



A review of trends in health-impact assessment and the nature of the evidence used

Trends in
health-impact
assessment

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Abstract *Developments at all levels between project and policy have a potential impact on human health. Health-impact assessment (HIA) is a discipline that seeks to assess these impacts to safeguard and enhance human health. There is a growing consensus about the scope, methodology and context for HIA but there are also many unresolved issues. This paper reviews the main trends as they vary between the healthy public policy, environmental assessment and environmental epidemiology communities; and between retrospective and prospective, developed and developing economies and urban/industrial versus rural settings. There are unresolved issues associated with the nature of evidence, the link with economic appraisal, and with the core biophysical and social health determinants. The nature of the evidence used is examined and some resolutions are proposed. The growing number of guidelines testify to a demand by development agencies for HIA, but increased consensus is required to ensure that quality assessments are delivered.*

Introduction

The case can be made that one of the first health-impact assessments in the world was published in 1842, entitled "An inquiry into the sanitary condition of the labouring population of Great Britain" (Hamlin, 1998; Hennock, 2000). Then, as now, an intense debate was underway between those concerned with the physical environment and those concerned with the socio-economic environment as the principle determinants of morbidity, mortality and well-being. People were migrating in large numbers from the countryside to the towns, where new factories had been established. An unfettered free market ensured that labour was sold at the lowest possible price. Adults and children were working more than ten hours per day in appalling conditions and then returning, exhausted and starving, to squalid and overcrowded housing without waste disposal or clean water. Epidemics of cholera, typhoid, typhus and other communicable diseases were common. The state recognised a duty of support to the sick and the destitute but without distorting the labour market. Reformers among a uniting medical profession recognised poverty and overwork as key

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determinants of health, but this was politically unacceptable. Others, including Chadwick, focussed on the filthy physical environment and this was politically popular. That is our legacy and may explain, for example, the pre-eminence of environmental impact assessment over health-impact assessment.

There are currently three main strands of debate around health-impact assessment. One strand concerns healthy public policy, a subject of debate in the world of public health for many years. It has been recognised that government policies at local, national and international levels have impacts on human health. Once this is accepted, it is natural to ask whether a new policy can be assessed prospectively for its impact on health. Proponents of this view are also especially concerned with distributional effects. A large body of recent evidence has demonstrated that even in the most developed economies there is a sharp gradient in health status associated with socio-economic position. A similar body of evidence is not available for developing economies. However, there is a sharp gradient in health status associated with gross national product per capita between countries (World Bank, 1993; Wilkinson, 1996; Acheson *et al.*, 1998; Wilkinson and Marmot, 1998).

The second strand views health-impact assessment as a progression from risk assessment and environmental epidemiology (World Health Organization, 1999). Quantification is emphasised. A broad view of health impacts is narrowed in favour of scientific accuracy, and the analysis is often retrospective. Retrospective assessment is important because it contributes to the knowledge base, but it is fundamentally different to prospective assessment.

The third strand of health-impact assessment arises from the environmental impact assessment of projects and programmes. In most countries, new projects are subject to a planning procedure that includes an assessment of unintended impacts. Environmental impacts have received most attention. Social impacts have received some attention. The assessment of health impacts has lagged behind. The relative importance that has been attached to physical environmental impacts in contrast to social impacts is particularly worthy of note. It is sometimes assumed that a social impact assessment captures all the relevant health issues. It is sometimes referred to as environmental health-impact assessment (EHIA).

These strands arise from the different traditions of environmental and public health. It has been suggested that public health emphasises health promotion while environmental health emphasises exposure reduction (World Bank, n.d.).

A separate question is whether the health-impact assessment should be carried out by the community or by a specialist, or by both. Those who approach the subject from a more technical background may assume that the assessment belongs in the domain of the specialist. Those interested in healthy public policy may assume that empowering the community to undertake an impact assessment is beneficial in itself. If a specialist is to be involved, the question arises as to whether that specialist should be primarily in the health

sector or not. If it is accepted that most of the important decisions that affect health are made by project proponents that lie outside the health sector, then the principle interest lies among non-health specialists. However, those within the public health domain are naturally uncertain about relinquishing their special expertise to other sectors. A related question is whether health assessment should be integrated with environmental assessment, or it should be a separate and parallel activity. Members of the first strand appear to be opting for separation. Members of the third strand tend to advocate integration. Members of the second strand focus on the science.

This paper offers a brief review of trends in the applied aspects of health-impact assessment, represented by guidelines and handbooks. Current concerns include:

- What is a guideline or handbook?
- How can health-impact assessment respond to economic issues?
- What kind of legislation is required?
- How can diverse forms of evidence be handled?
- How can health issues be prioritised?
- Can the healthy public policy tradition be integrated with the environmental impact assessment tradition?
- Are there any intrinsic differences between developing and developed economies in relation to health-impact assessment?
- What procedures and capacity building are needed? Procedures are systems for specifying who should do what, when and why. Capacity building consists of training courses, case studies and empowerment of government officers.
- Can HIA become an objective, evidence-based, scientifically verifiable activity susceptible to systematic review?

A broad definition of health will be used, consistent with the World Health Organisation. Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. It is a resource for everyday life, not the object of living. It is a positive concept, emphasising social and personal resources as well as physical capabilities.

This paper is about prospective, rather than retrospective, assessment of policies, programmes and projects that are at the planning stage. The plans usually lie outside the health sector and do not usually include health as an explicit objective. The proponents are not health specialists and may be unaware that the decisions they make can affect human health. No distinction is made between health-impact assessment and environmental health-impact assessment, as this appears to be purely political.

Guidelines and handbooks

There are a number of guidelines or handbooks in print or in draft about health-impact assessment (see Table I). These terms define short and concise documents intended to advise on how something should be done or the most important and useful information about a subject (Cambridge, 2000). They are different to textbooks, edited books or scholarly papers. The difference lies in the degree of integration between sections, the absence of repetition, the cross-referencing and the length. A number of the current drafts do not fulfil this definition (Health Canada, 1999; World Bank, n.d.). However, they were undergoing revision at the time of writing.

Many environmental impact assessment guidelines make little or no reference to human health. A typical example is the Department for International Development (1999) *Environmental Guide*. However, some recent DFID-funded research projects have explicitly included health-impact assessment components such as the conservation of floodplains and wetlands, and peri-urban natural resource development (Birley and Lock, 1999).

The existing guidelines and handbooks are either for developing or developed economies (see Table I). From a health perspective, the distinction can be summarised in the epidemiological or risk transition. The main burden of ill health in developing economies arises from the “traditional” diseases. These are largely communicable or associated with under-nutrition. By contrast, the main burden of ill health in developed economies arises from the “modern” diseases. These are largely non-communicable, associated with over-nutrition, or psychosocial (Birley and Lock, 1999).

National guidelines in developed economies may have statutory status, but seem to be largely advisory. Current examples include Sweden (Landstingsförbundet and Svenska Kommunförbundet, 1998), Canada (Health Canada, 1999), New Zealand (Public Health Commission, 1995), Australia (Ewan *et al.*, 1992) and Wales (Health Promotion Division, 1999). A resource book and a Merseyside Guidelines have been published in England (Scott-Samuel *et al.*, 1998; NHS Executive, 2000).

Canada

The Canadian handbook was intended to assist health professionals in providing health advice in an EIA process, and to provide a tool for EIA practitioners, who are not experts in health, to understand the areas of expertise and roles of health professionals (Health Canada, 1999). It was based on existing understanding of the determinants of health and gave equal weight to social and biophysical factors. It was intended for the Canadian, developed economy but the presence of an aboriginal community provided important links with the problems of a developing economy, including concepts of value, health and traditional knowledge. An intriguing example concerned hydropower, because of the presence of ethnic minorities in the vast and remote rural districts where reservoirs can be constructed. A recent summary paints a picture of rapid social change and conflict among aboriginal peoples affected

Organisation	Reference	Length	Audience	Level	Economic development
World Bank affiliated	Listorti (1996), World Bank (n.d.)	Long	Bank staff	Programme	Developing
European Centre for Health Policy, WHO	European Centre for Health Policy (1999)	Short	Public health community	Policy	Developed
Health Canada	Health Canada (1999)	Very long	Health and EIA practitioners	Projects	Developed plus aboriginal issues
Asian Development Bank	Birley and Peralta (1992)	Long	Bank staff	Project	Developing
WHO	Birley (1991)	Medium	Water resource specialists	Project	Developing
DFID/NRI	Birley and Lock (1999)	Long	Natural resource specialists	Project	Developing
World Bank	Birley <i>et al.</i> (1997)	Very short	Bank staff	Project	Developing
Merseyside HIA group	Scott-Samuel <i>et al.</i> (1998)	Very short	Public health practitioners	All	Developed
Welsh National Assembly	Health Promotion Division (1999)	Short	Policy and decision makers	Policy and project	Developed
Federation of Swedish County Councils and Local Authorities	Landstingsförbundet and Svenska Kommunförbundet (1998)	Short	Public health, politicians, communities	Policy and project	Developed
Philippines Department of Health	Philippine Environmental Health Services (1997)	Short	–	Policy and project	Developing
WHO/Eastern Mediterranean Region and Liverpool School of Tropical Medicine	Hassan and Birley (1999), Hassan <i>et al.</i> (n.d.)	Medium	Environment and environmental health officers	Project	Developing

Table I.
Summary of documents
reviewed

(Senécal and Égré, 1999). The organic material in the reservoirs initiated a chemical reaction that leached mercury from the underlying rock. The mercury accumulated in the food chain and reached unacceptable concentrations in the fish stocks on which the community depended for subsistence. The mercury changed a biophysical health determinant and social health determinants associated with food choices and belief in the safety of food choices. Mitigation measures included distributing frozen fish as a substitute. From one perspective, frozen fish are a substitute for the wild fish caught by subsistence hunter-gatherers, but they also devalued the people affected and caused anger and resentment.

A discussion of values in the Canadian handbook provides important links with the problem of economic analysis. The purpose of impact assessment was defined as ensuring that the project contributed something of value to those impacted. Values were differentiated into core and use values. Core values included good health, employment and protection of food sources. Use values concerned the means to achieve core values. For example, a project that creates jobs has a use value because it provides employment. Use values included: instrumental, absence and symbolic. Instrumental values can usually be monetized, e.g. a tool has instrumental value because of what it can do. Absence values are often recognised when something is lost, e.g. health or biodiversity. It is suggested that symbolic value cannot be satisfactorily replaced by something that has equivalent monetary value.

The Canadian handbook bridged the debate between healthy public policy and the inclusion of health in environmental assessment. In Canada the debate seems to have been led by the public health community, and HIA is frequently discussed as a policy rather than project-oriented approach (Institute of Health Promotion Research, 1999). Banken (1999) has discussed the inclusion of social determinants of health in environmental assessments and linked this to health promotion. The debate included the measurement of quantifiable indicators of population health (Hancock *et al.*, 1999). The elements to be measured have been succinctly described as:

- the aggregate of individual death, disease, disability and health status (the population health outcomes);
- the pattern of distribution of these outcomes across the community;
- the indicators of health determinants;
- the distribution of health determinants across the community; and
- the quality of governance including participation, cohesion and power distribution.

The debate also concerned the nature of health determinants. Kahan and Goodstadt (1999) surveyed key decision makers and sought consensus on the determinants of health and the manner by which they could be changed. Gillis (1999) initiated a community process that indicated the key health determinants included:

- jobs and employment opportunities;
- healthy child development;
- life-long learning;
- lifestyle practices;
- physical environment;
- safety and security;
- social support;
- stable incomes;
- health services;
- communication;
- community involvement;
- local control;
- leadership development;
- confidence in community;
- co-operation;
- spirituality; and
- respect for culture and history.

Another strand of the Canadian debate was a discussion paper on the integration of health in environmental assessment (Davies and Sadler, 1997). The paper emphasised the benefits of including health in environmental assessment, but noted that health can only be incorporated if the health advocate respects established procedures and requirements, including limits on time, resources or assessment approaches. The authors suggested that, as elsewhere, there were few administrative imperatives, no penalties, health was included on an *ad hoc* basis depending on moral persuasion and public concern, there was little agreement on the scope of the health issues that should be addressed and little consistency in approaches and procedures.

England and Wales

Guidelines were published by the Merseyside group in 1998 (Scott-Samuel *et al.*, 1998) and drew on both the public health policy and EHIA trend. The guidelines were intended as a work in progress that provided one possible model of health-impact assessment. It represented a consensus on the importance of distinguishing between procedures and methods, and a flow chart was produced that illustrated the difference.

A Welsh health-promotion paper discussed the merits of integrating environmental and health-impact assessment (Health Promotion Division, 1999). It suggested that the case for combining them was strongest in the context of development projects and weakest in the context of policy decisions.

Sweden

A report by the Federation of Swedish County Councils and the Association of Swedish Local Authorities considered how health-impact assessment could be incorporated into healthy public policy (Landstingsförbundet and Svenska Kommunförbundet, 1998). It assumed that public health specialists in collaboration with local politicians and affected communities would carry out health-impact assessment. Health was defined in terms of perception of wellbeing (health as an end) and capacity to act (health as a means). The report suggested that a model that supposed that a policy measure influences risk factors that influence disease and injury is too simplistic. The model needed to be expanded to include the social environment. Particular emphasis was given to social inequality.

Australia and New Zealand

A national framework document for health-impact assessment in environmental impact assessment was published in Australia as part of the National Better Health Program (Ewan *et al.*, 1992). This concluded that an environmental health-impact assessment process was essential but that existing procedures, resources, knowledge and skills were inadequate. It focussed on non-communicable diseases associated with pollution. It described the administrative context, the processes required and the resources needed. It established principles, tasks and responsibilities for public health authorities, assessing authorities, project proponents, the public and government. It paid particular attention to risk analysis and risk communication, defining risk as a socially constructed phenomenon rather than a technical and objective property of a hazard. An implementation guideline was published for public consultation in June 2000 (Environmental Health Council, 2000).

In 1995, the New Zealand Public Health Commission published a guide to health-impact assessment (Public Health Commission, 1995). This provided a framework for resource management issues that had a potential impact on health. It established principles and processes for identifying health hazards arising from proposed resource management policies, plans or consent applications; and identified roles and responsibilities and sources of information. Implementation has varied with the political climate but an active debate has continued (Morgan, 1998).

Developing economies

Guidelines for developing economies are often written by international donor or lender organisations and are intended to help with project-approval procedures. Examples include the Asian Development Bank (Birley and Peralta, 1992) and a World Bank update (Birley *et al.*, 1997). An exception is the Philippine National Framework (Philippine Environmental Health Services, 1997). Guidelines are also written by UN agencies and academic institutions as advisory tools (Birley, 1991, 1995; World Health Organisation, 1999).

World Bank's draft environmental health-impact assessment guidelines

The African regional office of the World Bank is engaged in a long-term project to link environment and health in sub-Saharan Africa. The overall name of this project is "Environment and health – bridging the gaps". The first phase was published in 1996 (Listorti, 1996). The second phase was a draft in five volumes in June 2000 (World Bank, n.d.). The author kindly permitted us sight of these drafts for inclusion in the current paper.

The main objectives of the project were to: tap health benefits systematically outside the health sector; include mainstream environmental health into World Bank operations; and help overcome the institutional difficulties that might arise. The report described environment-health linkages and their impacts, and proposed solutions. The main audience for the guideline was assumed to be non-health specialists such as task managers. Some health issues were specifically not included, such as mental illness.

A new approach to environmental health was proposed because many causes of ill-health lie outside the purview of the health-care system. Two contrary trends were identified: emphasis on single disease-control measures and neglect of health impacts of infrastructure development. One problem was identified as the dispersal of environmental health management among several agencies that did not traditionally collaborate. It is suggested that environmental health problems tended to be multi-sectoral and required multi-sectoral solutions. The main problems to achieving multi-sectoral decision making were identified as: insufficient procedures, inadequate budget, lack of data, lack of suitable technical solutions, lack of attention to the wider picture, inadvertent professional bias and inadequate health-personnel input. An example of bias was the priority accorded to outdoor air pollution over indoor air pollution. The paper listed an impressive set of development activities in which health specialists were not consulted. It suggested that the economic benefit of including health in infrastructure projects had not been properly evaluated and it provided some estimates of the DALY savings that may be possible.

The World Bank has also issued an update to its operational procedure for environmental assessment (4.01) but references to health remain minimal (World Bank, 2000). An update to its environmental sourcebook did include health (Birley *et al.*, 1997). The World Bank also held a workshop during 1999 to consider how infrastructure projects could affect the incidence of malaria. The workshop concluded there was a need for health-impact assessment. The proceedings were posted at www.liv.ac.uk/~mhb

The Philippines

The legislative basis for environmental impact assessment in the Philippines was enacted in 1978 (Philippine Environmental Health Services, 1997). In the course of implementation, it became clear that health was not receiving adequate attention. For example, there were no health specialists among the EIA review committee's pool of specialists. During the 1990s, an interagency

collaboration between the Department of Health and the Department for the Environment and Natural Resources was supported by the World Health Organisation. The rationale for environmental human health-impact assessment was linked to sustainable development.

The report emphasised distinctions between direct and indirect health determinants and outcomes. Direct health outcomes include acute and chronic poisoning, respiratory diseases, skin diseases, cancer and injuries. Indirect health outcomes include sexually transmitted infections, psychosocial dysfunction, alcohol and substance abuse, malnutrition and violence. The indirect health determinants were defined as factors that determined accessibility to factors that had direct health impact. Examples included water supply and sanitation, access roads, increased income, electricity and public health services.

The principles for screening projects for assessment were listed as: health-sensitive project components and health-sensitive project locations. The report drew on earlier guidelines prepared for the Asian Development Bank (Birley and Peralta, 1992) to categorise health determinants, or risk factors. It included the concept of evaluating the capabilities of various service providers. It distinguished qualitative and quantitative health risk assessment and proposed a system of prioritisation, with five ranks ranging from slight injury through to multiple fatalities. Environmental pollutants and hazardous chemicals, or physical rather than social determinants, were emphasised. It proposed an incident potential rating system, based on the historical incidence of adverse effects from projects of a particular type. It proposed an exposure rating ranging from “exposures are negligible” through to “exposures are excessive and will almost certainly result in health damage to workers or residents”. These indices were combined in a matrix associating degree of harm with degree of exposure.

Control measures were grouped as engineering controls, administrative controls, personal protective equipment and community strategies. It also discussed consequence recovery for mitigating measures including: first-aid programmes; medical emergency response strategies; community emergency and disaster plans; communication and warning strategies; and options for community rehabilitation and relocation in the event of a disaster. It discussed health surveillance, evaluation and monitoring plans. It included policies as well as projects and retrospective as well as prospective HIA.

World Health Organisation – general

The WHO HEADLAMP project on environment-health linkages focused on the physical environment and especially pollution (World Health Organisation, 1997). It proposed a five-level model: driving forces, pressures, states, exposures and effects. Driving forces create the conditions in which environmental health hazards develop. They include policies, technological developments and population growth. These impose pressures on the environment, including waste materials and pollutants. The pressures lead to

changes in the state of environment such as changes in land use and accumulation of chemicals in air, soil, water or plants. Exposure refers to the interaction between people and environmental hazards. A dose-response model was assumed. Health effects occur when exposure interacts with genetic factors, nutrition, lifestyle and other health determinants. The model objective was to find actions to safeguard or promote health at each of the five different levels. For example, in the case of microbiological water contamination, the driving force is poverty and the action is associated with expenditure on water and sanitation improvements.

The model has been used to describe the links between environment and health rather than as a tool for assessing new policies, programmes or projects. It is not a guideline on EHIA, but it is a potentially important component of an EHIA method.

WHO's submission to the World Commission on Dams advocated HIA, including capacity building and inter-sectoral arrangements (World Health Organisation, 2000). The method of HIA described closely follows previous publications (Birley, 1991, 1995; Birley and Lock, 1999), with innovations based on the deliberations of the expert committee associated with the submission.

World Health Organisation – regional initiatives

Many of the regional offices of WHO are currently producing draft guidelines including Europe, Africa and the eastern Mediterranean. Other regions are planning such documents, including Pan American Health Organization and South East Asia. An inter-regional conference was planned to co-ordinate these documents.

Both healthy public policy and health in EIA are actively debated in Europe. The European Centre for Health Policy, WHO Europe, carried out an e-mail conference during 1999 in order to establish a consensus about the nature of HIA (European Centre for Health Policy, 1999). The paper proposes the following set of values:

- democracy – the right of people to participate in the assessment of policies that affect their lives;
- equity – the need to assess the distribution of impacts across different community groups;
- sustainable development – emphasising both the short- and long-time scale of impacts; and
- ethical use of evidence – the rigorous use of both qualitative and quantitative evidence based on different scientific disciplines to get the most comprehensive assessment possible.

The proponents of including health in EIA have promoted work on chemical safety and transport policy. Most recently, a general environmental health-impact assessment guideline was commissioned and drafted. It focused on the accession countries of eastern Europe and linked with National Environmental

Health Action Plans (NEHAPs). It built on several earlier initiatives (Birley *et al.*, 1997; Davies and Sadler, 1997; Birley *et al.*, 1998).

The African regional office initiated an EHIA project during 1999. A guideline was planned but a discussion followed about whether there was a plethora of guidelines and suggested that a process of capacity building and institutionalisation was more important (Birley, 2000).

A draft guideline on environmental health-impact assessment for the eastern Mediterranean region is nearing completion (Hassan and Birley, 1999; Hassan *et al.*, n.d.). It was based on a series of needs assessments, workshops and country seminars. The audience was primarily decision makers concerned with the assessment and management of environmental health impacts of development projects in the region. The guideline distinguished policy, procedure and method. The method was based on Birley (1995, 1999). Many countries of the region were in transition from a traditional pattern of morbidity and mortality to an industrial pattern, and from a rural to an urbanised environment. Water was often a primary constraint, and the re-use of waste water was often an important development activity.

The various structural difficulties to implementation of HIA were illustrated. For example, environment protection agencies sometimes undermined rather than strengthened the role of the Ministry of Health with regard to environmental health. The Ministries of Health often seemed to have an inward-looking orientation, with little participation in the decisions of other sectors. Suggestions for policy resolution included adopting the principle that economic development should not create ill health, in other words a healthy public policy.

A case study was included based on fieldwork in Syria. Important causes of traditional morbidity were identified as diarrhoea and acute respiratory infection in children. The diarrhoea was believed to be associated with waste-water irrigation of fruits and vegetables. Summer epidemics of cholera were common. The acute respiratory infection was believed to be associated with indoor and outdoor air pollution and overcrowding. An initial estimate was made of the costs of the traditional environmental diseases as \$205 million per annum. The modern environmental diseases included lead poisoning and pesticide poisoning. Information was limited but suggested that blood lead concentrations were higher in the city than in the countryside. Pesticide poisoning was largely due to occupational exposure. An initial estimate was made of the cost of these modern diseases of \$1.75 million per annum. Many approximations were made to derive these figures, and lack of reporting by private medical practitioners was a source of error, as elsewhere.

A critical review of environmental impact assessment in the eastern Mediterranean region was made from a health perspective, based on 741 environmental permit applications and responses. All the proponents were from the private sector, despite the fact that the government projects were numerically greater. Almost all projects were located in the capital city and surrounding areas and were for small-scale industries. Protection of human

health seemed to be the primary concern behind the mitigation measures proposed in the environmental permits that were awarded, but most of the health-mitigation measures were very general. For example, the emission of pollutants should not exceed established thresholds but the permits did not indicate what those thresholds were or how to find them. The mitigation measures were typically established to prevent health risks occurring under normal working conditions rather than from accidents. Enforcement, monitoring and compliance were not discussed. The concept of health risks was biased towards non-communicable diseases. For example, there was no mention of the hygienic conditions required during the food production process. Child labour and gender problems received scant attention. There were poor links between relevant government agencies. Underlying problems included lack of resources and training for the staff conducting environmental assessment and a lack of inter-sectoral mechanisms.

Methods of HIA

Prospective HIA uses a model of causality in which projects and policies change the determinants of health and this, in turn, changes health outcomes. The determinants of health can be grouped into three main categories referred to as individual/family, environmental and institutional. There are many determinants within each category and they are more or less equally distributed between the bio-physical and the social. The link between health outcomes and health determinants is complex and multi-factorial. There may be substantial time lags, feedback and an absence of known parametric functional relationships between cause and effect. One response to this uncertainty is to focus the assessment on the determinants of health rather than the health outcomes. The assessment must weigh the evidence regarding the likely changes in health determinants and then provide a reasoned argument as to whether the net effect of these changes will be beneficial or detrimental to the health of specified community groups. The reasoned argument is used in negotiations with the project or policy proponents in order to agree, finance and implement changes to project design, operation and maintenance that are health promoting.

Evidence

Many different kinds of evidence must be used. These include, but are not limited to, scientific evidence. Other evidence may be derived from key informants or unpublished reports. The evidence used in health-impact assessment may be incomplete, inconclusive, imprecise, not completely credible, biased or uncertain. It has much in common with legal evidence (Schum, 1998).

From an epistemological viewpoint, an assessment establishes justifiable belief in the evidence (Audi, 1998). Justifiable belief depends on sources of information. Direct sources of information include perception, memory and reason. A less direct but equally important source of information is the

testimony of other people. Evidence acquired through testimony has two components: the testimony itself and the credentials and credibility of the informant. The rapporteur must provide justification that the testimony is credible. In the case of published scientific evidence, the justification may be the citation itself. When evidence comes from a key informant, it is necessary to establish the objectivity, veracity and observational sensitivity of the informant (Schum, 1998). This includes the credentials of the informant and the nature of the association between the informant and the topic. The credibility of the informant is based on competence and sincerity.

The evidence itself has the properties of inferential force, relevance and credibility. The force of evidence is dependent on individual judgement. Evidence is relevant if it makes the existence of a material fact more or less probable. Relevant evidence may be:

- direct – leads straight to a conclusion;
- circumstantial – provides a step towards a conclusion;
- ancillary – supports or refutes the strength of other evidence.

Establishing the credibility of evidence is the first step in legal argument. Credible evidence may be:

- tangible – open to direct inspection;
- authoritative – accepted as originating from an unbiased source such as a textbook; and
- testimonial – asserted by a key informant (“witness”).

Legal evidence can be dissonant or harmonious. Dissonant evidence may be conflicting or contradictory. Harmonious evidence may be convergent or corroborative. The legal model functions by expressing the possible conclusions as alternatives. In the case of HIA, the alternative conclusions are that a policy, programme, plan, or project has:

- no or little impact on health and no action is required;
- negative impact on health and action is required; and
- positive impact on health and action may be required.

In the legal model, the conclusion is reached by establishing the truth of penultimate probanda. In the case of HIA, these would be the three principal categories of health determinants, expressed as questions. Is the proposed policy, programme, plan or project likely to change:

- Individual/family health determinants in such a way as to increase or decrease the vulnerability of a community?
- Physical, social, or economic health determinants in such a way as to change the exposure of the vulnerable community to hazards?

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- Institutional health determinants in such a way as to increase or decrease the ability of health-protection services to protect the vulnerable community?

The answer to these questions, in turn, depends on examination of the subsidiary health determinants. In this way, a chain of reasoning is constructed from changes associated with the policy, programme, plan or project to changes in health determinants, to likely changes in health outcomes.

A recent paper expressed concern about the validation of prospective assessments (Mcintyre and Petticrew, 1999). They may not be verifiable. The objective of prospective assessment is to make rational decisions under conditions of uncertainty by using available evidence in a constructive manner. The act of making the assessment probably changes the outcome. There is a counter-factual argument: the assessment causes changes to the project that produce a different outcome to the one “predicted”. This raises complex questions about the nature of research. In the context of the social determinants of health, Veenstra (1999) discusses three philosophical perspectives: positivist, interpretative and “critical”. The positivist approach assumes that there are natural laws governing the behaviour of large human groups and that these can be discovered through science. The interpretative approach supposes that the observer imposes meaning and values and that social reality varies between groups. The third approach seeks a middle ground and takes account of the purpose and assumptions of the researchers.

A recent WHO guideline on assessing epidemiological evidence suggested that the credibility of environmental health-risk assessment depended on the strength of scientific evidence (World Health Organization, 1999). The guideline focused on chemical hazards where there was a dose-response model and substantial opportunities for quantification. It emphasised that while epidemiological and other scientific evidence may not always be available, public health action must often be based on the precautionary principle. The guideline distinguished two distinct activities of health-risk assessment and referred to these as health-hazard characterisation and health-impact assessment. Health-hazard characterisation involved the identification of environmental hazards by the assembly, evaluation, and interpretation of available evidence from epidemiology and other scientific disciplines concerning the association between an environmental factor and human health. Health-impact assessment was considered to involve the quantification of the expected health burden due to environmental exposure in a specific population by combining exposure assessment, dose-response assessment and risk characterisation. The different usage of the term HIA was discussed.

Economics

The question of how to use health-impact assessments within the broader context of economic appraisal is far from being resolved (Birley *et al.*, 1998). Recent discussions about rural livelihoods suggested a new approach (Carney,

1998; Institute of Hydrology, n.d.). This assumed that there were five forms of capital asset available to communities and that a link could be established between changes in health determinants and changes in capital assets (see Table II). The utility of this model had yet to be determined.

Conclusion

The review of trends in health-impact assessment supported the following conclusions:

- There were different communities of researchers with little interaction.
- HIA appeared to be a voluntary activity almost everywhere. There was little or no regulation or legislation.
- There was growing consensus of how a project or policy can change health determinants and what core group of determinants should be assessed.
- The integration of HIA with economic appraisal required more work.

Type of capital and definition	Examples of associated health determinants
Natural capital: the natural resource stocks from which resource flows useful for livelihoods are derived	Environmental health determinants such as natural vector breeding sites, animal herds, drinking water sources and waste-water sinks, food supplies, distance of travel for wild food and fuel collection
Financial capital: the financial resources which are available to people and which provide them with different livelihood options	Treatment-seeking behaviour, medicine purchases, food security, purchasing barriers to infection, insurance, reserves to counter lost production associated with illness; remittances from outside
Physical capital: the basic infrastructure and the production equipment and means which enable people to pursue their livelihoods	Drinking water delivery, communication routes, health centres, man-made vector breeding sites, machinery, boats, diversionary structures, irrigation systems; housing quality
Human capital: the skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies	Good health, freedom from fear, pain and suffering, wellbeing, educational achievement, empowerment of women and minorities, capacity and capability of personnel in institutions responsible for protecting health including health centres; health-promoting knowledge, beliefs, attitudes and behaviours; seasonal work migration
Social capital: the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring co-ordinated actions	Conflicts over traditional water, wild foods and land rights leading to traumatic injury, malnutrition and uncertainty; distributional mechanisms

Table II.
Association of health determinants with five forms of capital in relation to rural development

- There were general properties of prospective HIA that applied independently of economic conditions, settings, or technical content.
- There were opportunities for developing the academic rigour of the discipline, as the discussion about evidence demonstrates.

The availability of a wide range of guidelines and handbooks testify to the growing importance attached to HIA by international development agencies and national governments.

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