Acta Pædiatrica, 2006; 95 Suppl 453: 114–119

Taylor & Francis
Taylor & Francis Group

Policy and science in children's health and environment: Recommendations from the PINCHE project

PETER VAN DEN HAZEL[1], MONIEK ZUURBIER[1], MARIE LOUISE BISTRUP[3], CHRIS BUSBY[4], ALEKSANDRA FUCIC[5], JANNA G. KOPPE[2], CHRISTOFER LUNDQVIST[6], ROBERTO RONCHETTI[7] & GAVIN TEN TUSSCHER[8]

[1]*Public Health Services Gelderland Midden, Arnhem, The Netherlands,* [2]*Ecobaby Foundation and Emma Children's Hospital Academic Medical Centre, University of Amsterdam, The Netherlands,* [3]*National Institute of Public Health, Copenhagen, Denmark,* [4]*Green Audit, Aberystwyth, United Kingdom,* [5]*Institute for Medical Research and Occupational Health, Zagreb, Croatia,* [6]*Norwegian Knowledge Centre for the Health Services, Oslo and Department of Neurology, Ullevål University Hospital, Oslo, Norway,* [7]*Department of Paediatrics, Second School of Medicine, University La Sapienza Rome, Italy, and* [8]*Department of Paediatrics and Neonatology, Westfries Gasthuis, Hoorn, The Netherlands*

Abstract

Background: Policy recommendations result from the discussions and analysis of the present situation in environment and health. Such analysis was performed in PINCHE. This led to recommendations based on the scientific literature. In the field of children's environmental health the policy process will follow more or less fixed rules, but this process is still at an early level of development. The link between science and policy still faces many challenges. Scientific assessment of environmental risk must recognize and tackle the problems of data sets, variability of human and environmental systems, the range, spatial and temporal diffusion of potential health effects and many biases and confounding factors. *Results:* The PINCHE network recommends a general improvement of the supporting scientific fields in environment and health. Assessments from epidemiology or toxicology should play a key role in influencing science-policy decisions in programmes that are intended to inform the public policy process. Scientific committees at a local level could play a role. The relation between health and environment needs to be better incorporated in training and education. There is a need for harmonization of data production and use. The priorities in PINCHE focus on the most important issues. A classification of low, medium or high priority for action was used to describe a range of different environmental stressors.

Conclusions: PINCHE provided recommendations to reduce exposure for children. Exposure reduction is not always linked to improved health in the short term, but it will reduce the body burden of accumulating chemicals in children. A strategic choice is reduction of exposure of children to compounds by changing production techniques or by increasing the distance of child specific settings to sources. The contribution of all players in the production, distribution and use of scientific knowledge in the field of children's environmental health is necessary.

Key Words: *Children, environment, public health, policy, science*

Introduction

We define a policy recommendation as a proposed action in relation to a described risk factor in a specific situation which is intended to minimize or prevent unwanted effects of the risk factor. In addition and more generally, we include policy proposals intended to promote health, or actions to support and promote health and healthy environments. A policy proposal may have to be adapted to a specific situation; for example, depending on who should implement the policy, the level of the policy and the characteristics of the policy.

This article presents the main outline of policy recommendations resulting from the discussions and analysis of the present situation which were performed in PINCHE. Some recommendations are relevant for the European Commission or for the European Parliament. Some recommendations confirm the conclusions that were drawn in the process of developing the EU Environment and Health Action Plan [1,2]. Other recommendations are related to the work

Correspondence: P. van den Hazel, Public Health Services, Gelderland Midden, P.O. Box 5364, 6802 E J Arnhem, The Netherlands. Tel. +31 263773915. E-mail: peter.van.den.hazel@hvdgm.nl

ISSN 0803-5326 print/ISSN 1651-2227 online
DOI: 10.1080/08035320600886653

of Member States. These recommendations target ministers and policy makers in the ministries responsible for the environment, health or education. Finally, recommendations at a third level are related to regional or local authorities or municipalities. Regional differences and variation in environmental impact of stressors might have to be reflected in how policy is actually implemented.

These recommendations are presented in the PINCHE reports and are based on the scientific literature that was evaluated in the PINCHE project.

Policy objectives

Historically, the development both on content and organizational level of scientific information into policy has taken place to some extent in the area of environmental problems. This has lead to some institutionalizing of this field with clear roles for different stakeholders that apply the rules according to regulations, environmental policy programmes and laws. However, such a development has not been very clear in the field of environmental health.

We note that many major concerns about children's environmental health as expressed in many different international conventions or ministerial declarations have not yet been institutionalized. What do we mean by the term 'institutionalizing'? The concept of institutionalization is one of the central concepts in social and political science. It is defined as a process where values, norms and social activities are reflected in institutions. These institutions make a steady, collective pattern of rules and acquisition of data sources and information according to which, through the actions of the institution, societal players must (or in the best case, should) act accordingly.

In each social area policy will develop into a systematic statutory (i.e. legally binding) and inevitable system involving problem definitions and solutions with fixed patterns of interaction between different stakeholders and the development of policy processes according to more or less fixed rules.

In the field of children's environmental health this institutionalization has not yet taken place. The phase of naming the problems, of identifying the priorities in society and the building of a framework according to which the problems can be handled, are still at an early level of development.

Scientific objectives

The role of science as a guide beacon for policy making has become more complicated over the last few decades. From a linear relationship between knowledge and policy, the science- policy interface has become very complex. The increasing complexity of scientific knowledge goes hand in hand with the increasing risks in environmental health. The dependency of policy makers and citizens on the expertise of scientists is even more complicated by the lack of direct sensory perception of environmental health risks. The sensory perception of smoke from a stack, the noise of traffic and the visible pollution of soil are partly replaced by invisible, odourless, soundless pollution such as ionizing and non-ionizing radiation, low dose food contamination or fine particles in the air. This change disturbs the relation between science and policy. Humans have evolved to deal with evolutionary stresses, mostly visible, or if not visible, available through hundreds of years of observation of causes and effects and therefore accessible to the parents of children and for which warnings can be given. The rapid technological developments in the last 200 years have upset this process. Parents can no longer keep their children from harm since they cannot see or sense the threats. Nor can policymakers. Specialized equipment and knowledge are required. Furthermore, the social impacts of environmental health risks are not uniformly distributed among the non-scientific population or stakeholders. The universal apprehension in the public's mind of their children as potential victims has increased civil unrest about environmental health problems.

In addition, we see that other non-scientific stakeholders are also involved in the production of scientific knowledge. Not only universities, but also consultancies and advisory boards or research institutes produce scientific knowledge. At the side of the public there is increase of interest from different stakeholders. Not only national authorities, but also consumer groups, patients, industrial groups or environment and health organizations are using scientific knowledge. These stakeholders might use the scientific information for their own policy setting agenda.

The structural uncertainties of the scientific results put the science-policy relationship even under more stress [7].

In conclusion, the role of science is part of a complex system leading to policies.

Methods to connect science and policy

The literature has many models of science and its relation to policy. Policy process factors depend on the stage of the policy cycle, the make-up of the policy network, the nature of the issues involved (amenable to regulation or embedded systemic risk), the political climate and also increasingly the role of NGO stakeholders, the media and the general public. These

models are supportive in understanding how science can contribute in making policies.

There is more attention on translating scientific results into policies. However, there are some challenges in the science-policy interface. Scientific knowledge of environmental risk should ideally consist of a coherent body of codified, enlightened, objective, expert knowledge. It would be located in a relatively unified community subject to peer review and would be prepared to speak truth to power. There would be empirical reductive and deductive testing of hypotheses and inductive modelling of risk events, and the outcome for science advice to policy would be based on scientific views of experimentation, theory falsification, verification, replication, consistency and predictability. Empirical observation would be supplemented by controlled experiments. Indirect estimation would take place through extrapolation from analogous circumstances or exposure and chemical group characteristics. Estimating risk through statistical probability should be emphasised and applying 'no regret' policy should be the characteristic approach.

However, this ideal has to be tempered by pragmatism in the real world. Scientific assessment of environmental risk must recognize and tackle the imprecise nature of some core data sets, the dynamic nature and variability of human and environmental systems, the range, spatial and temporal diffusion of potential health effects, the complexity of many of the phenomena under investigation and especially the many biases and confounding factors.

Further problems that need to be solved include resolving the relationship between direct epidemiological study results and mechanistic effects based on laboratory animals, cell-culture or theoretical work. Furthermore, the relative limitations of epidemiology must be conceded, such as the statistical power problem for low prevalences, the cost and time required for prospective epidemiology and, again, especially the role of judgement in research scoping assumptions, determining the applicability of evidence and interpreting that evidence [3].

All these considerations demonstrate that ultimately, even in an ideal system, there must be concessions to uncertainty and some way of dealing with this, for example by using the precautionary principle. For theoretical approaches there are similar uncertainties; there is parameter uncertainty, model uncertainty and systemic uncertainty. The science-policy interface has to deal with these difficulties. The EU and other authorities have to deal with such a difficult field.

PINCHE recommendations

Research on exposure assessment, epidemiology and toxicology

The PINCHE network recommended a general improvement of the supporting scientific fields in environment and health.

However, more unconventionally PINCHE examined the process itself, looking behind the decisions themselves, at the process itself and came to various significantly novel conclusions. PINCHE concluded that the interface between science and public health policy and the important role that scientific assessments play in this interface are important issues and challenges. It seems obvious to give assessment primacy in programmes that are at the interface between science and public policy. It does not necessarily mean that exposure assessments or assessments from epidemiology or toxicology should be the primary focus of such programmes, but rather that they should play the key role in influencing science-policy decisions in programmes that are intended to inform the public policy process.

In this regard, PINCHE has recognized and cited evidence in its WP6 report that the acquisition of and handling of scientific environmental health data may be culturally biased by the needs of the institution handling the data and making representations about its meaning. This is the key area of argument in the case of science and policy. For example, the UK 'mad cow disease' science-policy interface was later shown to be both wrong (children died) and biased by the exclusion of independent scientists from the policy advice committee. The example studied in PINCHE was the transposition of the science of trichloroethylene carcinogenicity [4–6] into policy, and in this case independent examination of the process showed clearly the alarming uncertainty introduced by the various scientific players and organizations involved, who were from industry, academia and governments and were pulling in different directions through different interpretations of the same data.

PINCHE, for this reason, developed a recommendation that scientific advice committees on specific exposure questions be set up at the beginning as discursive or oppositional committees, with institutional funding to include independent scientists to examine issues of environmental health. Reports of these committees' discussions would include all sides of issues where there is some argument as to the health consequences of policies involving these substances or processes. It would then be for the policy makers to decide on the safety of the process that was being suggested or the exposure that was being investigated. Thus, the many stages in the science policy sequence would be available for examination if

later anything went wrong. This is PINCHE's main recommendation in this area.

In line with this, PINCHE believed that there should be some method implemented such that retrospective epidemiological analysis can be easily accomplished; the simple recommendation was to 'flag' the medical records of children living near environmental pollution hotspots, so we can see who have been exposed when, at a later stage in life, they show health effects. This discussion should deal with the ethical issues as well as with the practical side of such registrations.

Traditionally, research data from adult humans or animals have been used as a basis for development of policies. In risk assessment children have usually not been included. The special vulnerabilities in some hazards and children's specific exposure patterns have not been considered adequately. It is recommended to include children specifically in risk assessments if these are part of the science policy process. In this process the limitations of the role of interpretation of scientific data should be made clear.

Education and awareness raising

There is a whole set of recommendations on an educational level on chemical, biological and physical hazards. It is foreseen that recommendations on educational programmes will be fitted according to specific hazards in certain settings or locations. The ongoing awareness at different levels of authorities on the advantages of making data and information available to the general public needs to be translated into practical mechanisms to achieve this. The confrontation between striving for short term political solutions, and the long term process of behaviour change through health promotion and education, should be solved. This can be done partly by local investment of health education seminars and local expert workshops for dissemination of vital health information.

The relation between health and environment needs to be better incorporated in all kinds of training and education.

Data availability and accessibility

Several organizations and meetings related to children's health and environment have stated recommendations to improve the use of data to underpin policies. The access to reliable scientific data is often difficult to achieve. Also, in the PINCHE project, access to the studies under EU funding was in many cases difficult to accomplish. In most cases this was due to the fact that the outcomes of projects are used for dissemination via scientific journals. These journals have a delay of publication which can run over one or two years. Scientists and their funding organizations should be aware of this delay effect and strive for other, quicker ways of publications of results.

Access to medical and environmental hazards records is essential for monitoring of the health status of populations and for research on the causes and mechanisms of childhood carcinogens, neurotoxicants, respiratory health hazards, noise and other themes. Concerns about data protection and confidentiality may be impeding monitoring and research. Formal guidelines on interpretation and implementation of current legislation, taking account of the needs of public health research in general and childhood environmental health research in particular, are needed at EU level.

Dissemination of data on daily impact on children by environmental hazards is needed by (public) health professionals, policy makers and the general public. Refraining from spreading the data causes delay in addressing emerging problems.

The EU requires a certain level of systematic approach to the interpretation of research results. It is a challenge to develop such an approach.

Progress regarding protection of children will only be possible if scientists and authorities speak the same language. To reach this goal a harmonization of definitions and methods used is mandatory. This includes (working) definitions of neurodevelopmental disorders, epidemiological collectives and methods used, biomonitoring matrices, and biomonitoring parameters.

There is a need for harmonization of data. Cancer data are usually presented in terms of their primary site, e.g. breast cancer, lung cancer, and colon cancer. While this is broadly satisfactory for most adult onset cancers, which are mainly carcinomas, it is inappropriate for cancers in children in whom carcinomas are rare. Data on cancers in children and young people should be presented mainly in terms of morphology. It is important for comparing results on an international basis that a standard format for defining diagnostic groups and presentation of data is adopted.

Data accessibility should be improved to facilitate research on small numbers within a population. Data for cluster research should be available at a level of approximately 500 adult persons in the population. Formal guidelines on interpretation and implementation of current legislation and on ethical issues are needed at EU level.

Capacity building and training

Several regions in Europe are lacking the expertise in the field of coping with environment and health problems. The medical profession lacks specific knowledge on children's vulnerability in relation to

environmental hazards. However, training should not only direct paediatricians, general practitioners, and nurses, but also school teachers, journalists, lawyers, industrial key players, policy advisers and policy makers at local, regional and national level.

The establishing of Paediatric Environmental Speciality Units, such as in the USA and Spain, could serve as an example of building capacity in a group of important stakeholders.

Compounds per theme air pollutants, noise, carcinogens and neurotoxicants

A challenge in PINCHE was to identify the environmental stressors with the highest priority for action. The priorities in PINCHE are attempting to focus on the most important issues. It was not always possible to reach unanimously the same qualification for prioritizing the recommendations. For communications purposes a classification of low, medium or high priority was used. The level of proof for the contribution by some compounds to the burden of disease was one of the factors which influenced the priority setting. There was common agreement that all of the issues discussed were important. The discussion was more about the timing of taking action or the amount of urgency to deal with certain problems. Thus, there are children's environmental health problems that might receive higher priority in the near future. The partners in PINCHE sometimes had different priorities for brominated flame retardants, lead, PCBs, dioxins, ionizing radiation and some of the noise sources, such as discothèques.

There was immediate agreement on giving high priorities to the reduction of exposure to outdoor air pollutants and environmental tobacco smoke. For the heavy metals, the halogenated compounds (dioxins, PCBs, brominated flame retardants) and ionizing radiation there were different opinions on whether exposures to these stressors should be rated medium or high.

PINCHE concludes that reducing exposure to most of the air pollutants related to motor vehicle transport, including benzene, diesel engine emissions, nitrogen oxides and particulate matter, has the highest priority in protecting children's environment and health. Exposure to these outdoor air pollutants is high in most areas of Europe and causes serious health effects. Reducing exposure to environmental tobacco smoke, a fully preventable exposure, also has high priority because of high exposure and serious health effects.

The priority of reducing allergic symptoms is considered to be medium to high, because allergens are ubiquitous and millions of children in Europe are sensitized to allergens. Exposure of sensitized children to allergens greatly affects their daily performance.

PINCHE further concludes that reduction of exposure to ozone, another outdoor air pollutant, has medium priority. It is of specific importance for a susceptible group of children, those with asthma, in relation to outdoor activities. Reducing exposure to polycyclic aromatic hydrocarbons, which mainly originate from motor vehicle emissions and smoking, has medium priority; it can negatively influence the development of the foetus. Furthermore, exposure to the metals arsenic, lead, cadmium and mercury has a medium to high priority for action. Exposure to these metals has decreased, but some sources or settings still cause enough exposure to produce severe health effects.

Indoor exposure to mould, radon, formaldehyde and other volatile organic compounds (which also occurs outdoors, but indoor concentrations can reach especially high levels) also has medium priority for action. For each of these stressors, situations can be identified in which children can be exposed to high concentrations. Relevant indoor levels can cause adverse health effects.

Exposure to PCBs and dioxins has decreased but is now stabilizing, and current exposure levels can still cause some health effects; the priority is therefore medium. The concentration of brominated flame retardants required to produce health effects is not known, but concern is raised because of their toxic similarities to some persistent organic pollutants and their abundance. In addition, the levels of brominated flame retardants have increased rapidly in recent decades. The priority is medium, based on the precautionary principle, since more research is required.

Reducing exposure to noise at schools and from road traffic as well as 'voluntary' exposure to noise from personal audio players and to noise in discothèques also has medium priority. This exposure can lead to cognitive and auditory effects.

Reducing exposure to ionizing radiation from human-made sources has a medium priority, because this exposure might lead to additional cases of cancer, but the beneficial effects of therapy and diagnostics might outweigh the harm of these sources. Furthermore, reducing exposure to solar radiation has medium priority. Reducing exposure is very important because of the relationship with skin cancer. Especially acute sunburn should be prevented. Nevertheless, the vitamin D produced through exposure to sunlight is important, and a shortage of sunlight should therefore be avoided as well.

Finally, reducing exposure to pesticides is rated to have medium priority. This is because of the major differences in the use of pesticides, and thus children's exposure to pesticides, in different regions in Europe. Exposure to pesticides in countries with pesticide-intensive farming (often small-scale farming) may be

high because, for example, the parents take pesticides home with them on their clothes, and this exposure may cause negative health effects in children.

Based upon the information available, the other risk factors have all been rated to have a low priority. It must be noted, however, that near certain hotspots or in certain regions some of these compounds can have a high priority.

Discussion

The role of PINCHE and its results can be viewed against the different types of scientific knowledge that are important to discern in relation to the policy field – monitoring, direct policy advice, strategic knowledge and policy evaluation.

Monitoring is a method which is applied in the phase of policy implementation. The method is meant to judge and care for the progress of the implementation process. In addition, it provides insight into the consequences of the ongoing policies and its efficiency. In the field of children's environmental health there is a lack of monitoring. The PINCHE recommendations point at the development of monitoring systems which will include environment and health indicators in Europe. The scientific community is currently developing such systems. It would be promising to make links to the clinical monitoring systems in order to look for trends of new emerging diseases in children.

The direct policy advice deals with the relation between environmental stressors and children's health. PINCHE provided for a range of environmental stressors recommendations to reduce exposure for children. Even when exposure reduction is not always linked to improved health in the short term, it will at least reduce the body burden of accumulating chemicals in children. The EU and WHO have stated in several reports that exposure reduction is a way to comply with precautionary principle to avoid diseases in children. PINCHE underlines this approach by prioritizing some compounds to which children are exposed.

Strategic knowledge is used to improve health in the long term. There are strategic choices to reduce exposure of children to compounds by changing production techniques or by increasing the distance of child-specific settings to sources, such as highways or industrial sites. The scientific knowledge needs to be strong to stand in the political arena when long term changes are needed.

Policy evaluation is a tool to check the efficiency and effectiveness of implemented policies. This includes the evaluation of the process of reaching the goals of certain policies.

The contribution of all players in the production, distribution and use of scientific knowledge in the field of children's environmental health is necessary. PINCHE had such cooperation. That PINCHE reached consensus for most of the recommendations strengthens the results of the project. Radiation and some industrial bulk compounds were topics which lost some power owing to the fact that the scientific results were not all pointing in the same direction or not yet conclusive enough. In those cases it is recommended to carry out more research and avoid extra unnecessary exposure according to the precautionary principle.

The interaction between chemicals and multiple exposure is an issue that needs to be researched more, as there might be unknown effects and children might be more susceptible in situations of multiple exposure.

References

[1] European Commission. On the Sixth Environment Action Programme of the European Community – Environment 2010: our future, our choice. Brussels, European Commission, 2002.

[2] European Commission. The European Environment and Health Action Plan 2004–2010. Brussels, European Commission, 2003.

[3] European Commission. Communication from the Commission on the collection and use of expertise by the Commission: Principle and Guidelines. 'Improving the knowledge base for better policies'. COM 713 final.2002.

[4] Ruden C. Science and transscience in carcinogen risk assessment – the European Union regulatory process for trichloroethylene. J Toxicol Environ Health B Crit Rev 2003;6:257–77.

[5] Ruden C. Interpretations of primary carcinogenicity data in 29 trichloroethylene risk assessments. Toxicology 2001;169:209–25.

[6] Ruden C. The use of mechanistic data and the handling of scientific uncertainty in carcinogen risk assessments: the trichloroethylene example. Regul Toxicol Pharmacol 2002;35: 80–94.

[7] World Health Organization. Evaluation and Use of Epidemiological Evidence for Environmental Health Risk Assessment, EUR/00/5020369. 2000.