
Editorial: Integrated approaches to risk assessment and risk communication

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The papers in this volume are based on presentations given at a workshop on 'From risk assessment to risk response' held at the University of Athens, on 2 and 3 April 2008. The workshop was organised and partly supported by four EU-funded research projects – Integrated Assessment of Risks to Health of Environmental Stressors in Europe (INTARESE), Health and Environment Integrated Methodology and Toolbox for Scenario Assessment (HEIMTSA), Full-chain and Uncertainty Approaches for Assessing Health Risks in Future Environmental Scenarios (2-FUN) and Novel Methods for Integrated Risk Assessment of Cumulative Stressors in Europe (NoMiracle) – in association with the Society for Environmental Geochemistry and Health. This editorial essay draws out some of the key questions and themes that run through the papers included here, and in many of the presentations and discussions at the meeting.

The central question is a broad yet crucial one: in the context of the complex problems that increasingly face society, how can we achieve effective assessment of, and communication of information about, risks to human health in ways that ensure coordinated risk response by all the actors involved. This is a challenge that has long faced – and to a large extent frustrated – risk assessors and risk managers, for it implies the ability to link rigorous science to open processes of discourse with stakeholders, often against a background of limited evidence and considerable analytical uncertainty, as well as public anxiety and suspicion. In the context of many of the systemic risks to human health that arise from today's (often global) environmental problems, the challenge is both more intractable and more urgent. Intractability arises because of the multiple causes, pathways and effects that characterise many of these problems. Urgency comes from the large public health burden that these problems imply, and thus the need for precautionary policy action.

Traditional approaches to risk assessment, derived largely to deal with proximal and unitary risk factors, clearly have severe limitations when confronted by these modern, systemic risks to health. A new, more inclusive paradigm for assessment is therefore needed. As Briggs argues, this has begun to emerge in recent years, in the form of 'integrated assessment'. While originally developed primarily in the context of environmental policies (and thus to a large extent neglecting human health), this is now being extended and developed by the EU-funded projects represented here as a basis both for diagnosing risks to human health from existing (or emerging) environmental stressors, and as a way of prognostically assessing the health impacts of new or future policies. At the heart of this approach is the concept of the full chain (or web), linking primary sources via different environmental media and pathways to human exposures and

ultimate health consequences. ‘Integrated environmental health impact assessment’ thus requires the ability to model the way risks to health are propagated along this entire chains, and to aggregate the consequences into an overall measure of health impact that can be used to guide policy decisions. Because such risks also touch upon the lives of many different people, often across large areas and in different walks of life, it also requires the ability to engage stakeholders throughout the process: in defining the problems that need to be addressed, in designing the scope and methods of assessment, in conducting the assessment and in interpreting the results.

Doing integrated environmental health impact assessment is inevitably challenging, not least because of the complexity of the systems involved. These systems are characterised by many-to-many, one-to-many and many-to-one relationships, such that almost every element within the system is multiply inter-dependent. Interaction and feedback are thus inherent in the causal chains, with the consequence that few outcomes can be tied to specific individual causes, most causes have multiple effects, and intervention at any point in the system can trigger off complex and far-reaching changes. One specific example of this is seen in the existence of multiple exposures, whether in the form of chemical mixtures or the combination of different (e.g., physical, biological and chemical) hazards that may arise in the case of problems such as climate change or natural disasters. The science on which to base assessments of these multiple exposures remains poorly developed, and the consequences of the non-additive effects which might be involved are all too often ignored in traditional forms of risk assessment. Addressing these complexities thus requires significant advances in methodology and approach, not only in the individual disciplines on which assessments draw, but also, crucially, by linking them within a more integrated conceptual and analytical structure. This needs to recognise, in particular, the dynamics of interaction which occur at all levels in the systems being studied, from the molecular (e.g., biochemical reactions between different components of the pollution mixture), to human behavioural (e.g., effects of diet or lifestyle) to the societal (e.g., cultural influences on risk perceptions and individual behaviour). Sarigianis et al. explore such a ‘connectivity’ approach, in which various strands of the new -omics technologies are combined with environmental science, epidemiology, toxicology, physiology, molecular biology, biochemistry, mathematics and computer science to provide a more coherent basis for analysis of chemical mixtures. They show, especially, that assumptions of simple additivity of effect across different exposures may seriously distort estimates of risk and health impact. Better knowledge of interactions within the system, and better methods for modelling them, are therefore essential if integrated assessments are to be reliable and informative.

The challenges of complexity nevertheless have deeper implications for the way in which assessments are conceived and done. They also affect the way in which we see problems in the first place, the scope of any assessments that may then be done, and the uses that might be made of the results. Keune et al., for example, argue that the only means of effectively managing complexity in assessments is to reduce it. Tellingly,

“this is best done at the start, for otherwise large amounts of effort may be wasted on trying to analyse factors that, in the end, are too uncertain to carry any weight in the assessment, or too complex to communicate to the decision-maker. Retaining unnecessary complexity through the assessment may thereby act to reduce, rather than strengthen, the credibility or utility of the results in the eyes of the user.”

Issue-framing thus holds the key to effective assessment, and this is intrinsically an 'inter-subjective' process in which researchers discourse with each other, and the phenomena under study, to select and prioritise what should be assessed. Nor does the subjectivity end there, for no matter how detached and objective the scientists might try to be in the actual performance of the assessment, at the end choices have to be made and decisions enacted. Specialists, however, tend to shy away from making such inferences, because of their individual lack of wider knowledge and understanding. Ultimately, therefore, the non-specialist is left the task of making practical sense of the science, and the inherent complexities, so that the link to the scientific foundations is inevitably weakened. Public participation in this process, as well as that of issue-framing, is essential if the subjectivities are to be given a broader foundation, and if the results are to achieve respect and credibility.

How to achieve balanced and effective discourse with the many stakeholders involved is far from easy. If it is to be effective, risk communication has to be much more than a one-way process of information-giving, and instead requires the active participation and engagement of all those with genuine interests in the issue of concern. Identifying true stakeholders is itself difficult, especially for emergent issues, the impacts of which depend in part on how those involved respond. Participation is also often hindered by a range of circumstantial factors which limit opportunity to be involved, including the deliberate attempts at exclusion by the scientists or professional agencies involved, and the barriers of finance, time, confidence and knowledge that typically exist. Jardine et al. explore some of these barriers in the context of a specific environmental health issue (chlorinated disinfection by-products in drinking water) in two Canadian cities. Notably, the perceptions of the opportunities and barriers for involvement are very different between the statutory/regulatory agencies, on the one hand, and the lay stakeholders, on the other. Each group is thus, to a large extent, a prisoner of its own role, experience and circumstance. One implication is that efforts by statutory authorities to encourage wider, public stakeholder involvement are likely to be only partially successful, unless a real effort is made to see the world through the eyes of these stakeholders. Jamieson and Briggs discuss the potential of stakeholder partnerships as a means of sustained, long-term engagement. Important benefits of this approach are that it can help to foster the understanding and trust that are needed to address complex and controversial issues. To do so, however, partnerships must recognise (and accept) the differing styles of discourse and goal-seeking strategies that members bring, as well as their different levels of articulacy and expertise. This requires clear and agreed 'rules for engagement' within the partnership, along with the willingness to listen to, and learn from, each other, whatever the apparent imbalances in formal experience and role. Ultimately, however, they suggest that the greatest challenge may be to persuade the authorities concerned actually to share their responsibilities and adopt a truly negotiative rather than didactic approach to policy, without which any advice from partnerships is likely to be ignored and of little practical effect.

Assmuth et al. take this argument further. At the outset, they emphasise, both the contents (structures) and goals (functions) of integrated risk assessment need to be clearly stated if risk management is to be effective. Management also needs to be seen as a behavioural process that deliberately (as well as accidentally) impinges on the way in which the system operates. Risk managers are, therefore, key players in affecting how risks develop and the impacts they have, just as other stakeholders are important actors in

the management of those risks. The division between assessment and management that has often been seen as essential in traditional approaches to risk management is, therefore, artificial and in many ways counter-productive. They thus propose a more inclusive and integrated framework for risk analysis, linking the downstream (consequential) perspective of risk assessment with the upstream (attributive) perspective of management.

As all these papers thus indicate, recognition of the need for more integrated approaches to assessment, in order to deal with the systemic environmental threats to health that increasingly confront society, poses substantial challenges to the traditional paradigms on which risk assessment and risk communication have been built. On the one hand, integration implies the use of scientific concepts and tools that can deal with the complexities involved. On the other, it requires far more inclusive approaches to assessment and management, which harness more closely and effectively the experience, expertise, knowledge and interests of the many different actors and stakeholders concerned. As yet, our ability to achieve either of these goals remains limited.