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Review

On the use of systematic reviews to inform environmental policies

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ABSTRACT

Environmental research varies in its methodological quality, degree of bias, and relevance to policy questions. Using this heterogeneous, and sometimes polarised, research to inform environmental policies can be challenging. Policy-making in the healthcare field sometimes uses systematic reviews (SRs) to tackle these issues and present a comprehensive, policy-neutral, transparent and reproducible synthesis of the evidence. However, there is less familiarity with SRs in the environmental field. The aim of this article is to: (1) summarise the process of conducting SRs, using best practice methods from the healthcare field as an example, (2) explain the rationale behind each stage of conducting a SR, and (3) examine the prospects and challenges of using SRs to inform environmental policy. We conclude that existing SR protocols from healthcare can be, and have been, applied successfully to environmental research but some adaptations could improve the process. The literature search stage could be expedited by standardising the reporting and indexing of environmental studies, equivalent to that in the healthcare field. The consistency of the study appraisal stage of SRs could be augmented by refining the existing quality assessment tools used in the healthcare field, enhancing their ability to discriminate quality and risk of bias in non-randomised studies. Ultimately, the strength of evidence within SRs on environmental topics could be improved through more widespread use of randomised controlled trials as a research method, owing to their inherently lower risk of bias when conducted according to best practice.

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1. Introduction

Environmental research varies in its methodological quality,[1] degree of bias,[2] and relevance to policy. Using this heterogeneous, and sometimes polarised, research to inform environmental policies can be a challenging task, which at present is often first approached through the use of narrative literature reviews (Boyd, 2013). It is recognised that these types of literature reviews are vulnerable to author bias, which can occur when the review authors intentionally or unintentionally select or emphasise research according to their own opinions, prejudices or commercial interests (Higgins and Green, 2011). Furthermore, narrative literature reviews rarely consider, in a reproducible and meaningful manner, the methodological quality, degree of bias, and therefore reliability of the primary studies that are cited. These features of narrative literature reviews could lead to ill-informed environmental policies.

In evidence-based policy-making in the healthcare field, systematic review (SR) processes are used in order to tackle these issues, helping to present a comprehensive, policy-neutral, transparent and reproducible synthesis of the evidence. These SR processes are exemplified by the activities of the Cochrane Collaboration (http://www.cochrane.org/); an international network of more than 31,000 researchers and practitioners (a mix of volunteers and paid staff who are affiliated to the organisation), from over 120 countries, who work to help healthcare practitioners, policy-makers, patients, their advocates and carers, make well-informed decisions about healthcare, by preparing, updating, and promoting the accessibility of SRs on the effectiveness of healthcare interventions. The Cochrane Collaboration have published over 5000 SRs so far, all of which are freely available online in the *Cochrane Database of Systematic Reviews*, which is part of *The Cochrane Library* (http://www.cochrane.org/cochrane-reviews/about-cochrane-library).

There is a common belief outside of healthcare, however, that SRs intrinsically adopt a biomedical model that is of relevance only to medicine, for example only capable of using randomised controlled trials (RCTs) and only capable of answering certain types of questions (Petticrew, 2001). As demonstrated in this article, this belief is unjustified. The practices of the Cochrane Collaboration have spurred the development of another international initiative; the Campbell Collaboration (http://campbell.gse.upenn.edu), who prepare, maintain, and disseminate SRs on the effectiveness of social and behavioural interventions in education, social welfare, and crime and justice (Davies and Boruch, 2001). More recently, these practices have spurred the founding of the Collaboration for Environmental Evidence – CEE (http://www.environmentalevidence.org/); an open community of scientists and managers who, from their initial centres in Australia, South Africa, Sweden and the UK, have started to prepare SRs on environmental topics. Nevertheless, at present many environmental researchers, practitioners and policy-makers are typically less familiar with exactly what a SR involves, and often have major misconceptions about their history and purpose (Petticrew, 2001). The aim of this article is to: (1) summarise the process of conducting a SR, using the Cochrane Collaboration's exemplary methodology as an example (http://handbook.cochrane.org/), (2) explain the rationale behind each stage of the process, and (3) examine the prospects and challenges of using SRs to inform environmental policies.

2. The process of conducting a Cochrane systematic review

The key stages of producing a Cochrane systematic review (CSR), as described in the Cochrane Handbook (http://handbook.cochrane.org/), are illustrated in Fig. 1 and are summarised and compared to traditional literature reviews in Table 1:

2.1. *The rationale behind each stage of a Cochrane systematic review*

2.1.1. *Formulating a question*

As with any research, the first and most important decision in preparing a CSR is to determine its focus (O'Connor et al., 2011). This is best done by clearly framing the questions the review seeks to answer. Well-formulated questions will guide many aspects of the review process, including determining eligibility criteria, searching for studies, collecting data from included studies, and presenting findings (Jackson, 1980; Cooper, 1984; Hedges, 1994). In CSRs, questions are stated broadly as review 'Objectives', and specified in detail as 'Criteria for considering studies for this review' (O'Connor et al., 2011). A statement of the objectives typically begins with a precise statement of the primary objective, normally in the format of a single sentence. For example, for CSRs this may take the form: 'To assess the effects of [*treatment, intervention or comparison*] for [*health problem*] in [*types of people, disease or problem and setting if specified*]'. This might be followed by one or more secondary objectives, relating to different participant groups, different comparisons of interventions or different outcome measures (O'Connor et al., 2011). As this example suggests, the detailed specification of the review question requires consideration of several key components (Richardson et al., 1995; Counsell, 1997), including the types of populations (or participants), types of interventions and comparisons, and the types of outcomes that are of interest (*PICO* – Participants, Interventions, Comparisons and Outcomes) (O'Connor et al., 2011). As well as focussing review conduct, the contents of these sections are used by readers in their initial assessments of whether the review is likely to be directly relevant to the issues they face (O'Connor et al., 2011).

Systematic reviews are likely to be more relevant to the end-user and of higher quality if the initial questions and the

[1] Methodological quality is the term used to describe the extent to which a study's design, conduct and analysis have minimised selection, measurement and confounding bias (West et al., 2002, p. 2). Some authors argue that a more complete definition should also include external validity, appropriateness of statistical analyses, and use of ethical procedures (Berlin and Rennie, 1999).

[2] Bias is the term used to describe a systematic error or deviation in results or inferences from the truth.