

EDITORIAL

The power of weak signals: how systematic reviews direct researchers away from potentially biased primary studies

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Cochrane Database of Systematic Reviews 2022;(11):ED000160 <https://doi.org/10.1002/14651858.ED000160>

Published: November 2022

Systematic reviews are regarded as a cornerstone of evidence-based practice. High-quality reviews, such as those produced by Cochrane, are ideally placed to shape clinical guidelines, primary research, and clinical practice.^[1] However, the impacts of these reviews remain difficult to measure.

A type of impact that has so far received little attention is the effect of systematic reviews on the studies appraised within them. In addition to providing a summary of what is known about a given topic, reviews evaluate individual studies, identifying the most reliable ones and flagging those that are less robust. This is a complex task, as illustrated by the stringent criteria used by Cochrane Review authors. There are, however, some screening questions that review authors can pay attention to when trying to identify the most reliable studies.^[2]

Assessing the risk of bias of individual studies can assist in evaluating the overall strength of evidence but can also provide a useful signal for researchers who intend to publish in a certain area. Think about how a researcher might carefully consider whether to cite a study that has been retracted.^[3] In the same way, they might prefer to build their research on primary studies that systematic reviews have deemed solid.

In a recent study,^[4] we considered 22,928 publications assessed in 2,020 Cochrane Reviews. We performed difference-in-difference analysis on a carefully matched sample to explore whether risk of bias ratings could shift scientists' attention towards studies at low risk of bias. We focused on publications deemed at risk of bias due to selective reporting, a particularly concerning source of bias, associated with several factors, including the study's source of funding and the type of intervention evaluated.^[5]

We found that following the publication of a Cochrane Review, studies classified as being at high risk of bias due to selective reporting experienced a 7.9% ($P < 0.10$) decrease in annual citations relative to comparable studies rated at low risk of bias. This effect is rather modest when compared to retraction notices, which have been shown to lead to a decrease in citations of more than 50% ($P < 0.01$) up to two years after retraction and as much as 72% ($P < 0.01$) after 10 years.^[6]

A relatively smaller effect can be expected given that, unlike retractions, systematic reviews are not intended to correct the literature. Cochrane ratings address risk of bias, as opposed to outright misconduct. We also find that the citation effect depends upon certain characteristics of the rating, and the context. For example, the effect was stronger when the text comment attached to the rating was long, and for more recent articles.

Whilst risk of bias ratings might provide a relatively weak signal, it is still noteworthy that systematic reviews can redirect time-constrained scientists, supplementing more traditional signals such as citations or journal-level metrics. To the best of our knowledge, our study is the first to explore the effect of systematic reviews on the citations received by the appraised studies. The good news is that the 'traffic light' rating system appears to slow down wayward follow-on science. As such, it may offer a useful complement to retractions, which often provide only limited information and are slow to emerge.

The science system is a noisy and crowded intellectual landscape, in which scientists are liable to direct their attention to information that is easy to access. Changing the visibility and prominence of the risk of bias ratings might help turn this weak signal into a stronger one, generating a nudge to increase the efficacy of systematic reviews in shaping follow-on science.^[7] At a minimum, the ratings could be made visible from the Cochrane Central Register of Controlled Trials (CENTRAL) – at present, to access the ratings, scientists need to follow the 'How Cochrane used this article' link and retrieve the relevant review. More ambitiously, the ratings could be incorporated as a quality 'kitemark' by journals themselves, or into publication databases, such as PubMed. The risk of such interventions is that they might lead to disagreements between study authors and Cochrane Review authors. We would also need widespread education about how to correctly interpret the ratings.

Citations are not the only metrics used to assess the attention received by a scientific output. Altmetrics, for example, might offer some opportunities to understand whether systematic reviews impact non-academic audiences. While they might be susceptible to gaming, and potentially reward 'sensational' studies, altmetrics still present some advantages over the most traditional metrics, such as the ability to be observed

faster than citations. Other dissemination channels, such as Cochrane's partnership with Wikipedia, could also be explored. As incorporating ideas into Wikipedia leads to those ideas being used more even in the scientific literature,^[8] it is possible that the inclusion of review findings in Wikipedia pages might inform primary research.

Another set of questions concerns the review authors themselves. In their role as 'data detectives',^[9] review authors have the often uncomfortable task of looking for inconsistencies and unconvincing data. How does the scientific community respond to this role? Do review authors get punished or even rewarded for being the gatekeepers of a robust scientific system? It would be interesting to assess whether writing a review affects the career outcomes of the review authors, for example, by helping them attract more citations or shaping the type of research they pursue.

More broadly, systematic review is part of the wider post-publication review process, which extends to replication studies but also to blogs, Twitter commentary, and other new methods of dissemination. While these new platforms might enlist more people into scientific discussions, they may also generate some negative effects. In the process, the key messages might be lost, leading to controversies and epistemic trespassing (when experts in one field pass judgment in fields where they lack expertise).^[10] Upon inclusion in a review, the original studies may not be appropriately credited or become forgotten.^[11] As scientific studies are rarely an end point, but rather another means to carry on a robust discussion, the question is how best to structure post-publication interactions that generate informed debate, rather than unmoderated free-for-alls where 'the science' becomes personal very quickly.

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Declarations of interest

RS, PC and AS have written about the topic of this editorial in management journals. The authors declare no additional interests.

Provenance and peer review

This editorial was commissioned based on a proposal by the authors and was externally peer reviewed.

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