This is a draft of a chapter that has been accepted for publication by Oxford University Press in the forthcoming book *Environmental assessment and health impact assessment* edited by van den Bosch M, Bird W due for publication in 2018. https://global.oup.com/academic

Vohra S, Orenstein M, Viliani F, Cave B, Harris-Roxas B, Silvain F. *Environmental assessment and health impact assessment*, in van den Bosch M, Bird W (eds) *Oxford Textbook of Nature and Public Health: The Role of Nature in Improving the Health of a Population*, Oxford University Press: Oxford, p 304-311, 2018.

Environmental and Health Impact Assessments

Salim Vohra, Marla Orenstein, Francesca Viliani, Ben Cave and Ben Harris-Roxas, Filipe Silva

What is an impact assessment

Impact assessment is the name given to a range of systematic approaches and methodologies that are used to predict the future consequences of a proposed project, programme, plan or policy on human populations, flora and fauna. These consequences can be both positive and negative; intended and unintended.

Impact assessments are usually conducted as part of a regulatory process in order to inform decision-making about whether the project, programme, plan or policy should be implemented or not. For example, if a new dam is being built to provide hydroelectric power to a distant city, an impact assessment will usually be required by government before the dam is permitted to be constructed. The assessment would identify the likely potential effects of the dam on local ecosystems - flora, fauna, air, water and soil - and on the social conditions, economic status and health of surrounding human populations.

The purpose of impact assessments is both to improve the design and implementation of new or revised proposals and to advise decision-makers and stakeholders on the potential effects so that they can make better-informed decisions. Impact assessments therefore include both characterising the potential effects and also recommending mitigation measures. These recommendations are often presented as part of an impact management and monitoring plan,

and specify what can be done to lessen adverse effects and what can be done to increase the beneficial effects. For example, the impact management and monitoring plan might describe how air emissions could be minimised through the use of alternative technologies or filter. The plan might also describe how local hiring should be encouraged so that local people will benefit.

Impact assessments are prospective approaches and processes, meaning they are undertaken before a proposal is fully designed and implemented. This is because the timing of the impact assessment and the commitment of decision-makers to implement the findings of the assessment are crucial. The assessment needs to occur at a point in planning and decision-making where the recommendations are most easily incorporated, i.e. before activity has commenced.

Environmental and health[1] impact assessment approaches and processes can help to protect and enhance public health by:

- critically analysing proposals,
- analysing how they are likely to be implemented, and
- examining how they are likely to be operationalised in real world contexts.

The best impact assessments bring people together: proponent, decision makers, communities, academia and other stakeholders. The process therefore should be rigorous and scientific and, at the same time, encourage the participation of stakeholders with different backgrounds and interests. This requires a multidisciplinary team that has community and stakeholder engagement skills, communication skills, as well as technical subject-specific assessment expertise. A well conducted impact assessment can help to foster working relationships between organisationsand develop a consensus on shared priorities. Public health professionals and the healthcare sector in general therefore need to understand, engage with, and participate in both Environmental Impact Assessments (EIAs) and Health Impact Assessments (HIAs). By not doing so they abdicate responsibility to other groups who

[1] Health impact assessment can often be stated as human health impact assessment or community health impact assessment to identify that the focus is on humans rather than the health of flora and fauna. In this chapter the discussion of health is related to the health and wellbeing of individuals and groups in human communities.

quite reasonably focus on their own priorities at the expense of public and environmental health issues.

What ipact assessments focus on

Impact assessments deal with different types of proposals. EIA applies to projects only. A separate process called Strategic Environmental Assessment (SEA) is used to assess the environmental impacts of polices, plans and programmes. In contrast, in HIA the same methodology and approach are used for all kinds of proposals and their associated decision-making processes.

Environmental Impact Assessment and Strategic Environmental Assessment

EIA is the oldest and most established form of impact assessment. EIAs generally focus on the following topic areas or impact assessment specialties: geology and soils, water quality and flood risk, air quality, waste, transport and traffic, archaeology and heritage, noise, landscape and visual intrusion, and socio-economic impacts.

There are a number of definitions of EIA. One of the simplest and most widely quoted is that EIA is "an assessment of the impacts of a planned activity on the environment".[2] A more comprehensive definition is that: "…EIA is a process, a systematic process that examines the environmental consequences of development actions, in advance. The emphasis, compared with many other mechanisms of environmental protection, is on prevention. Of course planners have traditionally assessed the impacts of developments on the environment, but invariably not in the systematic, holistic and multidisciplinary way required by EIA."[3]

The requirements for conducting EIA are embedded within the laws and regulations of national and cross-country authorities (e.g. the European Union) across the globe. The process can vary between jurisdictions. The main intent, which is identifying and mitigating in advance the potential adverse environmental consequences of a planned action, is the same.

---

[2] United Nations Economic Commission for Europe (UNECE). (1991). Policies and Systems for Environmental Impact Assessment. Geneva. UNECE.

[3] Glasson J, R Therivel and A Chadwick. (1999). Introduction to Environmental Impact Assessment. UCL Press. London.

Though EIA encompasses impacts on human health, the health assessment component of EIAs[4] have traditionally had a narrow focus on the potential negative health impacts and the biophysical determinants of health[5]. This is often specifically framed in terms of the hazards and risks of exposure to chemicals in the air, water or soil that are associated with a project.

The requirement for EIA was originally mandated in the United States in 1969, with the passing of the National Environmental Policy Act (NEPA). This was an important landmark for EIA as it influenced the development of similar requirements in many other countries.[6]

Depending on the country or institution, EIA is also often called Environmental Assessment (EA) or sometimes Environmental Appraisal. An EIA Report is often referred to as Environmental Impact Statement (EIS) or Environmental Statement (ES). Similarly SEA can also be called Sustainability Appraisals.

Though there are range of different frameworks and steps that can make up an EIA process globally, in discussions of EIA theory and in practice, the core steps of an EIA process are:

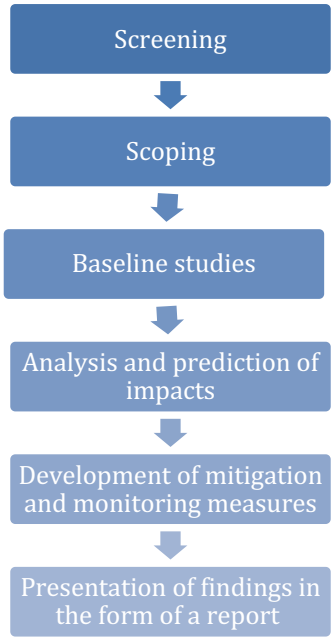
- screening,
- scoping,
- baseline studies,
- analysis and prediction of impacts,
- development of mitigation and monitoring measures, and
- presentation of findings in the form of a report.[7]

[4] Health Assessment Component is used here to mean the whole range of assessments that consider human health and include elements such as the air quality assessment, land contamination assessment, water quality assessment and socio-economic assessment as well as a health impact assessment that considers the implications of changes to the social environment because of a proposal.

[5] P. Harris, F. Viliani and J. Spickett "Assessing Health Impacts within Environmental Impact Assessments: An Opportunity for Public Health Globally Which Must Not Remain Missed" Int. J. Environ. Res. Public Health 2015, 12, 1044-1049

[6]Alm AL. (1988). NEPA: Past, Present and Future. EPA Journal.
Available at http://www2.epa.gov/aboutepa/nepa-past-present-and-future

[7] Morris P and R Therivel (Eds). (2001). Methods of Environmental Impact Assessment. Spon Press. Oxford.



Often three other key steps are included: an analysis of alternative proposal options to achieve the desired objectives; community consultation and engagement during the EIA process or after an EIA Report is published; and follow up on the implementation of the findings of the EIA Report through the development of an Environmental Management Plan and the monitoring of potential impacts.[8] These core steps are described in more detail in relation to Health Impact Assessment in the next section.

SEAs have a similar steps to those of EIAs, but uses a different methodology and set of methods. SEA is most often undertaken or commissioned by national or local governments. This is because the focus of SEA, is at the implications of changes in the vision, strategic direction, and options, for many or wide-ranging future developments or policy actions.

For example, an SEA may be conducted to assess the relative environmental, social, economic, and health implications of different options for opening a region to future mining and refining projects. This could also include not opening a region or part of a region to these developments. As no specific projects have been developed the options discussed at this early stage are focused on high-level questions. For example, whether the vision and objectives of the policy are sound from and environmental and health perspective; what criteria should be used to decide on where mines and refineries should be situated; and the kinds of

[8] International Association for Impact Assessment. (1999). Principles of Environmental Impact Assessment Best Practice.

technologies that could be used in these projects that are most likely to protect human health and the environment. An EIA would be then be conducted after an SEA has been undertaken; approval is given for mining development to occur in the region; and a specific detailed mining project is proposed by a mining company or by a national government.

Some countries, international lending institutions, international industry sector associations, and transnational businesses, have mandated EIAs that have a strong social impact assessment component. These impact assessments are often described as Environmental and Social Impact Assessments.[9] More recently some countries, international lending institutions, international industry sector associations, and transnational businesses have framed EIAs to have strong social and health impact assessment components and these impact assessments are described as Environmental, Social and Health Impact Assessments (ESHIAs). ESHIAs are part of a family of assessments called Integrated Impact Assessments (IIA) or Integrated Assessments because they bring together what in the past were separate types of impact assessments. Impact assessments are brought together in IIAs in order to produce a more integrated understanding of the potential impacts, an integrated set of mitigation and enhancement measures, and an integrated set of monitoring indicators.

Health Impact Assessment

There are a range of definitions of HIA in the literature. One key definition of HIA is that: "Health impact assessment may be defined as a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, programme or project on the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects."[10]

HIA has evolved from three main strands of thinking[11] (and their associated frameworks and processes):

1. Epidemiological and quantitative health risk assessment;
2. Healthy policy and health promotion;

---

[9] Harris-Roxas B, Viliani F, Bond A, Cave B, Divall M, Furu P, et al. (2012) *Health Impact Assessment: The state of the art,* Impact Assessment and Project Appraisal, 30(1):43-52.

[10] Health Impact Assessment International Best Practice Principles." IAIA Special Publications Series No. 5. September 2006. http://www.iaia.org/publicdocuments/special-publications/SP5.pdf

[11] John Kemm, Jayne Parry, and Stephen Palmer (2004) Health Impact Assessment. Oxford University Press

3. Social Determinants of Health.

From the 1950s, developments in epidemiology led to approaches that quantified the potential adverse impacts of exposure to man-made chemicals in the air, water, soil and food. These approaches, and associated methodologies, are known as health risk assessment. From the 1970s and 1980s, the healthy public policy and health promotion movements recognised that promoting health and preventing ill health were as important as treating disease. That health and wellbeing were not just about good quality healthcare. They were also about good quality and affordable access to the natural environment, housing, education, transport networks, and public and private goods and services. From the 1980s and 1990s, there was a growing recognition of the need to incorporate the social determinants of health into EIA. This was accompanied by the realisation of the limited value of a health risk assessment approach in most EIAs and the need to address and promote more equitable social and health outcomes.[12]

HIA is undertaken in many countries around the world, though has not been embedded in regulatory processes to the same extent as EIA. Several countries have adopted requirements for stand-alone HIA; while others, have endorsed better consideration of health in their national EIA processes or developed national level guidance on undertaking HIA or better considering health in EIA.[13,14,15]

The steps of an HIA are similar to EIA and are described in Box 1.

Box 1: The key steps in a Health Impact Assessment Process

Screening: Deciding if a proposal could generate potential health consequences and whether a HIA should be undertaken.

[12] Harris-Roxas B, Harris E (2011) *Differing Forms, Differing Purposes: A Typology of Health Impact Assessment,* Environmental Impact Assessment Review, 31(4): 396-403.

[13] Winkler, MS et al Untapped potential of health impact assessment. *Bull World Health Organ* 2013;91:298–305 | doi:10.2471/BLT.12.112318

[14] Ross, C.L., M. Orenstein, Marla, and N. Botchwey (2014) Health Impact Assessment in the United States. Springer

[15] Fehr, R., F. Viliani, M. Martuzzi, J. Nowacki "Health in Impact Assessments. Opportunities not to be missed". Joint publication WHO Europe, European Association of Public Health and IAIA . http://www.euro.who.int/en/health-topics/environment-and-health/health-impact-assessment/publications/2014/health-in-impact-assessments-opportunities-not-to-be-missed

Scoping: Setting the scope of the impact assessment by identifying the potential health impacts of concern, what issues do not need to be considered, what sources and types of evidence will be considered, what qualitative and quantitative methods will be used, whether there will be an expert steering or advisory group, and what the assessment's temporal, spatial and population boundaries will be i.e. what time period, geographical area and populations will be considered in the assessment. The findings and judgments made during scoping will be written up either as a Scoping Report or a Term of Reference for the HIA.

Baseline Assessment or Community Profile: Collecting and analysing a range of desktop and fieldwork information to understand the existing health and wellbeing status of the affected populations and the current state of the environmental and social determinants of health influencing them. This provides the baseline from which predictions on possible and likely health impacts are made. Information types that are used include demographic, health, environmental and socioeconomic statistics; scientific literature; existing policies; expert opinion; and community feedback and other stakeholders' views, including public health practitioners and healthcare providers.

Impact Analysis: Identifying, characterising, assessing the significance of and prioritising the potential health and wellbeing impacts.

Formulating Recommendations: Developing feasible mitigation and enhancement measure to minimise the potential negative impacts and maximize the potential positive impacts. These measures are written up in an Impact Management Plan.

Decision and subsequent implementation: The authority responsible for the HIA process will decide whether a proposal goes ahead and if it goes ahead what changes need to be made to the proposal based on the recommendations of the HIA. The proponent of a proposal will take responsibility for ensuring that the Impact Management Plan is implemented alongside the implementation of a proposal.

Follow Up: Monitoring and evaluation of both the implementation of a proposal and, less often, the HIA process.

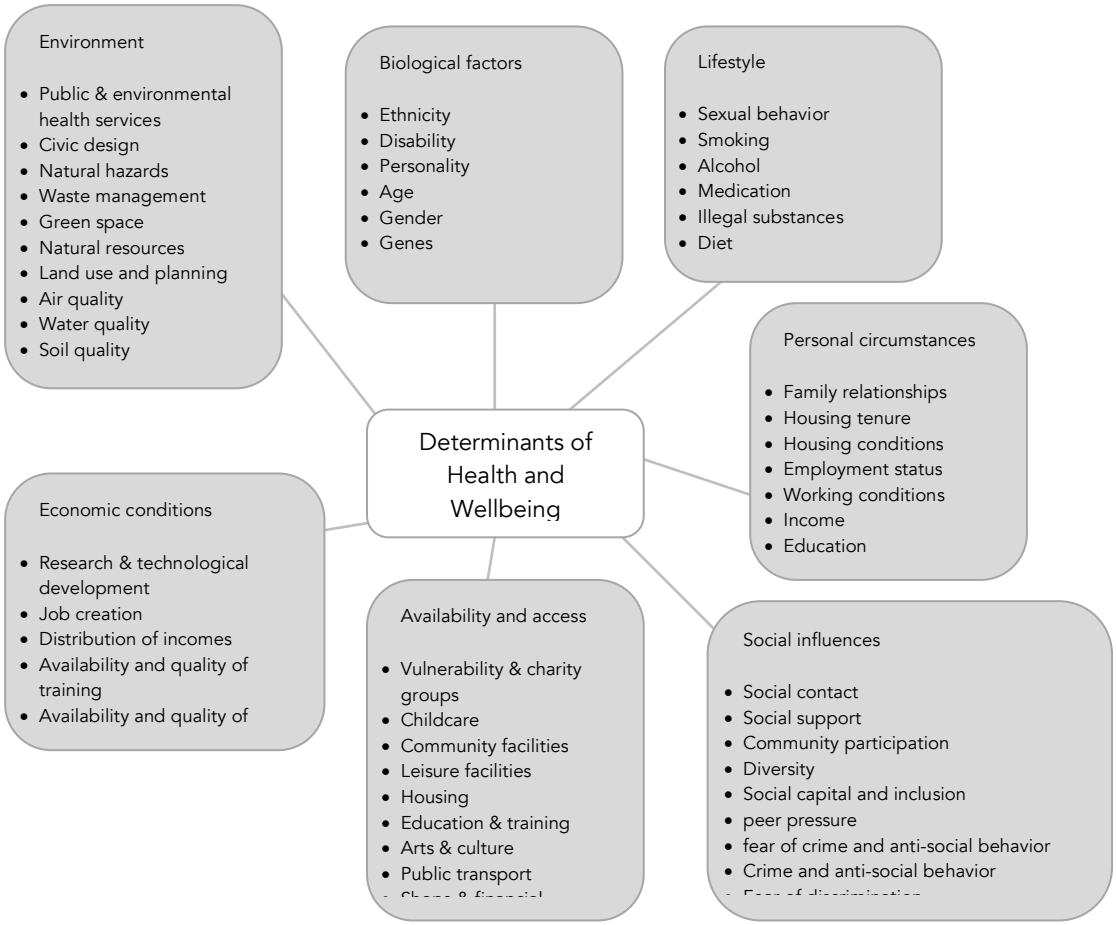
The findings of stakeholder engagement and consultation should inform the HIA process and its findings. Many guides recommend stakeholder engagement and consultation be undertaken at all steps of the HIA process. Often this is not practical and so stakeholder engagement and consultation generally takes place once or twice during the HIA process The above description of the steps of HIA makes it look like a linear process but, in reality, the process is more iterative and recursive with steps overlapping and being revisited as

new emergent issues mean that earlier judgments and thinking have to be critically reconsidered.

A key feature of HIA is that it considers both positive and negative impacts on community health and wellbeing. Those impacts can be direct or indirect. Direct impacts are those generated by a project and its activities. For example, air emissions and road traffic injuries from lorries going to and from the project. Indirect impacts are those generated by the project through 'ripple effects' on the wider social determinants of health. For example, better paid administrative jobs in the project attract teachers and health care staff to take up these less skilled but higher income jobs leaving a skills gap in local communities that affects the delivery of health care and education. The distribution of impacts across the different population groups is another important component of the HIA, and it is also referred to as an 'equity focus' or 'equity lens'. HIA is also a participative and input and feedback from stakeholders are sought throughout the process particularly the most vulnerable ones. This is important as HIA is concerned with the potential unequal distribution of the impacts among the the communities affected by a project whether they are near or far. An illustrative framework of key environmental and social determinants of health is shown in Figure 1.

Figure 1: The wider environmental and social determinants of health and wellbeing[16]

[16] Vohra S. Centre for Health Impact Assessment, Institute of Occupational Medicine. Adapted from Harris A. Rapid Health Impact Assessment: a guide to research. 2003.



HIA also has an explicit set of values that frame the HIA process. These values are being: democratic and participatory; equitable, sustainable, transparent, and ethical in the use of evidence. [17] [18] One additional underlying value of HIA that we would add is that the maximisation of health opportunities for all is an important societal good and a priority societal goal.

Health impacts are contextual and are linked to a given natural and socio-economic environment. HIA, like EIA, therefore aims to develop a set of evidence based, locally implementable, legislatively appropriate and culturally relevant recommendations for dealing with the impacts that are identified.

[17] European Centre for Health Policy (ECHP), WHO Regional Office. (1999). The Gothenburg consensus paper: Health Impact Assessment: Main concepts and suggested approach.
[18] Hurley F and S Vohra. (2010). Chapter 63 Health Impact Assessment. In Ayres JG, RM Harrison, GL Nichols and RL Maynard (Eds). Environmental Medicine. Edward Arnold. London.

Impact Assessment and Decision-Making

Impact assessment fits into the broader evidence-based policy movement. Hence, the general consensus is that the purpose of impact assessment is to support policy and decision-making in institutions such as national and local governments, private sector businesses, and international lending agencies. However, there is also debate in the field, on whether HIA is, or should be, an advocacy tool to support communities and provide them with a voice and mechanism to get their concerns heard by policy and decision-makers. [19]

Impact assessments also often generates a range of expectations and aspirations. Two examples can help to illustrate this. Firstly, commissioners and local communities can have high, and often unrealistic expectations, of how much influence an impact assessment process and its findings can have on a decision-making process. This means that HIA practitioners often have to be clear about and manage expectations. Secondly, local communities can come to believe, especially when there is little or no consultation and engagaemnet during the impact assessment process, that because a government or private sector business are commissioning an impact assessment that the findings are likely to be in favour of the commissioner. This is more often the case when the impact assessments are undertaken by paid consultants than by public health agencies of academic institutions. These challenges are not unique to impact assessment but because impact assessment works at the interface between communities, politicians, officers of institutions, business, and the policy and decision-making process and its strengths and weaknesses impact assessment findings and practitioners face these issues more often. Often the findings of an impact assessment and the way it was conducted can become a subject for judicial or quasi-judicial review, e.g. when cases are taken before a judge in a Court of Law or when impact assessment reports are reviewed at a Planning Inquiry or by a Planning Inspector.

One of the challenges that HIA has faced in different country settings is the lack of a legislative mandate similar to that of EIA and the lack of critical review of the quality of the health assessment component of an EIA. Another limitation to more widespread use of HIA is the focus by medical and health professionals on randomised controlled trials and cohort studies as the highest standard of evidence. For health impacts caused by biophysical changes, such

---

[19] Harris-Roxas, Ben and E. Harris. Differing forms, differing purposes: A typology of health impact assessment. *Environmental Impact Assessment Review* 33 (4):396-403, 2011. doi:10.1016/j.eiar.2010.03.003

as air pollution, there are epidemiological evidence that can help with the identification and quantification of health impacts. For several other health impacts caused by social or political changes the quantification is more complex or not currently doable and there is little or no epidemiological evidence. Finally, public health and health sector professionals have not been consistent or good advocates for the use and value of HIA by questioning its utility or by over-emphasising potential limitations in the evidence used. This, coupled with the political sensitivity and tensions between economic development and protecting the health of the public, has meant that HIA and the health impact assessment component of EIAs has faced more criticism and accusations of a lack of rigour and robustness than other forms of impact assessment. In essence, flora and fauna do not talk back and do not vote, their behaviours follow recognisable patterns and are predictable. This is not necessarily the case for humans.

Most impact assessment processes and their findings are therefore as much about engaging in a discussion and negotiation with a range of stakeholders, including the proponent, the policy or decision-making authority and communities. It is a process of applied science that uses best available evidence, a systematic and transparent approach to reduce bias, a range of sources of evidence, and a variety of qualitative and quantitative methods of prediction to ensure that the findings are as accurate as they can be.

Success or the effectiveness of an HIA should not be limited to having successfully altered the proposal under assessment; but it should also consider the broader opportunities generated. For example conducting a HIA can foster interagency working relationship or increase the visibility of health in the political agenda[20], and this is feasible when the experts and practitioners involved are both tactic and technical[21]. Researchers have developed a series of recommendations to make HIA and other impact assessments more effective[22] [23]:

- Consider if HIA is the right process for the object to be examined in the early phases;

[20] F Haigh et al. (2015). What makes health impact assessments successful? Factors contributing to effectiveness in Australia and New Zealand. BMC Public Health: 15:1009 DOI 10.1186/s12889-015-2319-8.

[21] Harris P. at al. "The fit between health impact assessment and public policy: Practice meets theory" Social Science & Medicine 108 (2014) 46e53

[22] F Haigh et al. (2015). What makes health impact assessments successful? Factors contributing to effectiveness in Australia and New Zealand. BMC Public Health: 15:1009 DOI 10.1186/s12889-015-2319-8.

[23] Bourcier E, Charbonneau D, Cahill C, Dannenberg AL. (2015). An Evaluation of Health Impact Assessments in the United States, 2011–2014. Prev Chronic Dis:12:140376.

- Clarify early in the process: purposes, goals, values and expected outcomes;
- Select an appropriate team to conduct the HIA with a mix of competences; as well as identify key stakeholders and their relative points of influence within systems;
- Involve stakeholders such as decision-makers, people with knowledge about and access to decision making processes and also people with relevant skills as early as possible;
- Ensure HIA processes include potentially affected communities and pay attention to the needs of vulnerable populations;
- Craft clear, actionable recommendations, with the support of the involved decision-makers;
- Be both technical and tactical: understand the context and the actors, proactively engage, and if opportune utilise the flexible but structured HIA process.

Impact Assessment, Health, and the Precautionary Principle

There is no commonly accepted definition of the Precautionary Principle or Precautionary Approach. Most definitions begin with the threat or risk of harm from an activity to the environment and human health. The threat is based on preliminary scientific assessments that provide reasonable grounds for concern about the potential for dangerous effects on the environment or the human, animal, or plant health.[24] Most definitions state that it is the principle that where there may be significant potential adverse impacts, on ecosystems and humans, scientific uncertainty should not be used as a reason to avoid putting preventive measures in place.[25] [26]

The Wingspread statement states "Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically". This puts the burden of proof on the

[24] *Communication of the Commission on the Precautionary Principle*. Brussels: European Commission; 2000.
[25] Martuzzi M and JA Tickner. (2004). The precautionary principle: protecting public health, the environment and the future of our children. WHO Europe.
[26] Report of the United Nations Conference on Environment and Development, 1992. Annex 1: Rio Declaration on Environment and Development

proponent of the activity and further states "The process of applying the Precautionary Principle must be open, informed and democratic, and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action."[27]

Impact assessments are inherently precautionary. They assess and recommend measures to reduce harm and enhance benefits. They do so in a context of uncertainty in relation to baseline health, environment, social and economic information and how these could change over time and because of a proposal. They consider both how a proposal will be implemented as well as how the proposal it is likely to operate over its life. Most importantly it examines who is likely to be worst affected, how and when. Good quality impact assessments gather the best available information and evidence within time and resources constraints, address uncertainty clearly, consider worse case scenarios, and develop mitigation measures to enable these worse case scenarios to be minimised.

However, there are challenges in applying the precautionary principle because different stakeholders and particular proponents, whether governments or businesses, can frame the impact assessment and the policy and decision-making process in ways that preclude the use of the precautionary principle to its fullest extent. Again a key issue is the defendability of predictions and statements made in an impact assessment in judicial and quasi-judicial settings. This is particularly the case in the following three contexts. Where there is a lack of or inconclusive evidence for an impact that is theoretically possible. Where there is no scientific consensus on the causal mechanism for the impact. Where there the likelihood of the impact occurring cannot be qualitatively or quantitatively estimated.[28] [29] [30]

Deciding when and how to invoke the precautionary principle is also not straightforward. An example of this are the opposing views on the potential environmental and health impacts from projects using high-volume hydraulic fracturing (fracking) for the extraction of natural

---

[27] Wingspread Consensus Statement, 1998 (available at http://www.sehn.org/wing.html)

[28] *Communication of the Commission on the Precautionary Principle.* Brussels: European Commission; 2000.

[29] Precautionary Policies and Health Protection: Principles and Applications, Report on a WHO Workshop, Rome, Italy, 2001. World Health Organization Regional Office for Europe in Environmental Impact Assessment: Practical Solutions to Recurrent Problems. David P. Lawrence, 2003 .John Wiley & Sons.

[30] Hardstaff, P. The Precautionary Principle, Trade and the WTO. Discussion Paper for the European Commission Consultation on Trade and Sustainable Development, 2000. Royal Society for the Protection of Birds, Bedfordshire, UK.

resources. International opinion is divided not only between project proponents and communities, but also between national and state governments in different countries. Some jurisdictions have allowed extensive use of this technology. Others have mandated a moratorium until further research is undertaken, the potential impacts associated with this technology are sufficiently understood, and a satisfactory regulatory framework is in place.[31] [32] [33]

Ultimately, the precautionary principle needs to be embedded in and be part of policy and decision-making processes for it to be fully effective with the impact assessment process. This is because, as stated in the previous section, impact assessments most often support and inform the decision-making process rather than advocate for a particular decision to be taken.

Conclusion

HIA and EIA are valuable approaches and processes for supporting better, healthier, and more sustainable policy and decision-making. They can also help to support better, more informed, transparent and democratic policy and decision-making when undertaken well and valued by policy and decision-makers. Though they are not a panacea they are one important piece of the policy and decision-making process jigsaw to protect, promote, and improve environmental, individual, and community health and wellbeing.

Public health practitioners and professionals need to proactively and consistently undertake and commission HIAs, as well as oversee and scrutinise the scope of work for and the findings of EIAs and HIAs that are commissioned and undertaken by others.

[31] For further information consult New South Wales Government reports available at: http://www.chiefscientist.nsw.gov.au/reports

[32] Scottish Government. (2015). Moratorium on fracking. Available at http://news.scotland.gov.uk/News/Moratorium-called-on-fracking-1555.aspx

[33] Keep Tap Water Safe. (2015). List of bans worldwide. Available at http://keeptapwatersafe.org/global-bans-on-fracking/