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COMMENTARIES

# Environmental health indicators in policy evaluation

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**In carrying out two projects involving environmental health indicators – a national environmental health programme evaluation and an international environmental health indicator system – in parallel, it became apparent that an international indicator set has limitations regarding the evaluation of a national programme such as the Swiss National Environment and Health Action Plan (NEHAP). The international indicator set proposed by WHO serves the structured description of the underlying cause–effect chains, allows an integrated monitoring of the general environment and health situation and provides valuable international comparisons. However, the relevance of an international indicator set varies in the national context. Moreover, it does not allow the evaluation of a national implementation process, which is highly important in assessing success or failure of an environmental health promotion programme. For a comprehensive evaluation of such a programme, a specific evaluation concept derived from the formulated goals and targets needs to be developed with emphasis on evaluation of the implementation process.**

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The authors are currently involved in two different projects relating to indicators in the environment and health area. We are responsible for the evaluation of the Swiss National Environment and Health Action Plan (NEHAP).[1] These novel instruments for action in the area of environmental health promotion were developed following recommendations made at the European Ministerial Conferences on Environment and Health.[2,3] Throughout Europe, around 40 NEHAPs have been presented so far. Switzerland was among the first western European countries to develop such a programme. As a consequence of these political activities, in 2000 the World Health Organization (WHO) started the development of a European environment and health monitoring system,[4–6] and recently proposed a first core set of environmental health indicators.[7] The project aims at establishing a comprehensive system for regular reporting on environment and health within the countries as well as on the WHO European level. The system shall also serve Member States to assess the progress and effectiveness in implementing their NEHAPs.[6] The authors are also in charge of the pilot implementation of this indicator set in Switzerland.

In carrying out these two projects – national evaluation and international indicator system – in parallel, it became apparent that an international indicator set has limitations regarding the evaluation of a national programme such as the Swiss NEHAP. In the following, we point out parallels and differences in the two approaches.

## THE WHO'S ENVIRONMENTAL HEALTH INDICATORS FOR THE EUROPEAN REGION

An 'environmental health indicator' (EHI) is a 'measure which indicates the health outcome due to exposure to an environmental hazard', thus consisting of 'an environmental indicator or a health indicator plus a known environmental-exposure health-effect relationship'.[8] Definitions also emphasize the policy relevance of EHIs: they should relate to aspects that are important to policy makers and amenable to control.[5,8,9]

Applying the EHI-methodology, a core set of EHIs was developed by WHO that in its current form comprises indicators on 10 different topics, along with some denominator variables (*table 1*).[7] As theoretical concept, the 'Driving Forces – Pressure – State – Exposure – Effect – Action framework' (DPSEEA) was used to derive the indicators.[8] This framework supports the structured description of the cause–effect chains between human activities and health outcomes. It also facilitates the identification of possibilities for action on the different levels.

However, the WHO EHI project is also confronted with a number of difficulties. The number of times a pollutant exceeds a threshold level is commonly proposed as an EHI (*table 1*). If these standards are risk based they contain information on the underlying environment and health relationship. Nevertheless, the percentage of the population exposed to exceeded pollution levels and, for future development, an economic valuation of the health burden would be highly desirable in view of the higher information value for policy makers compared to the percentage of exceeded measurements. A first step in this direction has been made in the WHO indicator set by including, for example, the population exposure to ambient air pollutants or the population annoyance by noise (*table 1*). While data may be available for air pollution, the required information on the population exposure distribution is often lacking in other fields. Another hindrance is that cause–effect chains between environmental exposures and health effects are often complex, and precise measures rare.[8,10–12]

## THE SWISS NATIONAL ENVIRONMENT AND HEALTH ACTION PLAN AND ITS EVALUATION

The development process of the Swiss NEHAP and its targets have already been discussed in detail[13] and therefore will only be presented in brief here: based on an analysis of the Swiss situation, Swiss authorities decided to set priorities in three areas with a need for action in which the association between environment and health can be communicated easily: Mobility and Well-being, Housing and Well-being, and Nature and Well-being (dealing with nutrition and agriculture).[1] The Swiss NEHAP was specifically designed as an environmental health *promotion* programme aiming at complementing already ongoing activities.[13] In each of the three areas, specific and mostly

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quantified targets were formulated. For example, the fact that in 1994 60% of journeys made by car were no longer than six kilometres demonstrates a large potential for non-motorized mobility in Switzerland. Accordingly, in the area 'Mobility', one target is the doubling of journeys made by bicycle as an ideal form of environmentally friendly mobility combined with exercise.

For the evaluation of the Swiss NEHAP, a comprehensive approach was applied, including planning and implementation as well as outcomes and impacts.[14]

In relation to implementation as well as evaluation it is important to remember that health promotion aims not only at the improvement of individual outcomes, but just as much at the change of political, organizational, and social conditions.[15] This is especially true for an environmental health promotion

**Table 1** Overview of the WHO project on environment and health monitoring (as at May 2002):[7] proposed topics, environmental health core indicators and position in the driving forces – pressure – state – exposure – effect – action (DPSEEA) framework

| Topic | Core indicators | DPSEEA |
|---|---|---|
| Air quality | Passenger transport demand by mode of transport | Driving force |
| | Road transport fuel consumption | Driving force |
| | Emissions of air pollutants | Pressure |
| | Population-based exposure to air pollutants (urban) | Exposure |
| | Infant mortality due to respiratory diseases | Effect |
| | Mortality due to respiratory diseases | Effect |
| | Mortality due to diseases of the circulatory system | Effect |
| | Policies to reduce environmental tobacco smoke exposure | Action |
| Radiation | Incidence of skin cancer | Effect |
| | Effective environmental monitoring of radiation activity | Action |
| Noise | Population annoyance by certain sources of noise | Effect |
| | Sleep disturbance by noise | Effect |
| | Application of regulations, restrictions and noise abatement measures | Action |
| Housing and settlements | Living floor area per person | State |
| | Population living in substandard housing | Exposure |
| | Mortality due to external causes in children under 5 years of age | Effect |
| | Scope and application of building regulations for housing | Action |
| | Land use and urban planning regulations | Action |
| Traffic accidents | Mortality from traffic accidents | Effect |
| | Rate of injuries by traffic accidents | Effect |
| Water and sanitation | Waste water treatment coverage | Pressure |
| | Exceedance of recreational water limit values / microbiological parameters | State |
| | Exceedance of WHO drinking water guidelines for microbiological parameters | State |
| | Exceedance of WHO drinking water guidelines / chemical parameters | State |
| | Access to safe drinking water | Exposure |
| | Access to adequate sanitation | Exposure |
| | Outbreaks of water-borne diseases | Effect |
| | Diarrhoea morbidity in children | Effect |
| | Effective monitoring of recreational water | Action |
| Food safety | Monitoring chemical hazards in food: potential exposure | Exposure |
| | Outbreaks of food-borne illness | Effect |
| | Incidence of food-borne illness | Effect |
| | General food safety policy | Action |
| | Effectiveness of food safety controls | Action |
| Waste and contaminated land | Hazardous waste generation | Pressure |
| | Contaminated land area | State |
| | Hazardous waste policies | Action |
| Chemical emergencies | Sites containing large quantities of chemicals | Pressure |
| | Mortality from chemical incidents | Effect |
| | Regulatory requirements for land-use planning | Action |
| | Chemical incidents register | Action |
| | Poison centre service | Action |
| | Medical treatment guidelines | Action |
| | Government preparedness | Action |
| Workplace | Occupational fatality rate | Effect |
| | Rates of injuries | Effect |
| | Sickness absence rate | Effect |
| | Statutory reports of occupational diseases | Effect |

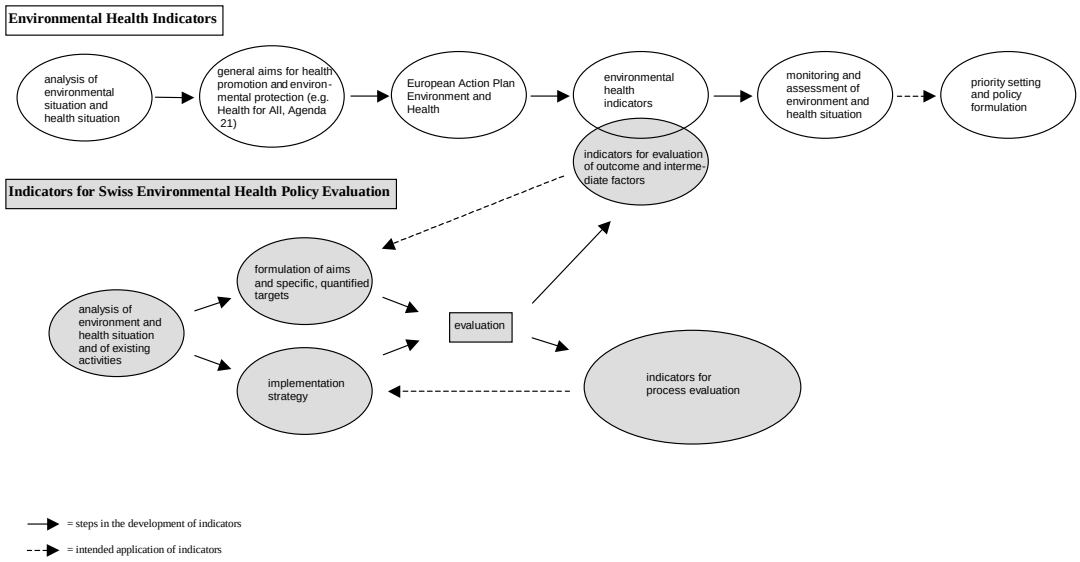


**Figure 1** Development and application of WHO's environmental health indicators and indicators for environmental health policy evaluation in Switzerland

programme like the Swiss NEHAP which is confronted with the difficulty that environment and health departments still operate within largely separated administrative structures in many European countries.[13,16,17] Thus, understanding the implementation process of such an intervention (process evaluation) and associated structural changes is of special importance in this field. Such changes in conditions should be seen as 'outcomes' of their own and additionally, they are the basis to understand success or failure in achieving quantified outcomes.[18–21]

Accordingly, emphasis was laid on the process evaluation in the Swiss NEHAP. The mostly qualitative data are collected by repeated interviews with the programme manager and staff as well as the partners involved in the implementation process. A NEHAP-project-database provides information on projects carried out in relation with the NEHAP. Information on the resources available for the implementation, the programme management structure and the ongoing activities (output) are also collected. Important political decisions relating to NEHAP topics are documented to allow a statement on the 'societal climate'. Additionally, a flexible user-focused approach is applied to provide additional information according to the needs of the programme management. As a result of this process evaluation, an implementation strategy for the Swiss NEHAP was developed recently.[22] The implementation will now be focused on three pilot regions and public relations will be intensified.

To define appropriate indicators for the Swiss outcome evaluation, impact models for each of the three topics were formulated. Consisting of hypotheses on the presumed relationship between the programme measures and expected outcomes, they serve as a basis to understand why targets were reached or what impeded programme success.[13,14] Additionally, potential weaknesses in conceptualization and formulation of targets become apparent. The formulation of such a programme impact theory also facilitates the consideration of intermediate factors not contained in the programme but which might affect goal attainment. For example, in relation to the target of doubling the journeys made by bicycle, not only the share of bicycle traffic should be evaluated, but also intermediate factors such as the access to a bicycle, the availability of a car parking space at the workplace, bicycle facilities at train stations, the development of accidents, or the number of short journeys made by car should be included. In this way, indicators for the Swiss NEHAP evaluation were developed based on the impact models. A baseline assessment of the three topics of the NEHAP was carried out in 1999/2000 to document the situation before the start of the programme, against which progress can be compared later, applying a distance-to-target approach.[23]

## PARALLELS AND DIFFERENCES BETWEEN THE TWO APPROACHES

*Figure 1* illustrates the development process of EHIs compared to indicators for the evaluation of a specific environmental health programme such as a NEHAP. Derived from general analyses of the environment and health situation, the EHI system proposed by WHO covers a wide range of issues, thus allowing integrated monitoring of the general environment and health situation. In countries like Switzerland, which don't have a tradition in environmental health reporting, such a general overview will be particularly useful. Additionally, the currently ongoing pilot implementation of the EHI core set in over a dozen European countries will allow valuable international comparisons.[7]

However, from the point of view of policy evaluation, the relevance of the suggested EHIs varies in the national context. Indicators for the evaluation of a national policy are derived from previously formulated, specific policy targets such as the ones in the Swiss NEHAP (*figure 1*). Therefore, international EHIs are only suitable for the evaluation of a national policy when they coincide with the national priority setting and address areas where action is taken within a country. In this case, national outcome indicators and international EHI sets can partly overlap (*figure 1*), whereby the degree of overlap may vary from country to country. For Switzerland, this is for example the case in the topics of outdoor air quality, noise and traffic accidents (*table 1*). Additional indicators were derived based on the targets formulated in the Swiss NEHAP and the impact models, including intermediate factors. The most important restriction of the WHO indicator set for policy evaluation is, however, that it does not allow the evaluation of a national implementation process, which is highly important in assessing success or failure

of an environmental health promotion programme. These indicators have to be derived from and adapted to the respective programme and the national context.

## CONCLUSIONS

We conclude that the DPSEEA framework applied by WHO serves the structured description of the cause–effect-chain of known environment and health relationships. An international set of EHIs based on this framework is useful for monitoring purposes as well as international comparison and priority setting. However, its suitability to evaluate progress and effectiveness of the implementation of the Swiss NEHAP is limited. For a comprehensive evaluation of such a programme, a specific evaluation concept derived from the formulated goals and targets needs to be developed with an emphasis on the evaluation of the implementation process.

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## REFERENCES

1 Swiss Federal Office of Public Health, Swiss Agency for the Environment Forests and Landscape. Aktionsplan Umwelt und Gesundheit APUG (Swiss National Environment and Health Actionplan). New 2001 edition. Bern, 2001.

2 WHO Regional Office for Europe. Environmental Health Action Plan for Europe. Second European Conference on Environment and Health; 1994 June 20-22; Helsinki, Finland: World Health Organization, 1994.

3 WHO Regional Office for Europe. Implementing national environmental health action plans in partnership. Third Ministerial Conference on Environment and Health; 1999 June 16-18; London: World Health Organization, 1999.

4 Wills JT, Briggs DJ. Developing indicators for environment and health. World Health Stat Q 1995;48:155-63.

5 Briggs D. Environmental Health Indicators: Framework and Methodologies. Geneva: WHO Sustainable Development and Healthy Environments, 1999.

6 WHO European Centre for Environment and Health. Environmental Health Indicators: development of a methodology for the WHO European Region. Bilthoven: WHO European Centre for Environment and Health (Bilthoven Division), 2000.

7 WHO European Centre for Environment and Health. Environmental Health Indicators for the WHO European Region: Update of Methodology. Copenhagen: May 2002. Report No.: EUR/02/5039762.

8 Briggs D, Corvalan C, Nurminen M, editors. Linkage methods for environment and health analysis: General guidelines. Geneva: WHO Office of Global and Integrated Environmental Health, 1996.

9 Corvalan C, Briggs D, Kjellström T. The need for information: environmental health indicators. In: Corvalan C, Briggs D, Zielhuis G, editors. Decision-Making in Environmental Health: from evidence to action. London & New York: E & FN Spon on behalf of the WHO, 2000.

10 Pastides H. An epidemiological perspective on environmental health indicators. World Health Stat Q 1995;48:140-3.

11 Cole DC, Eyles J, Gibson BL. Indicators of human health in ecosystems: what do we measure? Sci Total Environ 1998;224:201-13.

12 Briggs D. Methods for building environmental health indicators. In: Corvalan C, Briggs D, Zielhuis G, editors. Decision-Making in Environmental Health: from evidence to action. London & New York: E & FN Spon on behalf of the WHO, 2000:57-75.

13 Kahlmeier S, Künzli N, Braun-Fahrländer C. The first years of implementation of the Swiss National Environment and Health Action Plan (NEHAP): lessons for environmental health promotion. Soz Praventivmed 2002;47:67-79.

14 Rossi P, Freeman H. Evaluation: a systematic approach. 5th ed. Newbury Park, California: Sage Publications, 1993.

15 WHO Regional Office for Europe. Ottawa Charter for Health Promotion. First International Conference on Health Promotion; 1986 Nov 17-21; Ottawa, Canada: World Health Organization, 1986.

16 Ziglio E, Hagard S, Griffiths J. Health promotion development in Europe: achievements and challenges. Health Promot Int 2000;15:143-54.

17 Ritsatakis A. Experience in setting targets for health in Europe. Eur J Public Health 2000;10(4 Suppl):7-10.

18 Ziglio E. Indicators of health promotion policy: directions for research. In: Badura B, Kickbush I, editors. Health promotion research: towards a new social epidemiology. Copenhagen: WHO Regional Office for Europe, 1991:55-83.

19 Speller V, Learmonth A, Harrison D. The search for evidence of effective health promotion. BMJ 1997;315:361-3.

20 Nutbeam D. Evaluating health promotion: progress, problems and solutions. Health Promot Int 1998;13:27-44.

21 Koelen MA, Vaandrager L, Colomer C. Health promotion research: dilemmas and challenges. J Epidemiol Community Health 2001;55:257-62.

22 Swiss Federal Office of Public Health Environment and Health Unit. Aktionsprogramm Umwelt und Gesundheit: Ziele, Strategien und Instrumente (Action programme environment and health: aims, strategies and instruments). Bern: Swiss Federal Office of Public Health, 2002.

23 Bircher U, Haller D, Kränzlin I, Kahlmeier S, Braun-Fahrländer C. Evaluation des Aktionsplans Umwelt und Gesundheit: Ausgangslage. Kurzfassung (Evaluation of the Swiss National Environment and Health Action Plan: Baseline assessment. Executive summary). Basel: Institute of Social and Preventive Medicine of the University of Basel, Department Environment and Health, 2000. (http://www.unibas.ch/ispmbs/apug/apughome.htm)

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