European Commission

Science for Environment Policy

Air quality health impact assessments should use combination of metrics

Health impact assessments (HIAs) provide information on the potential health impacts of policies, and are important for developing regulation on air pollution. In this study, researchers evaluated the metrics currently used in air quality HIAs to provide recommendations for their use in policy.

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Clean air is important for human and environmental health. Over recent decades however air quality has deteriorated. Poor air quality is now the major environmental cause of premature death in the EU, and is estimated to cost society approximately €23 billion every year[1]. The EU has therefore been working hard to improve air quality, most recently via the Clean Air Policy Package.

Policy on air pollution often uses health impact assessments (HIAs). As well as evaluating the disease burden caused by pollution, HIAs can model the impact of future scenarios and the benefits of regulation.

Limitations to the availability of data mean most HIAs to date have been qualitative. The lack of quantitative metrics, which summarise health effects within a single figure, makes it difficult to communicate air quality impacts to decision makers. Although an increasing number of quantitative metrics are now being used, they differ in significant ways, and guidance is lacking how to best use these different metrics.

This study evaluated a range of quantitative air quality metrics that are currently used in HIAs. To identify the metrics, the authors reviewed literature published between 2011 and 2015. Metrics were evaluated using a set of criteria, which stated that the metrics should: be accurate and comprehensive, account for variation in exposure and population susceptibility, consider time lags, be easily understood by a wide audience, and describe uncertainty.

Using these criteria, the authors evaluated each type of metric to provide a summary of their respective strengths and weaknesses. Strengths of *predicted number of premature deaths, disease cases or unscheduled hospitalisations* included ease of interpretation and ability to demonstrate the magnitude of an impact based on the number of people affected, but the inability to make direct comparisons between populations and lack of information on the duration of impacts were listed as limitations. *Percent attributable* (the portion of disease cases attributable to exposure to air pollution) can highlight the most beneficial option for reducing the incidence of adverse outcomes, however its value can be limited if estimates for other exposures are not available. *Attributable rate* (e.g. the number of potential avoided mortalities in a population) enables comparisons between populations, but rates can be difficult to interpret. *Disability-adjusted life years* (DALYs, the number of years lost due to ill-health, disability or early death) account for the duration of an outcome, but do not fully represent the importance of disease outcomes due to weighting factors. *Monetised impacts* allow comparisons with other (non-health) types of impact, but may not accurately reflect the societal costs of disease. Finally, *functional-unit based metrics* (such as benefits per tonne) can identify emission sources for targeted reductions, but can be inaccurate due to uncertainties in data.

The authors also used a case study to demonstrate the formulation, use, benefits and limitations of metrics. The case study was based in the US, specifically Detroit, Michigan and the surrounding county, which is a mostly urban region. The researchers evaluated a scenario in which $PM_{2.5}$ concentrations are lowered across the country from 10 μg/m^3 to 8 μg/m^3 (the current national annual average is 12 μg/m^3). A variety of metrics were used, including rates of premature mortality, years of life lost and monetised impacts attributable to a reduction in $PM_{2.5}$ concentrations.

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1. http://ec.europa.eu/environment/air/index_en.htm

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Based on their combined findings, the authors provide recommendations for using HIA metrics to make policy on air quality:

- **Use quantitative metrics**

If the data are available, HIAs should use quantitative metrics to assess health impacts. They can compare scenarios, estimate the magnitude of impacts and the total number of people affected – evidence needed by decision makers creating air quality management plans.

- **Use several complementary indicators**

As no single metric could meet all the evaluative criteria, the use of several complementary indicators is recommended. This is important, because different metrics prioritise different health outcomes. For example, the 'number of avoided cases approach', which may describe the number of asthma cases avoided by air pollution regulation for example, emphasises common but low severity impacts, while DALYs emphasise the smaller number of premature deaths.

- **Tailor metrics to the local context**

Urban-scale HIAs can be used to inform decision makers about the benefits of exposure reduction methods, such as the use of vegetative buffers and indoor air filtration. The evidence from these HIAs could encourage decision makers to implement beneficial local interventions.

- **Consider community values**

Community values should be considered when choosing metrics for urban-scale HIAs. Engagement with stakeholders may help decide which metrics to use.

- **Use local information**

Using local data, such as emissions data, improves HIAs by accounting for spatial variability and demographic factors.

- **Use qualitative methods to enhance quantitative analyses**

Quantitative metrics may underestimate the total effect of a policy, because some impacts (such as cancer) cannot be reliably measured. Qualitative methods should be used to identify these outcomes.

- **Identify environmental and health co-benefits**

Some management strategies can have benefits for human health and the environment (e.g. climate change mitigation). These opportunities should be identified and quantified using the same metrics selected for air pollution HIAs to increase the comprehensiveness of the assessment of control strategies.

The authors also discuss some of the challenges of using HIAs. They say HIAs are most effectively performed using regional health data, which may not be available in countries where resources are limited. Long-term air quality data is also not available in many regions. While concentrations can be estimated, using satellite data for example, these methods have uncertainties and may not capture urban-scale patterns. Therefore, site-specific comprehensive HIAs may not be feasible in some regions. However, the authors say approximations can still be useful and can highlight important gaps in knowledge.