CHAPTER ELEVEN

ASSESSMENT OF HUMAN HEALTH AND WELLBEING IN PROJECT ENVIRONMENTAL ASSESSMENT

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Contents

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1. Introduction

This chapter introduces readers to considering human health and wellbeing within project environmental assessment (EA). The focus of the chapter is extending the concept of health in EA to include consideration of the wider factors that determine health, and that can be impacted upon by industry project development. In India as elsewhere, EA is undertaken as to meet statutory requirements, where health is usually associated with environmental and biophysical health impacts (Ministry of Environment and Forests 2001). In addition to these, this chapter emphasises the importance two further dimensions of health. First is incorporating health as a core aspect of sustainable development, which is becoming increasingly influential within EA practice, through assessing health as part of environmental, social and economic areas of impact. Second is the concept of health equity, which focuses on assessing the distribution of impacts and their human health outcomes among and within communities likely to be affected by projects.

There is increasing recognition of the importance of considering environmental impacts broadly and comprehensively within EA. The benefits of including health in EA as part of this broad assessment are made clear in this chapter. The costs have been made clear elsewhere, with tragedies such as Bhopal among the constant looming reminders of what can go wrong for communities, governments and industry where health is not considered fully (Sharma 2002; Sharma 2005; Satyanand 2008). However, the full incorporation of health in EA requires novel thinking and skills, supported by depth of knowledge concerning both health and EA. To this end this chapter builds on the international health and EA literature to offer concepts, practices, and frameworks that facilitate incorporating health in project EA. These will assist industry in India obtain environmental clearance by considering health and wellbeing as part of environmentally, economically and socially sustainable development.

The chapter first outlines the links between health and the environment by introducing how health is broadly defined. The chapter then reviews the current literature on EA, discussing EA's purpose and history, outlining criticisms and offering a way forward through the inclusion of health as part of sustainable development. The third and final section of the chapter shows how to include health in EA, building on the lessons from health impact assessment.

2. Links Between Health and The Environment: The Determinants of Health and Wellbeing

2.1 World health organisation's definition of health

For over 60 years the World Health Organisation has defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (World Health Organisation 1948). There are a number of aspects to this definition which situate health as a concern for EA. Firstly, health is more than disease. That is health is more than the treatment of illness or disease by health or medical professionals within medical facilities or elsewhere. Rather, health should be considered on a continuum, from health creation and maintenance of good health, to prevention of ill health and disease to treatment of illness and disease. EA covers the initial part of this continuum by encouraging development activities to create and support health while protecting against illness and disease. Second, health is more than a physical construct, and includes mental and social wellbeing. This broadens the concept of health to situate the physical body within, rather than separate to, the environment in which it exists. These 'inextricable links between people and their environment constitutes the basis for a socioecological approach to health.' (World Health Organisation 1986). For EA, this broad definition of health encompasses direct links to health, for example changes to air quality impacting on respiratory conditions, and indirect links, for example providing housing and education for employees' families impacting on quality of life.

2.2 The determinants of health and health equity

In recent years there has been an increasingly large body of work that provides evidence that health is subject to wider determinants. These determinants are the socioecological factors that are associated with health and wellbeing outcomes, usually indirectly. The evidence is clear that these determinants must be influenced to create and maintain good health across the population. This evidence is comprehensively captured in the *Final Report of the World Health Organisation Commission on the Social Determinants of Health* (World Health Organisation 2008).

Importantly however, this body of evidence adds a new dimension to the above definition of health, that of 'health equity'. The evidence is now clear that those with the least resources and opportunities in society are the most likely to live within environments that are poor for or pose risks to their health, resulting in poorer health than other groups in their societies (for an overview of the creation of this vulnerability in relation to industrialisation see (de Souza Porto and de Freitas 2003). Health equity concerns the differential distribution of health among and within different population groups that is considered both avoidable and unfair (Whitehead 1990).

EA, and health impact assessment (HIA), are now recognised as powerful influences in the redistribution of health more equitably in society because these explicitly seek to influence the wider determinants of health and health equity (Dahlgren and Whitehead 2006; World Health Organisation 2008). Guidance on including the determinants of health in EA/HIA has been developed in a number of countries, including Canada (Health Canada 2004) and Australia (enHealth Council 2001; Harris et al. 2007).

One of the most widely cited models of health (Dahlgren and Whitehead 1991) describes the determinants across five levels (see figure One below): biological factors such as age, sex and hereditary factors; individual lifestyle factors such as eating and drinking, physical activity, smoking and alcohol consumption; social and community networks; living and working conditions such as agriculture and food production, education, work environment, unemployment, water and sanitation, health-care services and housing; and general socio-economic, cultural and environmental conditions.

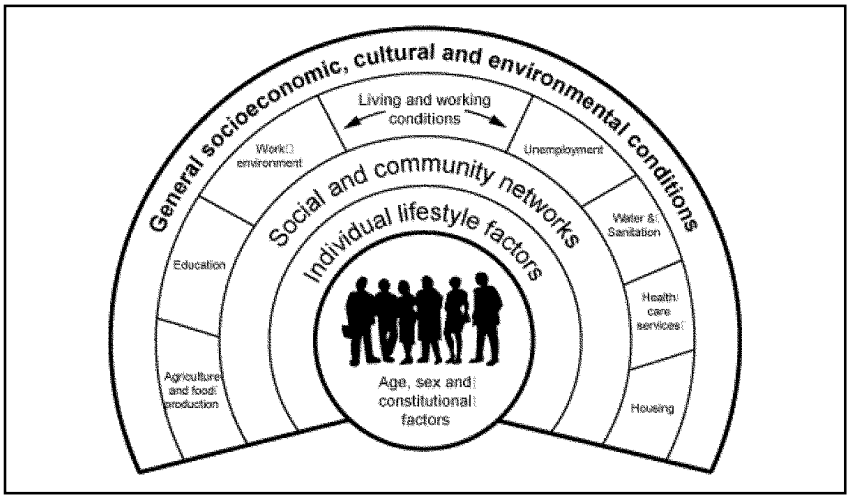

Figure 1: The Wider Determinants of Health 'Rainbow'.
Adapted from Dahlgren and Whitehead (1991)

Planning professionals have recently reinterpreted this model (see Figure Two below). Named 'The Health Map', the model reflects the ecosystem of the local human habitat (Barton 2003; Barton and Grant 2006). By placing people at its centre, the model explicitly aims to place people at the centre of sustainable development. This is done by linking the differing levels of health determinants to social, economic and environmental factors. The authors provide a useful explanation of how health and wellbeing can be indirectly affected via the determinants of health:

"The importance of the model is that it can be used to analyse knock-on (indirect) effects, which are often much more significant in terms of health. Take a new road, for example, the pattern of human activity – travel behaviour and destinations – is changed. Activity, in turn, affects the local natural environment (air pollution) and the global ecosystem (greenhouse emissions). It also affects local economic efficiency and people's lifestyle choices (the likelihood of walking or driving). Lifestyle changes may well affect the pattern of social networks. It is apparent that every sphere representing health determinants – except the inherited characteristics – is affected to a certain extent. The model can help identify these processes and contribute to sustainability and health impact assessment." (p. 253)

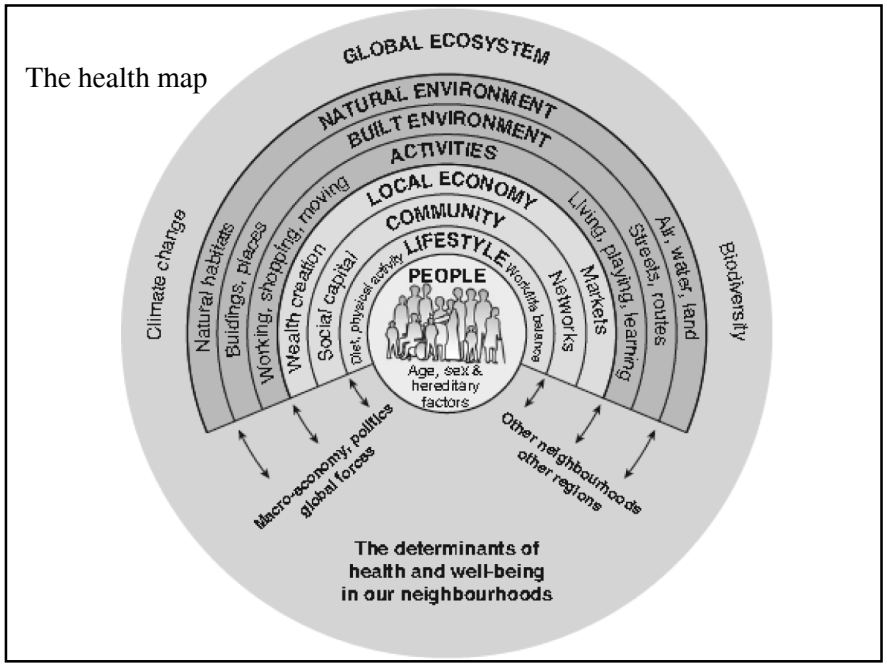

Figure 2. The Determinants of Health – A Planning Model (Barton and Grant 2006)

2.3 Coverage of the determinants of health in EA

The determinants of health perspective for EA was first championed by the World Health Organisation (Corvalan and Kjellstrom 1995). This is because, as the above models show, the determinants can provide 'a chain of reasoning' to the complex and multi-factorial pathways or gaps between actions, changes or options associated with a development project, to changes in health determinants, and then to changes in specific health outcomes (Birley 2002; Joffe and Mindell 2002; Bronson and Noble 2006). These chains of reasoning provide EA the opportunity to map causal

pathways of development at varying levels of impact from the bio-medical and genetic to individual to community to living and working conditions to macro level conditions.

These links between the environment and health and their exposure-effect relationship can be supported by the inclusion of indicators across the causal chain from determinants to outcomes in an EA (Spiegel and Yassi 1997). This is the basis of the World Health Organisation's 'Driving forces-Pressures-State-Exposure-Effects-Action' framework (Carneiro et al. 2006; Morris et al. 2006). This enables analysis of either the multiple health effects and pathways of a single environmentally based activity (e.g. a driving forces or pressure of 'cars as transport' leading to a state or exposure of more vehicles and greater pollution, leading to an increase in poor health outcomes such as motor vehicle injuries, respiratory illness, or noise disturbance) or the multiple causes of a single health effect (e.g. the outcome of acute respiratory infections in children resulting from driving forces of income and poverty influencing the state of living in poor housing close to a development) (Corvalan, Kjellstrom et al. 1999).

Despite this obvious utility of adding health and the determinants of health, the promise of a health determinant approach to EA has yet to be fully developed (Birley 2002). However, an EA on mining developments in Northern Canada is one published example of this approach. This EA included indicators in relation to four causal pathways suggested to link exposure to mining developments and health effects (Spiegel and Yassi 1997). Pathway one covered human exposure to environmental contaminants such as radiation, noise, workplace safety. Pathway two involved human exposure to ecosystem mediated effects such as flora, fauna, air and water. Pathway three involved health effects associated with direct participation in the mine for individual employees, their families and the existing community. Pathway four referred to the general impact of the mining industry on the community and region. This case is also important because it is an example of linking cumulative impacts of development activities within a region through EA, which is something EA has struggled with historically.

2.4. Summary

In summary, this section has introduced readers to the internationally recognised definition of health as being more than disease or the medical treatment of disease. This definition has opened up the concept of health to be situated, created and maintained by the environments within which humans live. This in turn leads to an understanding that health is influenced by wider determinants, which are socio-ecological factors within the environment that are associated with health outcomes. In addition, evidence now shows that it is those in society with the least

resources and opportunities who often live in environments which are poor for their health. The result is great health inequity between and within groups in society. However, both EA and health impact assessment are now recognised approaches to addressing these inequities because they explicitly aim to influence the environments that determine health. The section conduded with outlining how the determinants of health approach can be used within EA, supported by a case study from an EA on mining.

However, while there is clear utility from a health perspective for taking the determinants of health approach within EA, this may not be clear to others less familiar with health. The chapter therefore turns to a critique of EA pointing to how health can add value as part of the evolution of EA practice.

3. Environmental Assessment: Purpose, History, Criticisms and Proposed Future

3.1. EA's history and purpose

Environmental assessment (EA) refers to the regulated process of identifying, predicting, assessing and mitigating the potential environmental effects of development projects on the environment (Davies 1997; Noble and Bronson 2006). The first articulation of EA was within the US National Environmental Policy Act (NEPA) of 1969. At its outset human health was a core concern of NEPA, which contained explicit reference to public health and the importance of people's relationship with the environment (McCaig 2005; Wernham 2007; Bhatia and Wernham 2008). In practice however concerns for natural ecosystems provided the original focus of EAs under NEPA, with early studies ignoring impacts on human communities and human health (Giroult 1988; Arquiaga 1992).

Since NEPA, EA is globally recognised as both a process and a document (Alenius 2001) that is based on the straightforward rationale that if decision-makers are aware of the potential impacts a proposed development may have, they will be better informed and make better decisions (Bond 2004). This provides EA with a number of functional boundaries. Where the purpose is a proactive planning tool (Steinemann 2000) with the aim of influencing 'real world' decisions, EA is based on a quasi-quantitative approach rather than a traditional scientific rationalist approach to evidence (Benson 2003; Cashmore 2004). However, rigour is required as it provides decision-makers with a systematic technical examination of the environmental implications of a proposed action before a decision is taken (Eyles 1999; Glasson 2005). Further, EA aids decision-making through the provision of a framework for considering location and design issues and environmental issues in parallel, early in the life of a development (Bond 2004; Glasson 2005). EA also

enables community and public input into the assessment of developments (Glasson 2005). 'The output of an EA' is an informational document that allows the public, proponents of proposals, and regulators to understand the potential impacts of a proposal (Bond 2004; Glasson 2005; Bhatia and Wernham 2008). In doing so, EAs can establish mechanisms and measures for the follow-up and management of the potential environmental impacts of a proposed developments (Arts, Caldwell et al. 2001).

3.2 Criticisms of EA

EA is not without its detractors, who are concerned about both utility and effectiveness. Some view EA as a bureaucratic hurdle that it is costly, time-consuming, lengthy and overly prescribed procedure that duplicates information requirements, creates unnecessary procedural delays, and increased opportunities for special interest litigation (Cole, Wilhelm et al. 2004; Cole and Fielding 2007). Others argue that EA is technically weak in practice concerning including meaningful public participation, considering alternatives, recognizing uncertainty in prediction, including cumulative effects, determining significance and influencing decision-making, and forcing monitoring and auditing (Canter and Clark 1997; Benson 2003). More recently, EA has been labelled an anachronism from the 1980's when sustainable development was not as relevant as today (Barton and Grant 2008).

However, despite these criticisms there is recognition that EA is now a 'globally significant decision tool' (Cashmore 2004) that has made an impact on development planning through design modifications, institutional learning, and stakeholder involvement (Canter and Clark 1997; Glasson 2005; Jay, Jones et al. 2007). Over 100 countries now have EIA systems in place, although practice and effectiveness is likely to be variable (Bond 2004; Glasson 2005). In the face of this, the above criticism that EA is an anachronism and requires replacing (Barton and Grant 2008) is problematic and unhelpful. Rather, it is more useful to recognise that approaches such as EA do not stand still but continually evolve. It will be more productive for EA to evolve conceptually and in practice to address the criticisms levelled against it (Glasson 2005; Jay, Jones et al. 2007).

Notably many of EAs limitations stem from the legislative systems within which EA sits (Bond 2004; Glasson 2005) . For example, it is well-known that those with current legislative responsibilities under planning legislation are often reluctant or unable to include impacts associated with the determinants of health beyond the standard 'bio-physical' issues related to noise, air pollution, contaminated land, odours, waste issues, and water quality (Barton and Grant 2008). This is a concern, given

the often-made argument that none of the above will be undertaken if this broad coverage of health is not included in EA legislation (National Health and Medical Research Council 1994; Davies 1997; Steinemann 2000; Alenius 2001; Ahmad 2004; Dora 2004; National Public Health Partnership 2005; Bhatia and Wernham 2008; Hilding-Rydevik, Vohra S et al. 2008).

However, the argument that practice only stems from legislation may be incorrect when that practice is actually examined closely. For example research we undertook on coverage of health and wellbeing in major project EAs in Australia, also found that these traditional bio-physical impacts were well-covered (Harris, Harris et al. 2009). However the EAs we reviewed consistently went further and were more sophisticated than the statutory based requirements issued to proponents, extending their coverage to include socio-economic impacts associated with sustainable development. Fortunately, this supports the practice of the private sector and industry that internationally EA is moving beyond the limitations of legislative requirements (Equator Principles 2006; IFC 2006).

3.3. The way forward: EA, sustainable development, and health

As stated above, EA practice is evolving. Since the 1970's there has been a shift in the definition of the 'environment' in the EA literature from a 'narrow' focus on strict bio-physical impacts - such as air, water and land – to include a 'broad' focus on socio-cultural, economic and human health impacts and sustainable development (Steinemann 2000; Glasson 2005). It follows that the better integration of health within EA is becoming increasingly obvious and important, particularly in relation to sustainable development (Davies 1997; Banken 1999; enHealth Council 2001; Ahmad 2004; Bronson and Noble 2006; Bhatia 2007).

Given the criticisms of EA, the incorporation of health within EIA can assist with the call to place humans at the centre of the interaction between economic and social development, the natural environment, and the reciprocal impacts of human actions on each (Barton 2003; Glasson 2005). Further, given the links between the determinants of health and health equity, integrating health also enables EA to include improved consideration of the equitable distribution of impacts experienced by the general population and vulnerable or sub-population groups (Alenius 2001; Ahmad 2004).

It should be noted that while taking a broad focus is generally now accepted in EA, there is caution of 'overburdening' EA with too many issues and expectations (Hilding-Rydevik, Vohra S et al. 2008). These concerns are valid, stemming from health considerations becoming yet another set of demands within an already complicated

process - for a recent overview of these demands (without mention of health) see (Hacking and Guthrie 2008). The answer to these concerns is for health to be incorporated through the increased influence of sustainable development on EA practice. Advocates for health within a broader sustainability agenda have long proposed that health becomes an explicit outcome of 'environment', 'social', and 'economic' sustainability priority areas (Hancock 1996; Mahoney and Potter 2004; McMichael 2006). Our research on major project assessment in Australia showed that each of these 'determinants' formed a part of EA practice (Harris, Harris et al. 2009). These results supported work elsewhere showing that EA practice is evolving to considering both traditional bio-physical and social and economic considerations (Glasson 2005). However, our research also showed that across these triple bottom line determinants, EA practice could be improved by:

- including health data
- developing causal pathways between exposures or determinants and health effects, and
- considering the equitable distribution of exposures and impacts in relation to different population groups.

These recommendations were supported by results from similar research into EA practice from other countries (British Medical Association 1998; Steinemann 2000; Alenius 2001). How to incorporate each in EA is the subject of the next section.

3.4 Summary

In summary, this section has introduced EA as a process and a document that aims to improve decision-making concerning the environmental consequences of development. EA practice is evolving to cover impacts including but going beyond bio-physical impacts to those related to sustainable development. This practice can move ahead of regulated requirements. While EA has its critics, the reality is that EA systems have been set up in over 100 countries worldwide. Building on the evolution of EA to encourage sustainable development that includes health as a core element within 'environmental', 'social' and 'economic' areas of impact is likely to be the most productive approach to addressing these criticisms.

The chapter now turns to this inclusion, building on the lessons from our work in Australia teaching, conducting and building capacity for health impact assessment (Harris-Roxas and Harris 2007; Harris et al. 2007; Harris-Roxas 2008; Centre for Health Equity Training Research and Evaluation 2009).

4. Including Health Within EA: Lessons from Health Impact Assessment (HIA)

4.1 Background to HIA

HIA is concerned with assessing the potential health impacts of a proposed policy, plan, program or project on the health of a population to make practical recommendations to improve that proposal (World Health Organisation European Centre for Health Policy 1999; Quigley and Taylor 2004). There is increasing consensus concerning the essential elements that underpin HIA's use (Quigley 2006; Harris 2007). The assessment of impacts in HIA generally includes the severity and likelihood of both positive and negative, direct and indirect, impacts on the health of a population (Kemm 2001; Joffe and Mindell 2002; Harris 2007). To make an assessment, HIA can take both a 'tight' and 'broad' orientation to health impacts, depending on the proposal being assessed, the issues being addressed, and the availability of quantitative or qualitative evidence (Kemm 2000; Harris 2007). Considering the equitable distribution of those impacts on different population groups is now emerging a core element of HIA practice (Kemm 2005; Simpson, Mahoney et al. 2005; Harris et al. 2007). Finally, HIA then engages decision makers in considering health impacts and the determinants of health in their deliberations and in recommending measures to mitigate negative or enhance positive health impacts (Kemm 2000; Davenport, Mathers et al. 2006).

4.2. HIA steps, linked to the EA process

HIA, like EA, follows a standard set of steps. These are shown in Table 1 below, with links to the equivalent in the EA process as outlined under EIA notification in India (Ministry of Environment and Forests 2006).

Table 1. Overview of the Steps of HIA, their purpose and the main tasks involved (Harris 2007a) against EA notification equivalent in India.

Step	Purpose	Tasks	EA equivalent
Screening	Determine whether HIA is appropriate and required	• Pre-screening tasks • Conduct a screening meeting • Make screening recommendations	Screening to determine whether project requires environmental clearance / project description including baseline conditions

continued Table 1

Scoping	Set out the parameters of the HIA	• Set up a steering committee • Choose the appropriate level of depth of HIA that needs to be undertaken • Setting the scope of gathering the evidence • Design a project plan	Scoping linked to 'Checklist of Key Parameters') / Setting Terms of Reference
Identification	Develop a community / population profile and collect information to identify potential health impacts	• Develop a community/ population profile • Collect primary and secondary, qualitative and quantitative information	• Project description / Site process and alternatives • Public Hearing • EIA report: • Description of Environment • Description of Environmental Impacts
Assessment	Synthesis and critically assess the information in order to prioritise health impacts.	• Assess the information on the impacts collected from the different sources. • Deliberate on the impacts to assess their significance and prioritise them	• EIA report: • Description of Environment • Description of Environmental Impacts • Analysis and (initial) selection of alternatives / (initial) mitigation measures
Decision making and recommendations	Make decisions to reach a set of final recommendations for acting on the HIA's findings	• Develop a draft set of concise and action-oriented recommendations • Write a final recommendations report for implementation and action	Selection of Alternatives / Mitigation measures
Evaluation and follow-up	Evaluates the processes involved in the HIA and its impact, and follow up of the HIA through monitoring and a health impact management plan	• Conduct process and impact evaluation • Set up monitoring impacts • Develop a health impact management plan	Environmental Management Plan

For detailed coverage of HIA and each step see 'HIA: A Practical Guide' (Harris et al. 2007). The section below covers the three areas discussed to improve EA practice to consider health within sustainable development, based on this guide. These areas are

- including health data
- developing causal pathways between exposures or determinants and health effects, and
- considering the equitable distribution of exposures and impacts in relation to different population groups.

4.3 Including health data

The inclusion of health data is a vital element in providing concrete links of prospective project activities through the environmental, social and economic determinants of health to different population groups to health outcomes. The first task however is to consider the population profile of those living within the sphere of the project and the potential determinants of health that exist within the affected area (and potentially beyond, for example where hospitals or education facilities may be). This enables an initial estimation of equity through considering local population size and distribution, but also current health status, baseline environmental conditions (including issues such as transport links), other health determinants and locations where at risk groups may be concentrated such as schools or hospitals (Harris et al. 2007). At a minimum this profile should focus on age groups, gender, culture and ethnicity, aboriginality, socio-economic status or position, and locational disadvantage (where people live) and current health and disability (Harris-Roxas, Simpson et al. 2004; Harris-Roxas and Harris 2007; Harris 2007).

Data on health impacts in EA can be both quantitative and qualitative, with different methods of gathering both. However, attempts should be made to collect information on potential impacts through triangulating two or more data sources, as this adds weight to the assessment and developing recommendations (Harris et al. 2007).

It should be noted there is a persistent concern in literature that health impact data is vague, uncertain, and will add time and cost requirements to the EA process (Steinemann 2000; Commission of the European Communities 2003; Ahmad 2004; Cole, Wilhelm et al. 2004; McCaig 2005; Hilding-Rydevik, Vohra S et al. 2008; Thomson 2008). However, where the purpose of EA is as a proactive planning tool

(Steinemann 2000) with the aim of influencing 'real world' decisions, both EA (Benson 2003; Cashmore 2004) and HIA (Birley 2003; Veerman, Mackenbach et al. 2007; Kemm 2008) are based on a quasi-quantitative approach rather than a traditional scientific rationalist approach to evidence. This is well known in EA professional circles (but less so in the health profession where many of the criticism about evidence in EA / HIA stem from), where predictive risk assessment is in the main undertaken using expert opinion rather than quantitative data analysis due to difficulties in prospectively quantifying what is yet to exist.

EA requires good quality quantitative evidence for prediction (Kemm 2005) (for an Indian mining example of quantitative data that links to health see (Ghose 2007). However gathering quantitative evidence is not a panacea. This is in part due to the need for qualitative as well as quantitative evidence to fully understand impacts (Mayoux and Chambers 2005; Harris et al. 2007). Also, designing and using quantitative studies for prediction for EA is difficult (Ghose 2007) and collecting good quality quantitative data is challenging (for example see (Bongers, Janssen et al. 2008). This is particularly true for the determinants of health because the associations between the determinants and health are by their very nature diffuse and indirect – and research funding to date has yet to be oriented toward investigating these associations (Kemm 2008; World Health Organisation 2008; Ostlin, Schrecker et al. 2009). Perhaps the most important next step in the iteration of health impact assessment will be to improve the quantitative evidence base concerning the determinants of health and their pathways to health outcomes (Kemm 2005; Veerman, Barendregt et al. 2005; Veerman, Mackenbach et al. 2007).

However, the drivers for EA and HIA, for example addressing the determinants of health and health inequity, often require that decisions be made now rather than in the distant future when science has caught up. EA and HIA therefore require balancing science against the pragmatic realities of decision-making (Birley 2002; Cashmore 2004; Kemm 2008). However, this does require the most rigorous assessment possible to provide decision-makers with a systematic technical examination of the issues (Eyles 1999; Glasson 2005). A good quality EA / HIA report is built on transparency concerning the data used, methods used to generate this data, and the decisions and recommendations made based on this data (Glasson 2005; Harris et al. 2007; O'Connell and Hurley 2009).

4.4 Developing causal pathways between exposures or determinants and health effects

The determinants of health, as discussed, form useful links between a project activity, or a potential area of impact, and health outcomes. An example in the EA process where this is particularly useful (although not limited to) is the scoping of project 'input requirements' through to health outcomes. A simple additional requirement could be to ask whether each scoped project parameter, using the checklist of key parameters (Ministry of Environment and Forests 2001) provided to proponents. For example 'Noise vibration: frequency' could have a range of health effects including sleep deprivation and stress. This could be supported by existing known data or outcomes from past public consultations.

There has been a concerted effort in the health sector in recent years to understand and map the causal pathways between a broad range of exposures and outcomes, culminating most recently in. the World Health Organisation's work on 'Driving forces-Pressures-State-Exposure-Effects-Action framework' (Carneiro et al. 2006; Morris et al. 2006). Such frameworks provide a solid platform to progress causal pathway mapping in HIA (Birley 2003). It is noteworthy that these frameworks are similar in structure to logic models. Logic models identify project inputs, processes to achieve change, and the predicted impact and outcome of those changes. These categories are useful to adapt within EA to create causal chains between project activities, determinants of health, populations affected, and health outcomes.

4.5 Considering equitable distribution of exposures and impacts in relation to different population groups

In addition to the determinants and their causal associations it is important to consider the equitable distribution of each project input or activity on different population groups. Considering equity fully however is a three step process. First is assessing the differential distribution of health effects among and within populations. Fortunately, driven by the health sector, there is now a sophisticated understanding of collecting and using data to measure the differential distribution of health among different population groups (Alenius 2001; Ahmad 2004; Dahlgren and Whitehead 2006). More recent developments in HIA as part of EA in Sweden have provided useful methods to assess differential impacts based on a risk assessment approach (Linell and Knutsson 2008).

However differential distribution of impacts alone is not useful for EA, as the list of groups differentially impacted upon can be endless and the allocation of responsibility to address the distribution becomes impossible. To remedy this in EA, the second and third steps of assessing equity require considering whether the distribution of impacts is fair and whether it is modifiable. Fairness requires making, and negotiating value judgements concerning impacts (i.e. this is unfair so action must be taken). Modifiability is a pragmatic lens that explicitly considers whether or not it is possible to take action to remediate, mitigate or change the predicted differential impact (i.e. this is modifiable so responsibility for action can be assigned).

4.6 Use of assessment matrix and or lens

Consideration of causal pathways and equity is facilitated by using a matrix or a structured process that assesses activities, gaps or issues in the proposals as inputs along a causal pathway ending with initial draft recommendations (including alternatives or mitigation measures). An example is shown in Figure 3 below. Importantly, each category should be scoped for inclusion and importance. For example while distribution should always be considered, where this is most important (i.e. large numbers of population groups affected) this should be considered before other categories such as likelihood of impact.

In addition, rapid HIAs we have been involved in have taken a less detailed approach by using a lens (see Box One) (Harris 2006) that operates similarly to the matrix, working from an input to recommendations, but in less detail. This could be adapted for inclusion at various stages of the EA process (for example screening whether to proceed by making an initial equity assessment).

Following the use of these tools, then initial impact recommendations can be prioritised against various criteria (for example likelihood, magnitude, severity and size of differential effects, modifiability, fairness).

BOX ONE: Health equity Lens (Harris, Harris and Kemp, 2006)
- What is the initiative trying to do?
- What is the evidence of inequality of the initiative?
- Who may be disadvantaged by the initiative?
- What are the potential unanticipated impacts of the initiative?
- How can the initiative be improved?
- Equity recommendations for the initiative

Figure 3. Comprehensive assessment matrix using a mining example (Harris 2007a)

Activity	Relevant Determinants of Health	Source of information	Nature of Impact[1]			Timing of impacts[2]	Size of Impact/ Magnitude[3]	Likelihood[4]	Groups, communities or populations bearing differential Impacts[5]	Nature of differential Impacts			Scope for rec.s to be adopted and acted upon[6]	Initial Rec.s[7]
			+ve	-ve	unclear					+ve/ -ve/ unclear	Is this modifiable?	Is this fair?		
Generation of excessive noise and vibration	Housing	Population profile		√		Long	Small	Probable	Children,elderly, low socioeconomic housing	-ve	Yes	No	Low	Insert sound barriers
	Workforce	Literature		√		Short	Medium	Definite	All, current disability	-ve	Yes	Yes	Medium	Ensure OH&S practices are adhered to
Release of pollutants	Farming	Population profile			√	Short, medium, long	Large	Definite	Farmers and workforce, place of farms	-ve	No	Yes	Low	Relocate farms
	Injury	Literature / prior consultation		√		Short	Negligible	Speculative	Children, elderly, current disability	-ve	Yes	No	High	Control effluent

[1]Impacts can be both positive and negative – provide notes on what aspects are negative, positive or unclear.
[2]Long, Medium or Short. Note the information this assessment of timing of impacts is based on
[3]Large, medium, small or negligible. Note the information this assessment of magnitude is based and why that category (L, M, S, N) was chosen
[4]Definite, probable or speculative. Note the information this assessment of likelihood is based on.
[5]List groups, communities or populations who bear may bear differential impacts. At a minimum consider differential impacts in terms of age, gender, ethnicity/culture, socioeconomic position and locational disadvantage. Include the size of the population (Large, Medium, Small, Negligible, Unclear), noting the information this assessment of size is based on.
[6]High, medium low or negligible. Note the information this assessment of achieving change is based on
[7]List possible recommendations, drawing on the evidence gathered in the identification step. Consider differential impacts when formulating recommendations in order to maximise positive impacts, minimise negative impacts and to ensure an equitable distribution of impacts.

4.7 Summary

This final section of the chapter has focussed on technical elements to include health in EA practice, building on lessons from HIA. One element is incorporating health data by developing a population profile and then gathering and using both quantitative and qualitative data. A second is elucidating causal pathways between project activities, the determinants of health, and health outcomes, using frameworks and logic models. The third is considering equity pragmatically by focussing on whether impacts are distributed fairly and whether taking actions for change is possible. Finally, some tools to incorporate these elements in EA were provided.

5. Conclusions

This chapter has brought together the most up to date thinking and literature on the inclusion of health and wellbeing within EA. It is increasingly clear that EA practice is evolving to better consider sustainable development. The next step in this evolution is to include health and wellbeing as an inherent part of environmentally sustainable development. This is because health adds a tangible outcome to the environmental, social and economic considerations that can be used to better inform decisions about project development. These include improving risk analysis, selecting appropriate alternatives, and identifying and developing feasible, appropriate and adequate mitigation measures. Health is a critical enabler for and an outcome of sustainable development (McMichael 2006). It is hoped that the chapter enables readers to incorporate health as part of quality and equitable sustainable development in India and beyond.

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