile phones or broadcasting antennas causes cancer.
9. Stress that to prove a negative (that is, that "EMF does not cause cancer") is a logical impossibility. The best that can be done is to show that after a great deal of exhaustive research, no evidence can be found that implicates EMF in the induction or progression of cancer in humans. While much research has been completed, more is under way, and it will continue until health advisory groups are finally reassured and can advise the public that no evidence has been found that links EMF with cancer in humans.
10. In dealing with the public, it is useful to provide a summary of the information above, together with copies of relevant statements by various national and international health advisory authorities.

Source: WHO Regional Office for Europe *(7)*.

foster useful evaluations (Box 23). Though these conditions may overlap and influence each other, it is unlikely that they will all be achieved simultaneously. Evaluators must prioritize these properties based on the circumstances, balancing what is desirable with what is feasible. Each of the conditions is described more fully in the sections that follow.

Box 23. Favourable conditions for evaluation

Ideally evaluations will be arranged so that:
- they are an integral part of the management cycle;
- they coincide with the expectations and needs of direct stakeholders;
- they deliver reliable, valid, useful and understandable results;
- they are efficient, not only financially but also with respect to other resources, such as personnel;
- they are both flexible and action-oriented;
- they are completed in a timely fashion;
- they do not interfere with daily routine in environmental health services; and
- they are acceptable to evaluated individuals and stakeholders.

Integrating evaluation into the management cycle

Integration means that the evaluation should not be an isolated event. External evaluations, for instance, could yield insights that might otherwise be overlooked. These insights are more useful when they are linked to policy formulation and implementation. Integrating evaluation into the management cycle plays a major role in achieving effective results. Integration offers three benefits. First, evaluations that arise from a specific need for information (defined in the policy at its implementation stage) are more likely to be put to a specific use. Second, strong linkage to the policy formulation stage may increase the relevance and usefulness of the results for future policies. Third, integrated evaluations are more likely to consume fewer additional resources.

Meeting the needs and expectations of stakeholders

Environmental health services function among a wide range of organizations and stakeholders. Together these groups form what might be called the social and political context of evaluation, which affects the likelihood that an evaluation will be used *(6)*. The social context is particularly important, and a wide range of interested and involved parties (stakeholders) can be identified. Examples are provided in the following list.

- *Decision-makers*. These include both commissioners of an evaluation and potential users of the results.

- *Funding agencies*. These include agencies involved in funding specific environmental health service activities and agencies that might have funded the evaluation itself.

- *Target groups*. These include individuals involved in (or affected by) the service, programme, activity or policy being evaluated (for example, a high risk group).

- *Environmental health service managers*. These managers may play several important roles as commissioners, evaluators and users.

- *Environmental health service staff*. These people (within an environmental health service) may also be evaluated and will, of course, have specific expectations and needs with respect to the evaluation.

- *Evaluators*. These include evaluators themselves as stakeholders, especially when they are also users of evaluation results (for example, management), and those judging the evaluation on its methodological strengths.

- *Others*. These include technical specialists and other services and agencies with similar goals.

All these stakeholders may be present during the course of an evaluation. They have different interests in the evaluation process and its results. In order to secure the use of evaluation results, it is important to keep the evaluation process open to two-way communication with stakeholders – to allow the introduction of new information. Proper planning and regular communication channels are essential. More importantly, knowing the needs, expectations and preferences of stakeholders can help provide results that will be used.

Evaluators often have to find a balance between what stakeholders view as useful results and what can be done within an evaluation. It is impossible to take all views and expectations into account; often there are conflicting interests. Among the strategies that can help to reduce conflict are the practices of allowing stakeholders time to comment, documenting their concerns and responding actively to those concerns. Maintaining adequate communication with relevant stakeholders is also vital, before, during and after an evaluation. Sometimes it is beneficial to plan meetings during the evaluation process, so that stakeholders can review the progress and evaluators can fine tune their activities (but this is not always feasible).

Formulating reliable, valid, useful and understandable results

The validity and reliability of evaluation results are an obvious goal. This entire book is directed towards enhancing the validity, reliability and credibility of results. Chapter 4, in particular, discusses these concepts in more detail, as the different methods of evaluation call for different approaches to ensure and maintain validity and reliability. In addition, it is important to emphasize that, although the exact mixture of skills necessary for evaluation will vary, evaluators must possess a basic level of competence in the techniques of evaluation in order to obtain valid results. Additional training in communication techniques or management theory and practice may also be required.

Presenting results in a way that is both understandable and useful to stakeholders is also a central theme of this book. Highly technical results that explain the scientific merits of an evaluation may not, for example, be appropriate for all audiences. (See also the sections on general dissemination issues, page 127, and communication and user involvement, page 137.)

Promoting efficiency

As is the case for environmental health services, evaluations themselves need to be carried out efficiently. Ideally, inputs and outputs of an evaluation should be balanced, and benefits should outweigh the costs involved.

Evaluations sometimes lack support because they are considered an unwarranted additional cost or effort. Evaluators and commissioners of an evaluation (for example, the management), therefore need to promote the efficiency of the evaluation process, before and during evaluation activities. This might be done by clearly outlining costs in the evaluation plan and by close cooperation between evaluators and commissioners.

Though financial considerations are essential for efficiency, other inputs (such as commitment of personnel) and outputs (such as organizational learning and improved relationships with stakeholders) are also relevant. Efficiency is often not just a matter of comparing numbers, which may be extremely difficult, but is rather a matter of instinct, good project management and communication.

Keeping evaluations flexible and action-oriented

In order for evaluations to be successful, they need to be flexible and action oriented. Action orientation and integration of an evaluation in the management process go together; they are complementary concepts, as are flexibility and efficiency. Paying specific attention to planning is essential for developing an evaluation that is flexible and aimed at delivering useful results. Flexibility can be promoted in evaluation plans that are adaptable and open to informal feedback with stakeholders. Orientation towards action can be encouraged through a clear outline of the need and use for evaluation results.

Producing timely results

One constraint that evaluators must address is timeliness. An evaluator may be pressured to deliver fast results, but faster is not necessarily better. On the other hand, evaluators need to deliver results before they become obsolete. In certain planning processes, such as the yearly budget cycle, there are specific periods when new information is particularly useful. Timing evaluations so that results are disseminated before or during these periods not only fosters the production of useful results but also helps to minimize conflicts between evaluators and users.

Minimizing disruptions to service delivery

Evaluations can potentially disrupt the daily routine of environmental health service delivery. Such interference may make staff members reluctant to cooperate, which can undermine the efficiency and effectiveness of the evaluation. Involving staff as evaluation partners and showing them what benefits will be gained from the evaluation may help to minimize negative impacts on daily routines.

Maximizing acceptance of results

Broad acceptance of the evaluation is also important. To the extent possible, efforts should be made to ensure that evaluation activities and results are acceptable both to those being evaluated and to the broader stakeholder audience. This means that evaluations should avoid judging those being evaluated on a personal level. When assessing service staff performance, it is necessary to develop a full understanding of the pressures and obligations under which staff work, and to reassure them that the evaluation is intended to be informative rather than judgemental (see also Chapter 1).

Stakeholder acceptance is also essential. Evaluators need to be aware of stakeholders' needs and expectations, and to work to secure their support throughout the entire evaluation process. Striving to make evaluations relevant to stakeholders helps ensure acceptance. (See also the section on meeting the needs and expectations of stakeholders, page 132.)

Core evaluation factors

Several core factors contribute to an evaluator's ability to promote the goals listed in Box 3 (page 39), including financial resources, instrumental resources, evaluation staff, communication and planning. Paying close attention to these factors improves the chances that evaluation results will be put to good use *(7)*.

Financial resources

Sufficient financial resources must be available to conduct evaluations. Evaluators, however, need to avoid diverting them from other service activities. Also, sufficient resources are needed to ensure that evaluations remain flexible and open to new problems and changing contexts. Environmental health service managers may as a standard practice want to consider reserving a small amount of the service budget for evaluation activities.

Instrumental resources

Specialized equipment required for collecting and storing data and information are often referred to as instrumental resources. The term covers a wide range of tools, including the basic computer hardware and software found in offices, complex environmental sampling systems used in the field, analytical instruments found in a laboratory, and even audio and video recording equipment used in interviews and focus groups. Instrumental resources must be of sufficient quality to supply the evaluators with valid and reliable data. In some cases, it may be necessary to acquire new equipment, but in other cases pre-existing instruments may suffice.

The importance of instruments varies depending on the purpose of the evaluation and the information needed. Though environmental monitoring is impossible without sufficient instruments (such as sophisticated sampling equipment and laboratory analysers) these tools may be less important to an evaluation of, for example, the

relevance of a specific environmental health service activity to the public. Computer resources (hardware and software) are usually required for every type of evaluation – not only for data processing and analysis but also for high-quality compilation and presentation of results.

Evaluation staff

The personal qualifications of the evaluators also have an influence on the way an evaluation is received by stakeholders. Internal and external evaluators alike must have:

- a basic knowledge of evaluation and of the specifics of environmental health and environmental health services;
- the necessary evaluation skills; and
- the motivation to perform the evaluation efficiently, effectively and equitably.

The skills and commitment of evaluators are important for maintaining flexibility, developing good relations with stakeholders and integrating an evaluation with the overall management cycle. Multidisciplinary training in relevant environmental health services is essential, and communication and management skills must be strong in order to interact with interested parties and to cope with external pressures *(8)*.

Communication and user involvement

The role of communication (both internal and external) in the evaluation process cannot be overemphasized. Internal communication is the exchange of information between members of the evaluation team and between the team and the staff evaluated. It is essential for securing an open exchange of ideas and new views. External communication is the exchange of information between the evaluation team and stakeholders. Periodic external interactions help evaluators remain current on the changing service context, evolving perceptions and new data. Building opportunities for evaluators and potential users to exchange information, ideas, needs and expectations is recommended. Close contact with users generally improves

the utilization of results, making user participation in the design and execution of evaluations even more valuable.

Planning

Evaluation needs careful planning to provide a practical guideline for day-to-day actions. The evaluation plan outlined in Chapter 1 shows how planning can develop (see Fig. 4 and Box 1). Planning helps to ensure that evaluations are integrated into the management process and that results are delivered when managers and decision-makers need them for developing policy. Planning also keeps evaluation expenses reasonable by clearly defining tasks, and the costs and personnel requirements associated with them.

Box 24 contains a list of questions that may help make evaluations more useful.

CONCLUSION

An evaluation of environmental health services is not an easy task. There is no single recipe for a successful evaluation, because each must be developed based on the specific service being evaluated. Different environmental health services have different models that govern their development and delivery. Evaluation can and should interact with these models to improve the design and implementation of the services. Making evaluations work is partly an instinctive process, perhaps more art than science. The ability to weigh the necessary objectives and limitations and to strike the right balance is a skill that comes only with practice. Depending on the circumstances, the different approaches introduced in this book will be more or less relevant and feasible.

Nevertheless, evaluation is an essential component of improving the management and delivery of environmental health services across the European Region. The necessary time and resources should be allocated to make evaluation an integral part of the life cycle of environmental health service delivery. The Helsinki and London conferences have highlighted major challenges faced by environmental health service providers. Meeting these challenges remains an important priority for WHO, but will be impossible without commitment to evaluation.

Box 24. Questions to help make evaluations more useful

The following questions are not intended to be a comprehensive check-list, but instead are intended to provide a taste of the issues that should be taken into account.

General
What are the most important qualities this specific evaluation should have?
What factors contribute to securing these qualities?
What is the relevance of the evaluation to decision-making and policy formulation?

Integration
Is the purpose of the evaluation relevant to decision-making or policy formulation?
Is the evaluation activity part of a larger process of policy development?
Do direct stakeholders view the evaluation as an integral component of service activity?
Is there a balance between using existing resources (staff, finance, instruments) and potentially new insights that can be provided by "outsiders"?

Stakeholders
Who are the main stakeholders and what role do they play?
How are their preferences dealt with in the evaluation process?
How do you deal with conflicting interests of stakeholders?
Is there a line of communication between evaluators and potential users?
Is communication aimed at different stakeholders or "audiences"?
Does the evaluation plan or procedure allow for communication with stakeholders?

Validity, reliability and understandability
How are validity and reliability assured in the evaluation?
Does the presentation of results include recommendations for action?
How are results presented and communicated?
What is the message to be transmitted?
Who is to receive this message?
What specific requirements are necessary to make the message understandable?
What media are used to disseminate results? (See also the first section in this chapter.)

Efficiency
How much will this evaluation cost?
What personnel requirements are needed?
What benefits can be expected?
How much additional work is expected from service staff?
How is efficiency promoted and safeguarded?

Flexibility and orientation towards action
Does the evaluation plan leave room for new situations or a changing context?
How are new situations (such as lack of data) or ideas handled within the evaluation framework?
Are evaluators skilled or equipped to handle new situations?
How are results put into useful information for stakeholders?
In what time frame are results to be delivered and is this feasible?

Timely results, daily routine and acceptance
How might evaluation activities interfere with the daily routine within an environmental health service?
If the possibility for interference exists how can it be prevented?
When do decision-makers need results of upcoming evaluations?
Are evaluations and evaluation activities acceptable to stakeholders, especially to the people being evaluated?

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6

Case Studies of Evaluation in Practice

This chapter provides five case studies of evaluations that were carried out in the European Region. Though each case is discussed in detail, the collection of cases does not give a representative picture of all evaluation practices in the Region. Instead, these cases are intended to provide the reader with concrete examples with which to compare the theories, guidelines and concepts described in previous chapters.

Each of the five case studies in this chapter includes a brief introduction and discussion of the evaluation steps outlined in Fig. 4. The procedures used to secure support, to define the purpose, subject, scope and process (methodology), and to produce and disseminate the results are reviewed and discussed. The main features of each evaluation are presented in Table 9.

Member States have expressed an interest in sharing their evaluation experiences further. Professional networks, such as the Healthy Cities network, have been quite useful for sharing information and learning from peers. Should an active information network be established among environmental heath professionals, additional examples of good evaluation practices could easily be incorporated into it.

THE PROVISION OF AIR POLLUTION ADVICE BY LOCAL AUTHORITIES

Air quality has been an important public health concern in the United Kingdom for at least 100 years. The law recommends that local

Table 9. Summary of evaluation case studies

Case	Commissioning organization	Evaluating organization	Subject	Tool(s) used
Air pollution advice by local authorities in the United Kingdom	Department of Health	Department of Health	Adequacy and process of air pollution advice given by local authorities	Questionnaire and database
Assessment of environmental monitoring in Estonia	WHO; Health and Welfare Canada	WHO team	Process and efficiency of environmental monitoring	Site visits and interviews
Assessment of environmental health services in Sweden	National Board of Health and Welfare	National Board of Health and Welfare	Efficiency and effectiveness of environmental health service action	Questionnaires, visits and interviews, plus seminars and conferences
Assessment of an environmental health consultation service in Germany	Consultation service management	Consultation service management and staff	Output, process, efficiency, relevance and effectiveness of the service	Registration system and software
Use of performance indicators in the United Kingdom	Audit Commission	Auditors; data collection also by local authorities	Efficiency, effectiveness and quality of services by local authorities	Performance indicators

authorities provide health advice to the public when certain levels of pollution are exceeded. Provision of such advice by local authorities, however, has not occurred on a large scale. In dealing with air quality, local authorities have developed close ties to the Department of the Environment but the relationship with the Department of Health remains fairly undefined. In December 1993, the Department of Health commissioned an evaluation of the provision by local authorities to the public of advice on the health effects of air pollution. In brief, survey results show that while the majority (90%) of local authorities monitor the quality of the air, only a few (10%) distribute advice on the health effects of the pollution. The reason stated for not providing advice was that the authorities did not know what to say.

Step-by-step analysis

The evaluation was pursued under the authority of the Department of Health, but no mention of securing additional political support was made in the available documentation (C. Hall, unpublished data, 1994). The Department commissioned the evaluation to determine the extent of the knowledge "gap" between advice provided and advice requested (or required). The subject was the provision of air pollution advice services by local authorities in the United Kingdom. More specifically, the scope was narrowed to the adequacy of air pollution advice services and the process through which they are provided. The Department, as coordinator of the study, envisaged that the results would aid policy development in the area of air pollution health advisories. The benefits of the evaluation would not only go to the public, who should ultimately receive better advice on how to deal with periods of high pollution, but also to the professionals working in the service itself, because a national strategy for improving the overall policy would be developed.

The study was carried out once, over a total period of about 6 months. The method consisted of a survey of air pollution monitoring and advice practices. It was sent to 364 district, metropolitan and county councils in December 1993. The survey requested information on monitoring efforts, information base, local collaborating partners, health advice, source of health advice and research. A total of 17 questions were asked. It was possible to use a short, relatively simple questionnaire because the scope of the information desired was very limited. A statistical database was established in the Department of Health to organize the responses. Over 95% (348/364) of the authorities returned the survey within the 3-month period allotted. Over 89% (312/348) of the responding authorities monitored air quality (a breakdown of pollutants monitored was also provided) and disseminated their findings to committees of elected members, the general public, the media and other local authorities. The local authorities also reported using data for planning proposals and local health studies. Despite this abundance of air quality data, and interest in air quality, only 32 of the responding authorities (less than 10%) provided the general public with any sort of health advice that was related to the adverse effects of air pollution.

The survey illustrated that the adequacy of the air pollution advice service in local authorities (as of 1993) was insufficient and

that the process for its provision was virtually nonexistent. Although many authorities did monitor air quality and did provide the results to Councillors, most did not associate the data with their health implications for local communities. Two reasons were cited for this lack of association.

1. Most local authorities appeared to believe that, since it is extremely difficult to provide real-time pollution data, providing health information would be irrelevant.

2. Many authorities did not have sufficient access to the necessary information that linked health effects with air pollution, so they could not provide meaningful advice.

The final report concludes that even if real-time data could not be provided, retrospective advice could still be an important factor in instigating behavioural change among the population. The report encourages the practice of providing health advice. In addition, it recommends several activities to improve the overall provision of air pollution health advice to the general public, including the following:

- prepare a leaflet that summarizes the health advice issued by the Advisory Group on the Medical Aspects of Air Pollution (Department of Health) and distribute it to all local authorities;

- establish and update annually a database of research work undertaken by local authorities in the field of air quality and ill health; and

- improve links between local authorities and the Department of Health, for example, by contributing regular articles to the Department's *Bulletin for environmental health officers*.

The report was issued and distributed within the Department of Health. Copies were sent to all local authorities in England. An article for publication in a peer-reviewed journal was submitted by the authors. Finally, the results of the evaluation were also presented, at technical meetings, to representatives of local authorities. Overall, it

is still unclear how the results will actively influence air pollution advice policy. Real changes in the practices of local authorities, in terms of the way pollution advice is provided, remain to be seen.

Discussion

This study was an analysis at the national level of local services. It worked in part because the scope was small enough to design a short, easily completed, straightforward questionnaire. In addition, thorough efforts were made to ensure a good response rate (initial and follow-up letters included addressed and pre-paid envelopes). The purpose, subject, target audience, evaluators, frequency, methodology and information base were straightforward and well defined. Only two aspects, adequacy and process, were evaluated in any detail. It is important to recognize, however, that this is not necessarily a drawback. Having a limited scope enables the work to be completed in a short time and with a relatively simple procedure. For example, if a cost analysis had been included, the time needed to develop and carry out the survey might have been extended. The recommendations clearly show how knowledge gained can be applied to future policies and decisions. Besides these positive aspects, some features of this study could have been improved. Political support, for instance, was not specifically sought, but lack of such support did not appear to harm the data collection in this case.

This case study illustrates how an evaluation of a particular service can *identify gaps* in the provision of that service. In this case, an inadequacy was suspected, a survey was formulated to gather data, and the results of the survey were used to develop recommendations for improving the services.

Assessment of environmental monitoring in Estonia

In December 1992, after Estonia's independence, the WHO Regional Office for Europe initiated a project to assess Estonian environmental monitoring. Previous interviews with professionals had suggested that many of the monitoring data in Estonia (and other former Soviet republics) were of dubious quality. Since the organization, personnel and methods had not changed after the dissolution of the Soviet Union, the validity of the data collected at the time was also in doubt.

Both intentional and unintentional misrepresentations of the medical and environmental information were suspected. For example, publication of certain information on radiation-related exposures and illnesses was supposedly suppressed. In addition, the number of sick days was thought to misrepresent the health of the population, because clients often benefited by collecting sick leave authorized by the system.

A particular problem was seen in the environmental monitoring data, especially with regard to laboratory analysis. The use of Soviet analytical methods was required in all the former Soviet republics, but the requirement often prescribed outdated technology and equipment. Many data sets were not tested or checked for validity by other laboratories, and many laboratories operated with insufficient supplies to correctly carry out the specified methodology. Health and Welfare Canada funded this project, which was managed by the WHO Regional Office for Europe, whose aim was essentially to evaluate the process and efficiency of environmental monitoring practices in Estonia. The entire project lasted about 10 months (from December 1992 to September 1993).

Step-by-step analysis

Political support was established by close contact between project coordinators and relevant personnel in the Ministry of Health. The Government of Estonia was represented throughout the project by faculty of the Institute of Chemical Physics and Biophysics. The purpose of the project was to improve the validity and reliability of (and thus, the confidence in) environment and health monitoring data in Estonia. The aim of this evaluation was to provide a baseline of data from which progress in the quality of data collection could be measured. One central question to be answered was: “How well is the monitoring being done?” The evaluation also assessed the process of collecting and reporting environmental data in Estonia. The types of sample chosen for study were: air, groundwater, surface water, drinking-water and effluents – each for a selected range of organic and inorganic compounds. Three specific tasks were set to assess:

1. analytical methods used;
2. existing laboratory facilities; and
3. environmental analytical data produced in Estonia over the previous 5 years.

An analysis of efficiency was also required in order to determine how well the service was delivered. The immediate benefactors of this exercise are assumed to be the planners themselves as well as other environmental health professionals in the Ministries of Health and of the Environment. The project is a one-time situation assessment. A team of five Estonian environmental health professionals and one WHO consultant was identified by the programme funders and managers. The Estonian team compiled a background report for the project. The WHO consultant then spent a week in Estonia in June 1993 gathering further information during site visits to laboratories and through interviews with environmental health professionals. A further review of analytical methods and facilities on each target group of chemicals or compounds was also compiled. Finally, proposals for improvements and changes were made to the Government of Estonia during the project review, held in September 1993.

The site visits confirmed earlier reports of inadequate supplies of materials used to analyse samples (such as pure carrier gases for gas chromatography analysis and quality filter papers). Also, the lack of automation for routine analyses, the shortage of funds and the loss of traditional supplies were thought to have contributed to inefficiency. The laboratories, now, are attempting to improve the quality of their services. Most of those visited had adopted international standards for calibration. There was, however, very little evidence of quality assurance or quality control within the individual laboratories.

The following conclusions were drawn in the reports (these findings are from 1993).

- A substantial amount of environmental analytical data has been produced in Estonia, but not all of it is available and not all of it is reliable.

- Many laboratories have only one method of sophisticated analysis available to them (owing mainly to financial constraints), and it is particularly difficult to analyse samples with low concentrations of contaminants. Only a few laboratories have the ability to analyse many different types of sample. There is no single laboratory that can analyse all types of pollution determinant.

- Shortages of appropriate spare parts, reagents, standards, etc., affect the quality of analytical results, even where suitable instruments are available.

- Several standard methods of analysis are permitted for the same pollution determinant. Because the results depend on the method used, results from different laboratories are likely to be incompatible.

- New methods introduced to the laboratories appear to be insufficiently validated to estimate the accuracy of the analytical results produced.

- There is a serious lack of within-laboratory quality control and basic documentation of sampling procedures, sample tracking, analytical procedures actually used, etc.

- Retrospective examination of pollution data would be expensive.

- Overall, the monitoring data are unreliable for a variety of reasons, and any use of the existing data might lead to invalid conclusions.

The supporting information required for this assessment was minimal, but adequate. The Estonian team compiled an extensive background report that was supplemented by site visits and unstructured interviews. The information collected was compiled in a series of freestyle prose reports. No additional computer software was required. This exercise mainly provided a baseline of information to be used in the future by planners and data managers. In September 1993 a project review was held in Copenhagen, Denmark, with the stakeholders in this project. The following recommendations were made to the Government of Estonia.

1. The quality of data provided by different institutes was acknowledged to be widely diverse. If the data are to be used, they should be carefully assessed for accuracy and reliability.

2. A few selected chemicals, the occurrence of which can be properly monitored, should be identified according to three

criteria: existence of technical capacities to produce reliable and comparable data; relevance to existing problems; and economic acceptability.

3. One cause of poor data quality has been a lack of clarity in distributing responsibilities. Some tasks are duplicated unnecessarily and others are not completed at all. Reorganizing and consolidating health and environmental services would improve this problem.

4. Intersectorality should be vigilantly practised in reorganizing services. Careful attention should be given to procedures that allow the exchange of data and information among various ministries. Communities and local authorities should also participate in a two-way flow (to and from) of information.

5. The highest priority for monitoring should be given to the most afflicted regions.

6. The possibility of establishing relevant structures and identifying funds for the following environmental health needs should be pursued:

   - training personnel;
   - promoting quality control of laboratories;
   - committing laboratories to regular inspection and to authentication of their procedures;
   - promoting the commitment of management to improving quality control;
   - elaborating standard methods; and
   - participating in international programmes.

7. Reliable channels for supplying required standards, reagents and special materials must be established and maintained. Production of such supplies should be promoted in Estonia. Advanced techniques, including automation of analyses, should also be promoted.

8. Sound validation of methods should be performed by independent referees and by the laboratories themselves.

Several documents were written as a result of this project *(1,2)*. The recommendations were submitted to the Government of Estonia, and the formal project review was archived in the Regional Office bibliographic database.

Discussion

This project was not designed specifically as an evaluation of Estonia's environmental monitoring procedures. Project planners were responding to a perceived need to assess the data quality in Estonia. The project has been used here as a case study, because all the major evaluation steps occurred. The positive aspects of this case study include a clearly defined scope and purpose, a frequency that corresponds to the specified goals and a thorough methodology appropriate to the purpose. The unstructured nature of the interviews allowed compilation of diverse information, and may have helped to identify new problem areas and collect information about them. Also, sufficient situation analysis, adequate information support and good application of knowledge were visible in this case.

Though the overall process was positive, there are some points of criticism. Political support could have been better organized before the site visit. The Ministry of the Environment was apparently not aware of the project and was reluctant to release data to the project coordinators without receiving a letter of explanation. It was not possible to procure such a letter in the allotted time. This case illustrates that careful planning and communication are essential. Enough time should be allotted for contacting the proper people so that the proper information can be made available. Another issue was the target audience: exactly who was expected to benefit most from the activities was not well defined in project materials. Though the mission and information gathered for it were well documented, it is unclear how results were distributed. A meeting with the stakeholders took place in September 1993, but additional follow-up and assurance that the recommendations were taken seriously were not addressed in the material available.

Overall, the project helped to define the status of environmental monitoring data quality in 1993, but the project's effectiveness could have been improved by defining more clearly how the conclusions and recommendations could be used by the Government of Estonia.

ASSESSMENT OF ENVIRONMENTAL HEALTH SERVICES IN SWEDEN

The National Board of Health and Welfare (NBHW) is a national supervisory authority, connected to the Ministry of Health and Social Affairs in Sweden. The work of the NBHW is based on different plans and regulations aimed at protecting human health, in the fields of health care, social welfare, infectious disease control and environmental health. The NBHW supervises the evaluation of different health services in the 288 municipalities and the 24 County Councils in Sweden.[5] Important features of these evaluations include a county-by-county approach and a dialogue-oriented evaluation. These features have been used for about 5 years.

Local municipalities in Sweden are responsible for such services as environment and health protection, social welfare and physical planning. With only a few exceptions, however, local municipalities are not responsible for health care and medical care. Usually they have no medical competence within their organization. Medical expertise, including environmental medicine, is available at the County Councils. One of the reasons for evaluating the environmental health activities of local services is the so-called right to self-determination of municipalities. This is a prominent policy principle in Sweden. It means that the municipalities have the right to organize their work in the way they want, as long as the goals described in the different plans are achieved. Against this background, national supervision by follow-up and evaluation have become more and more important.

Step-by-step analysis

The evaluation activities were performed by (and under the authority of) the NBHW, with the support of the Ministry of Health and Social Affairs. One purpose of the project was to evaluate whether the goals in the different regulations on health protection were fulfilled, and to promote effective utilization of existing resources. Another purpose was to promote the development of local and regional programmes for evaluating environmental health services.

[5] A series of evaluation reports have been published for each county evaluated. With one exception *(3)*, they are not translated into English. For further information, contact Mr Martin Eriksson, Head of the Environmental Health Section of the NBHW, Sweden.

There are 24 counties in Sweden and every county has an average of about 10 municipalities. The NBHW visits about 4 counties each year.

The scope of an evaluation usually covers both general and more specific questions, such as:

- Which local and regional objectives and targets are endorsed?
- How is environmental health action organized?
- Which resources are available (in terms of finance and staffing)?
- How do the municipalities and County Councils cooperate with each other?
- How do the municipalities and County Councils cooperate with other involved parties?
- Which results are documented?

The typical county evaluation can be described by a number of steps. As a first step, the NBHW decides on a theme, such as health risks in the indoor environment. By choosing a theme, the scope of the evaluation is narrowed to a certain area of interest. The next step is to send questionnaires to all municipalities and the County Council. After this, some of the municipalities are visited. Professionals and decision-makers are also interviewed. Results from interviews sometimes contrast with answers returned in the questionnaires.

The results of questionnaires, visits and interviews are usually published in a report. This report also contains comments from the NBHW, together with specific issues that need further attention. As part of the dialogue-oriented approach, a seminar is arranged for discussions with decision-makers and professionals about the results of the evaluation and its conclusions.

When all municipalities in a county have been evaluated, a conference is arranged with decision-makers, leading politicians and the heads of the different services involved. The Director-General of the NBHW leads the conference. The NBHW's overall conclusions are presented and discussed and the NBHW addresses questions on how important areas can be improved in the future.

As a final step, a small follow-up is performed, about 1–2 years after the conference, to see if anything has changed or improved. An example of a specific evaluation, on health risks in schools, is given in Box 25. The evaluation and its results are supposed to benefit both the NBHW and the local authorities. The NBHW will ultimately gain a better insight into the environmental health practices at the local level, including the evaluation component, while the local services themselves have a chance of improving their activities by learning from the results.

Box 25. Health risks in schools in two counties

During 1994, the NBHW conducted a follow-up of the inspections of school premises in two counties. The aims were to study the occurrence of environmentally related health problems and to examine how schoolchildren's need for a good indoor environment were met. These aims were directed by the municipalities' responsibility to control the environmental health status in these premises, as laid down by health protection legislation, and the County Councils' overall duty to prevent ill health, as laid down by the Health and Medical Service Act.

The structure (for example, organization and resources), the process (for example, priorities, plans, objectives, targets and service activities) and the results in two counties and in the municipalities in the counties were described. A special question about local and regional evaluation of these services was asked.

Comments on the actual quality of objectives (the structural quality and the process quality) were given by the NBHW. Some of the comments follow.

- The inspection work would benefit from a clearer statement of objectives and priorities. The objectives must be more than just visions: they must be operative and permit follow-up and evaluation.
- Resources, in terms of competence levels and staffing levels, are too small to permit the offices to satisfactorily perform their duty of inspecting educational premises. Overall regional resources should be reassessed. The possibilities for pooling resources should be considered.
- Many local environment and health departments are self-critical and consider themselves to be insufficiently aware of the general standard of educational premises, especially of the effects premises may have on a pupil's state of health.
- In the municipalities where the inspection work has been most successful, inspection has been carried out in the form of a joint inventory project conducted with both the Real Estate Department and the school's governors. This approach mobilizes a broader base of experience and knowledge than is available when the environment and health departments carry out the inspection by themselves. The effectiveness might be increased through county-wide coordination of such projects.

Box 25 (contd)

- The environment and health departments ought to maintain a better level of contact with the Occupational Safety Inspectorate, to promote greater effectiveness.
- Of the 35 municipalities evaluated in these counties, only 6 conduct a regular follow-up of a school's indoor environment, and only one of these had an established structure for performing follow-up and evaluation.

The following questions were posed for consideration.

- How can the County Council's work in environmental medicine be made more region-specific and how can it be given directed applicability so that, to a greater extent than at present, it leads to collaboration between municipalities in their efforts to mitigate and assess current problems?
- How can the region's work in the area of environmental health be made more effective, by coordination of planning and joint resource use?
- How can a continual supply of region-specific expertise be ensured in the area of environmental health?
- In what way(s) can follow-up and evaluation on schoolchildren's health contribute to increased effectiveness in the local environment and health departments' inspection of educational premises?
- Who is responsible for strengthening systems that make it possible to register environmentally related health problems in children?

Source: Eriksson et al. *(3).*

Discussion

The dialogue-oriented follow-up and evaluation has proved successful, and it has initiated processes at the local level. Moreover, the approach is appreciated by the local and regional authorities. They appreciate that national authorities are coming out "in the field" and creating direct personal contact and dialogue. For the NBHW, it offers a unique opportunity to learn of the current situation at the local level, especially as a starting point for different national measures.

An important purpose of the approach is to initiate local routines of follow-up and evaluation of the municipalities' effectiveness within their own services. Very often such an evaluation routine is lacking, and local targets are often so general that they are not fit to be a starting point for an evaluation. To promote higher quality in the local evaluation, the NBHW is currently working with a handbook

that translates the relevant ISO standard into an applicable model for evaluating local environmental health services. The direct personal contact and the dialogue achieved by the interviews and the seminars are expected to be important determining factors in a successful evaluation. In addition, the project is significantly important in promoting processes that improve environmental health services. Another advantage of the project is that it is also relatively cheap.

ASSESSMENT OF AN ENVIRONMENTAL HEALTH CONSULTATION SERVICE

The Free and Hanseatic City of Hamburg is one of the smallest of the 16 German *Länder* (States), but it has a long tradition of innovative environmental health services. The Division of Health and Environment is one division in the Office of Health. An environmental health consultation service (a clinic) was started in response to a publicly perceived need for a centre specializing in the diagnosis and treatment of problems that result from exposure to environmental pollution. This consultation service was designed as a pilot project, and an evaluation component was required from the very beginning. The evaluation procedure *(4)* was designed to provide timely information on the services to the managers of the programme, and to help the managers make decisions about the process and structure of the clinic itself.

Step-by-step analysis

Accounts of attempts to draw political support for this evaluation were not included in the available literature *(5)*.

The purpose of the evaluation was three-fold:

1. to show that the concept of an environmental health consultation service is transparent and rational;
2. to help facilitate exchange of experience with other consultation services; and
3. to create a basis for making decisions about the further development of the service.

Ultimately, the planners hoped to show the usefulness of the information system that had been designed and to use the evaluation

to plan a better consultation service, both for the future and for other localities.

The subject of the evaluation was to be very broad. The outputs, process, efficiency, relevance and effectiveness of the services were to be analysed. The workers in the environmental health consultation service carried out the activities for the evaluation, and their reports were reviewed by the donor groups and by the Health and Environment Division of the Office of Health. The ultimate target group for the consultation service is people exposed to environmental pollution. The target for the evaluation itself, however, was not only to help the general public but also to help other medical practitioners, other consultation service planners and the planners of this service, so that better-informed decisions could be made for the following years. (The consultation service will be evaluated each year.)

A reporting system was developed to provide information to the programme managers. Two types of report are kept on separate cards. The first type is the individual patient record, which includes personal details (such as name, address and occupation), a brief medical history, how the patient heard about the service, the nature of the exposure suspected and the problems experienced by the patient. A separate set of cards was organized according to the problems encountered. Records traced the actions taken for each problem encountered. Each set of cards was analysed separately with the computer program Epi-Info.[6] Staff in the Health and Environment Division of the Office of Health helped the clinicians working in the consultation clinic analyse the data and draw conclusions.

The programme was judged to be a success both in general and in financial terms. It evolved, however, a bit differently than first envisaged. The main thing to be analysed by the first year's evaluation was the evaluation process itself. Originally, the evaluation component was expected to fulfil the need for balance in the project and to be an instrument of control and monitoring. But during the course of the project, there was a dynamic interaction between the direct collection of data and the evaluation component. As a

[6] Epi-Info is a non-copyrighted, free software program distributed by the US Centers for Disease Prevention and Control and WHO.

result, the entire concept of the consultation service changed (see also Discussion, page 158).

The assessment of the evaluation process identified many problems that can be solved through good planning. One key lesson learned was about the need for minimizing the amount of paper work. Another important lesson learned was how to use the evaluation as a control mechanism. If, however, the data are to be useful, they must be analysed regularly and applied where appropriate. By looking at the number of people who called or came to the clinic, the programme planners judged the service to be relevant to the needs of the community and argued not only that the programme should be continued, but also that it should be implemented in other locations.

Information collected by the consultation service staff, who asked structured questions of their clients, was used to inform the administration how often the public used the consultation services, which provided a strong argument to continue and expand this type of service. In addition, a clear baseline of information was developed. The baseline of information could then be used in comparisons with data gathered, for example, after a special media event describing a spill or a particular hazard about which people should be concerned.

The evaluation system was, in part, designed to help planners make decisions. In this respect, it served its purpose well. For example, the service was originally intended to provide extensive medical examinations of people who suspected they had been exposed to something harmful in the environment. But, since most of the people who contacted the service wanted only general information, the procedures for collecting information changed. The managers realized that collecting detailed socioeconomic and medical histories from such callers drained scarce work time that could have been used more productively. In the end, procedures were changed so that only minimal background information was collected from callers with general questions, and more detail was collected from those receiving more extensive medical examinations.

The evaluation was also to be used to justify the continuation and expansion of the project to other districts. Thus, disseminating

the findings of the evaluation was important. Much of the information gained by implementing the service and evaluating it has been published in peer-reviewed journals.

Discussion

As this is the only case study described in this publication that was specified as an evaluation from the very beginning, most of the steps recommended here were carried out. Especially important were the ideas to use the information gained throughout the process to improve the process itself and to make decisions about the procedures and activities in the future. In this case, the application of the information gathered is very well developed, because one of the stated purposes of the evaluation was to provide a tool that could be used by management to improve the service. Unfortunately, there were also some negative results, despite efforts to avoid having only a positive or negative connotation. The consultation service staff felt that they, personally, had been judged positively or negatively on their work. The programme managers continued to stress the importance of reporting on the work itself, not just the data collected from patients.

In summary, this case study illustrates an evaluation as a predefined component of a service. It shows that even with good planning, evaluation and monitoring systems can indicate areas for improvement.

Performance indicators in the United Kingdom

The Audit Commission for Local Authorities and the National Health Service in England and Wales has been established as the watchdog for fiscal accountability at the local level. The Commission promotes quality, economy, efficiency and effectiveness in local authorities by appointing auditors for authorities, setting and maintaining standards for auditing, and investigating and reporting on the impact of local authorities. In 1992, the Local Government Act was passed requiring the Audit Commission to develop a set of indicators for services delivered by local authorities. After collaborating with many representatives from relevant sectors and local authorities themselves, a list of performance indicators to be addressed in the first year

(1993/1994) was developed. The indicators are part of a wider government initiative to make public services more open and accountable to the public: the so-called Citizen's Charter. The list of indicators was expanded for the second year of the programme (1994/1995). Many of these indicators address environmental health services that are delivered mainly at the local level *(6–14)*.

The Audit Commission divides the indicators into four different categories: performance, cost, quality and background information, and provides the following description of each.

- *Performance indicators* include the concepts of efficiency and effectiveness. Some of these indicators are more prescriptive than others. At one extreme, the Commission requires only that something be measured and some target be set, giving authorities more autonomy; at the other extreme, specific things have to be measured and targets are set by the Commission.

- *Cost indicators* are meant to measure value. Generally, these are expressed as price per unit of service, or as cost per person. The Commission recognizes that it is important not to assume that high costs mean low value. These indicators are used alongside performance indicators to determine overall value for money.

- The Audit Commission considers *quality indicators* to be best measured by groups of indicators. The Commission has developed check-lists of the components that services should have. Similarly, no one service is represented by only one indicator.

- Finally, *indicators that provide background information* help to place services in a social, economic, political or historical context. These indicators (for example, how much a service is used or what the population using a service is like) help link outputs and outcomes of services to the amount of work required to provide them.

In the first year of the programme (1993/1994), the Audit Commission used only a few environmental health indicators. The number

of indicators collected will increase gradually every year, so environmental health indicators are likely to improve in both number and quality. Box 26 shows the topics of the indicators for the first two years and beyond.

Step-by-step analysis

In 1983, the Government made local authority auditing (a tradition since 1846) the responsibility of an independent body, the Audit Commission. In 1992, the Commission's duties were expanded, and it began to issue directives for local authorities to publish comparative performance indicators. The Government supported these activities, although the Commission operated independently as a non-departmental public body. The purpose of the Citizen's Charter was to ensure that authorities were accountable to their public. As a consequence, the comparisons made between authorities had to be accessible to the public.

There is a difference between the general goal of the Charter and the more specific and operational goals of environmental health indicators of local authorities. The subject has been clearly defined as the services

Box 26. Citizen's Charter indicators

The environmental health indicators are shown in *italic*.

Time frame	Topics
First year (1993/1994)	Council tax and housing benefit, council tax collection, development control and local plans, education, fire, housing,[a] *refuse collection*, police, public libraries, social services, *waste disposal*
Second year (1994/1995)	*Environmental health*, highways and rural footpaths, leisure parks and open spaces, *public toilets, street cleaning, street lighting*, trading standards
Not yet covered	*Building control*, coastal protection, county parks and tenanted farms, economic development, licensing, museums and art galleries, *strategic planning, tourism*

[a] Housing has not been included as an environmental health topic because the housing indicators selected thus far are principally financial in nature and do not relate to environmental health.

Source: Audit Commission *(10)*.

provided by local authorities in the United Kingdom. This is an extremely broad subject, but was more narrowly defined for the first year. In subsequent years more topics to be evaluated were added, widening the scope of the evaluation. The local authorities conducted the evaluation and gathering of data by themselves. To guarantee that systems for gathering data were of sufficient quality, agents from the Audit Commission were also involved in the evaluation work, though indirectly. The final evaluation results were intended for public consumption. It was envisaged that the public would use the indicators to judge the performance of the local authorities. Politicians were also a target audience. The information was to be collected and published on an annual basis. The Audit Commission has developed sets of indicators to measure the quality, economy, efficiency and effectiveness of services provided by local authorities. A wide range of interested parties was consulted over a period of several years in order to create the indicators. Trained auditors visited the local authorities gathering the required information. Only four sets of 1994/1995 indicators that are particularly relevant for evaluating environmental health are presented here: dealing with the public, refuse collection, waste disposal and environmental health (Box 27).

The stated purpose of the indicators developed by the Audit Commission was to ensure the quality, economy, efficiency and effectiveness of local authorities. The relevance and adequacy of the services were not stated priorities of the Audit Commission or the Citizen's Charter. Figures were published in the local press, and drew national press interest. Information sources were clearly defined and were to be obtained through local authority statistics. The Authorities were told in advance what data were to be collected in order that they could provide them. The Commission's agents received detailed instructions on collecting information. For each indicator topic there were several figures collected. The Citizen's Charter requires that results be published in local newspapers. National newspapers were to publish aggregate results and comparisons. Several studies were done to determine the best way of presenting the information to the public, and advice on presentation of material was disseminated to the local authorities.

The Citizen's Charter indicators were designed to measure how well local authorities in the United Kingdom were doing their job,

Box 27. Relevant performance indicators

Dealing with the public

1. *Answering the phone*
   What is the authority's target for answering calls?
   How was performance monitored?
   What was the performance against the targets?
2. *Answering letters*
   What is the authority's target for answering letters?
   How was performance monitored?
   What was the performance against the targets?
3. *Complaints to local authority ombudsman*
   How many complaints were considered by the ombudsman?
   How many were classified as: (i) local settlement; (ii) maladministration with no injustice; (iii) maladministration with injustice?
4. *Handling complaints*
   What is the authority's definition of a complaint?
   What are the answers to the following questions?
   - Is there an up-to-date written policy available to the public?
   - Does it contain information on the procedure for making complaints?
   - Does it clearly describe allocation of responsibility and actions required?
   - Does it contain time limits and targets?
   - Does it specify that when limits are exceeded complainants must receive notice?
   - Does it specify that written complaints must receive a written response?
   - Is there a follow-up procedure if a complainant is not satisfied?
   - Does the authority have a written policy on remedies?
   - Is there a system for reviewing the causes of complaints?
   - Does the authority publish a report on complaints that is available to the public?
5. *Access to buildings*
   What is the number of the authority's buildings (offices) open to the public?
   What is the number of these buildings in which all public areas are accessible to disabled persons?

Refuse collection

1. *The service provided*
   Does the authority provide containers for household waste?
   Does the authority provide wheeled bins for household waste?
   Is household waste collected from the back door of domestic properties?
   Is garden waste collected?
   Is garden waste collected free of charge?
   Are appointments given for collection of bulky waste?
   Is bulky waste collected free of charge?
   Are recyclable materials collected separately from household waste?
   Is a direct dial telephone service available 8 hours per working day and is there a phone answering service that takes messages of complaint at all other times?
2. *Reliability*
   What is the authority's target for reliability of household waste collection service?
   What was the performance against the targets?
   What is the authority's target for rectifying errors?
   What was the performance against the target (rectifying error)?
3. *Recycling*
   How many tonnes of household waste were collected?
   What was the percentage of household waste recycled?
4. *Expenditure*
   How many households were included?
   What was the net cost per household?

Waste disposal

1. How much household waste was received?

Box 27 (contd)

2. What is the percentage of household waste that was:
   recycled?
   incinerated with recovery of heat and power?
   incinerated without the recovery of heat and power?
   disposed of in other ways?
3. What was the net cost per tonne of household waste received?

Environmental health (the local environment)

1. How clean are the streets?
2. What is the percentage of highways that were:
   of a high standard of cleanliness?
   of an acceptable standard of cleanliness?
3. What was the method of inspection used to monitor item 2?
4. What was the average time taken to remove fly-tips?
5. How many public conveniences were there?
   What was the percentage of these providing:
   (i) access for disabled people?
   (ii) baby changing facilities?
6. What is the target time for response to complaints?
   What is the target time set by the authority for responding to environmental health complaints and requests for services?
   What is the percentage of responses provided within the target times?
7. What is the scope of food inspection?
   How many food premises are there?
   What was the percentage of such premises due to be inspected that were inspected?
8. How timely was the response to consumer protection complaints?
   What is the target time set by the authority for responding to consumer protection complaints and requests for services?
   What was the percentage of responses provided within the target times?
9. What is the scope of the inspection of premises covered by consumer protection legislation?
   How many premises were covered by consumer protection legislation?
   What was the average number of visits per high and medium risk premises?

thereby showing the general public whether their money was well spent. One can presume that if citizens expressed dissatisfaction, the authorities would attempt to improve their services. But in the literature reviewed, the Audit Commission did not provide guidance on how local authorities could use the indicators to improve services, only guidance for citizens on how to interpret the indicators.

The Commission went through a review process for the first set of indicators, and a few changes and additions were made for the second year. It is important to note that the Audit Commission does have guidelines on many types of local service, including the National Health Service and the Environmental Health Services. But there is no direct evidence that specific recommendations on the

best course of action in certain situations were provided to the local authorities.

The Audit Commission looked towards the future. This was clearly a long-term project and a large undertaking. Each year new indicators were to be added. In addition, the indicators themselves were reviewed and revised as appropriate. For example, from the 1993/1994 period to the 1994/1995 period, language was clarified, a few indicators were deleted and many new indicators and topics were added.

The Citizen's Charter mandated that the results be published in local newspapers. The Audit Commission had also developed a document entitled *Watching their figures. A guide to the Citizen's Charter indicators (14)*, which was targeted at helping lay citizens understand the laws and use the results to judge local authorities. The indicators, first published in early 1995, are packaged in a two-volume set with an additional index.

Discussion

The Audit Commission does meet its own goal of developing indicators that are disseminated to the public, thereby providing the public with a mechanism for evaluating the services. The Commission has established a concrete set of data against which the public can react. In this way, the public may become better incorporated into the decision-making process – for example, by knowing exactly what services are being provided by the authorities, and at what price. Theoretically, major changes in public consensus on which services should be provided might be reflected in the response to the publication of the indicators. Though the set of indicators developed by the Audit Commission contains good points, it is not flawless. Several areas have room for improvement – in particular, with regard to methodology, actual evaluation and formulation of conclusions.

The methodology could be improved in a number of ways. One way to improve it is to provide more detail on how information would be supplied. Another way is to improve the methodology used to develop the indicators. Most of the indicators do little more than count activities that have been deemed important. It seems that few actual decisions or conclusions will result from the efforts of the

auditing exercise. For the analysis, it must be noted that the indicators developed reflect poorly the effectiveness of the services. Furthermore, relevance and adequacy are virtually ignored. An overall review of environmental health services should include these subjects. In addition, there are voids in the methodology: there is no mechanism for asking whether an alternative service could have been provided; there is a lack of a clear explanation that links the information provided by the indicators with the efficiency, economy, quality and effectiveness of the services; and there is no guidance on using this information to improve future services.

The indicators encompass a narrow view of environmental health services. The areas receiving major attention are food inspection, waste collection, waste disposal, public conveniences, response to complaints and housing. No indicators, however, have been developed for water services, monitoring pollution (air, water, soil, noise, light) and occupational health. Also, the housing indicators, though not discussed in depth, generally concentrate on finance rather than environmental health. Such a narrow set of indicators may result in local authorities ignoring services or aspects of services that are not specified by the Commission. This may be extremely problematic when specific local problems that should be addressed by the local authority are ignored because no indicators are mandated to be published in the newspaper for that particular service. Put another way, too much centralized control of local services may violate the concept of subsidiarity (government authority should reside at the level that is most appropriate to the specific goals of the policies).

The intended use of the indicators is also too limited. Fiscal accountability to the public is clearly a relevant goal, but it does not go far enough. The public needs indicators so it can make decisions about future services. Indicators could also be used more effectively to introduce innovation into the local government process. Though the Audit Commission says this is an aim, it does not describe how the aim is to be realized. Because politicians have been defined as a potential target group, there is a danger that the results of the performance indicators could be manipulated for personal political gain. The Audit Commission's heavy reliance on statistical and monetary figures provides a tool that might be manipulated to such an end.

This case study is meant to provide an example of one type of evaluation of environmental health services occurring in Europe today. It is our understanding that the Audit Commission has incorporated as many stakeholders as possible into the development of this system of performance indicators. To be fair, we have to remember that the Audit Commission does not have an intrinsic mandate to evaluate environmental health services, and environmental health services are by no means the primary reason it has developed these performance indicators. Nevertheless, this case study has been included in order to illustrate certain points and to further the debate on the development of effective performance indicators with which to evaluate public services, including, of course, environmental health services.

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This publication aims to fill a gap identified by Member States: to provide a practical introduction for environmental health professionals and managers to evaluate their services. The first task is to review the most critical components and aim of an evaluation, to see how these relate to the overall framework of environmental health service management.

Evaluation of health services is an established field. Several books and reports have been published on the subject, both inside and outside of WHO. This publication does not intend to rewrite these documents or restate their arguments. Its goal is to introduce environmental health professionals to evaluation principles, tools and examples from which they can pick and choose elements to suit their specific needs.

The book is designed to guide practitioners towards questions that must be answered to evaluate and improve services. With this in mind, references and suggestions for further reading appear at the end of each chapter, and key recommendations are presented in boxes throughout the text.

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