# Planetary health as a laboratory for enhanced evidence synthesis

A key challenge in the Anthropocene is to adequately understand future risks to the health of human and natural systems and to design solutions that successfully avoid, prepare for, or manage the identified risks.[1,2] This process of learning needs to be swift and rooted in the best-available evidence—ie, in formal evidence synthesis.

Both the health and the global environmental change communities have developed into flagships of scientific policy advice with distinct approaches. Global environmental assessments—particularly those done by the Intergovernmental Panel on Climate Change (IPCC)—synthesise the knowledge required to advance international negotiations. These syntheses were crucial. Without the robust evidence provided by the IPCC and the institutionalised dialogue between scientists and climate diplomats, neither the Kyoto Protocol nor the Paris Agreement would have been possible. Similarly, evidence synthesis in the health sciences have dramatically improved our understanding of the exposures that harm health and the efficacy of various interventions to improve patient treatment and accelerate progress through enhanced efficiency and information flow. Method development and standardisation of systematic reviews of evidence routinely inform health-care policies. The success of this approach is catalysing uptake in other disciplines, such as the social and environmental sciences.[3]

Evidence synthesis in health science is primarily an ex-post, bottom-up exploration of risks and interventions. The basic framework is that population health problems can be compartmentalised into specific questions regarding, for example, the effects associated with a particular exposure and the effective everyday treatment of patients, with each concept organised as an individual evidence pyramid (from primary studies to guidelines and decision support tools; figure). Learning emerges almost exclusively from a rigorous understanding of what works on the basis of an experimental exploration of the effectiveness of interventions.[4] Systematic reviews are the central building blocks of evidence synthesis. Learning is mainly facilitated by aggregating results from similar experiments across the literature and understanding the drivers of variations. Such evidence syntheses follow rigorous standards established by organisations such as the International Agency for Research on Cancer, Cochrane, the Campbell Collaboration, or the Collaboration for Environmental Evidence to inform decision making with the best available evidence rooted in the principles of transparency, repeatability, objectiveness, and comprehensiveness.[5] Policy demands can be met by moving up an evidence pyramid from primary studies to systematic reviews—ultimately to clinical guidelines and decision support tools.[6] Therefore, no overview assessment across health domains exist as they do in the global environmental change community.

Evidence synthesis traditions in the global environmental change community emerged to answer broad, multidisciplinary, and mainly forward-looking policy questions through comprehensive assessment reports that synthesise multiple lines and types of evidence. Such grand scientific assessments of future risks are required because climate change is a wicked policy problem that could severely, pervasively, and irreversibly affect human and natural systems in the absence of an adequate human response. In such a world of foresight, there is a broad perception that relevant evidence includes mechanistic understanding, theory, data, models, and expert judgment, because there is no observed data for projected future events.[7,8] Model ensembles exploring

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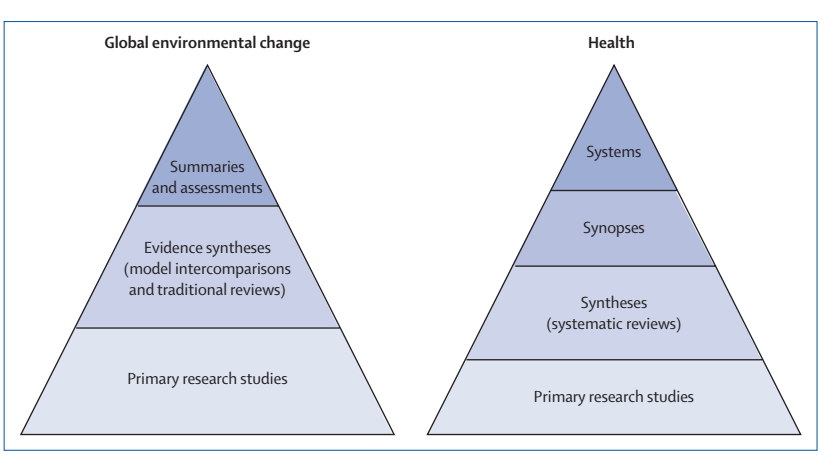


*Figure:* **Schematic pyramids of evidence synthesis traditions for the global environmental change and health communities**

alternative futures function as important synthetic hubs, where knowledge from different disciplinary domains are combined. The evidence synthesis pyramid is organised from the top down, where the middle layer focusing on evidence synthesis is expected to emerge, driven by knowledge demands from IPCC and other global environmental assessments. This demand is currently met primarily by the modelling community that has institutionalised scenario development and synthesis platforms such as Coupled Model Intercomparison Project, the Integrated Assessment Modelling Consortium, or the International Committee On New Integrated Climate change assessment Scenarios.[9]

Despite their strengths, both the health and global environmental change approaches have weaknesses that limit enhanced learning. The narrow, disciplinary-focused approach in health might be appropriate to understand the effectiveness of different interventions, but does not lend itself to understanding the grand challenge of securing human and planetary health. Some of the biggest public health risks are projected to be ahead of us, but scenario approaches that evaluate alternative futures remain largely foreign to the health community. The framework for systematic reviews—the only commonly accepted tool for evidence synthesis in the field—cannot be directly applied when synthesising studies of the future risks of climate change. For example, setting a priori criteria for evaluating the quality and results of models does not lend itself to assessing global environmental change with its deep uncertainty on how certain outcomes unfold in a particular time and space. Moreover, wicked policy problems around the health of natural and human systems often raise much broader questions that do not follow an intervention-focused systematic review logic. Instead, integrating multiple lines of evidence from different disciplines is crucial to developing actionable policy-relevant information, but the field of health has been slow in developing adequate methods for its toolkit.

The global environmental change community successfully established model intercomparisons as a rigorous, synthetic tool that has been instrumental for understanding global environmental change.[9] However, little progress has been made outside the modelling community in understanding climate solutions because of a noticeable absence of systematic review methods and their communities of practice. In most of the agricultural, social, and engineering sciences of global environmental change, reviews are generally personal, non-transparent synopses of selections of the scientific literature. As a result, there is little learning on what policy interventions and governance structures work under what conditions and why. Similarly, the absence of common practices to critically appraise study validity leaves untouched any potential to increase the quality of future primary research by identifying best practices and deficiencies in study design.[3]

Because evidence synthesis traditions in the health and global environmental change communities are highly complementary, bringing them together would facilitate shared learning and enhanced evidence synthesis practices. This merge would require a fundamental cultural shift in two matured and siloed scientific communities that would ultimately require changes to research practices, university curricula, academic incentive systems, and funding schemes. A pragmatic start could focus on establishing a dialogue and scientific exchange between these communities. We suggest four entry points. First, raising awareness and education: knowledge sharing and education of researchers and decision makers regarding evidence synthesis methods and traditions could increase capacity for and understanding of both systems, and facilitate integration and cross-fertilisation. Second, collect synthetic evidence: low-hanging fruit for strengthening the evidence of global environmental assessments and connecting them with medical research communities is packaging systematic review evidence and channelling it into IPCC and similar assessment processes during the review of drafts or by providing it to chapter leads or authors. Similarly, public health assessments can be strengthened by considering how global environmental and other changes could affect the magnitude and pattern of future health burdens.[10] Third, engage the communities: a broader involvement of systematic review scholars with appropriate expertise to be coauthors on global environmental assessments (we recognise that evidence synthesists are already engaged in health-related chapters to some degree). On the other hand, working groups on key global environmental change topics such as climate change or biodiversity could be founded within Cochrane, the Campbell Collaboration, and the Collaboration for Environmental Evidence. Fourth,

institutionalise communication and collaboration: it will be important to establish sustained communication between lead institutions in evidence synthesis communities such as the IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Cochrane, the Campbell Collaboration, or the Collaboration for Environmental Evidence. Collaborations could be institutionalised by founding working groups on climate and global environmental change in these institutions, and by electing health and systematic review scholars into governing bodies of global environmental assessments.

These starting points are modest given the challenges, but developing collaborations across these communities is an effective approach to raising awareness of the societal need for them to join forces. Comprehensive solution-oriented assessments of the grand challenges of our time require merging both evidence synthesis traditions—ie, rigorous systematic review of policy interventions that tell us what works under which conditions and why, and model-based explorations of the future through IPCC and the large model-intercomparison exercises. Merging both evidence synthesis approaches will provide more comprehensive and rigorous synthetic evidence.

A new, enhanced evidence synthesis system that entails both traditions can create formal interfaces between ex-ante and ex-post, qualitative and quantitative, as well as modelling and empirical evidence. Such a system will provide increased efficiency, better evidence-informed policy on issues that matter, reduce research waste, and higher quality research and assessment. It could enable, for the first time, an evidence synthesis pyramid that really works. The planetary health community is in a sweet spot between the health and global environmental change community. As such, it could become a major catalyst of change towards enhanced evidence synthesis that will unleash desperately needed progress in both communities and lift actionable scientific policy advice to the next level.

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