Viewpoint

Possible editorial responses to the proliferation of problematic meta-analyses and research syntheses

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Abstract

Journal and book editors in most disciplines are faced with a flood of meta-analyses, which critical reviews have shown are not always of sufficient quality. In the short run, editors could give targeted instructions to authors and make specific recommendations to reviewers to ensure that not only meta-analyses but also research syntheses more broadly, published under their watch, meet acceptable publication standards. In order to achieve satisfactory improvements in the long run, editors should foster fundamental changes in the way the publication of negative and non-significant results is handled.

Introduction

Over the past 20 years, meta-analyses have proliferated in most fields of research. An article by Page et al[1] proposing revised reporting guidelines for meta-analyses has been cited over 67,000 times so far, according to Google Scholar. One might argue that the staggering number of meta-analyses that have been published in recent years is linked to the concomitant expansion of the literature in virtually every field of research. According to some estimates, 5.14 million articles were published during 2022, substantially more than the 4.18 million published just 4 years earlier.[2] At the same time, with conflicting demands on their time for teaching, supervising undergraduate and graduate students, reviewing for journals, or writing grant proposals to compete for limited funding, researchers generally find it challenging to devote many hours to reading articles of interest in sufficient depth.[3,4] It is not surprising that researchers appreciate efforts made to synthesize relatively large bodies of literature in the form of meta-analyses or systematic reviews.

Notwithstanding a few dissenting voices, especially in the humanities,[5-9] meta-analysis has been presented from its inception as a robust technique with a strong statistical foundation. Nevertheless, implementations of meta-analysis in practice have been the object of strong criticisms. In a number of fields, e.g., education research,[10] medicine,[11] plant ecology[12] and agronomy[13-15] researchers have assessed the quality of meta-analyses, found it overall to be low and noticed that core quality criteria necessary to conduct sound meta-analyses do not appear to be well understood by authors. Recently, in soil science, Fohrafellner et al[16] assessed 31 meta-analyses and scored the quality on a scale of 1 to 30. Only one meta-analysis, with a score of 29, got close to the maximum mark, and more than half of the meta-analyses had a score lower than 15/30. Among the quality criteria that seem to be the most problematic in these various assessment exercises are the theory-based requirement for studies included in meta-analyses to be weighed according to the inverse of their variance, for meta-analyses to avoid mixing primary studies that have no connection with each other (the "apples and oranges" problem), and for authors of meta-analyses to pay close attention to any bias that may exist in the literature, e.g., when journals solely publish articles describing positive, statistically significant results.

Detailed assessments of the quality of meta-analyses clearly need to be, and no doubt will in the future, be carried out by researchers in all disciplines. This will eventually have a sanitizing effect on the practice. Meanwhile, should editors of scholarly publications influence the way meta-analyses are reported and ensure a minimum level of quality control – and could they? Surprisingly, literature searches I have carried out suggest that even in articles that have documented problems in that context, virtually nothing has been written in the literature about what journal and book editors could do to improve things. The objective of the present viewpoint article, written from the perspective of a long-time journal editor, is to envisage various actions editors could take to ensure that meta-analyses published under their watch, as well as research syntheses more broadly, meet acceptable standards.

Instructions to authors for accurate reporting

To ensure that reviewers and readers are able to determine whether sufficient quality standards have been met in articles describing meta-analyses and, more broadly, any kind of synthesis of the literature, editors must require that authors report accurately the process that was followed in collecting and analyzing sources. The focus should be on reporting: journals should not instruct authors

about the proper way to carry out meta-analyses. As with any statistical technique, e.g., Analysis of Variance (ANOVA), researchers should obtain elsewhere the information needed to carry out these analyses correctly and should routinely consult specialists to ascertain that they are doing it right.

However, despite the proliferation of meta-analyses in virtually all scientific disciplines and the clear quality-control issues they raise, many scholarly journals still do not provide precise instructions to authors on how to report appropriately the outcomes of meta-analyses in manuscripts submitted for publication. General, discipline-independent guidance for proper reporting has been available for at least 15 years, since the development of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA),[17] which has been revised recently.[1] Other guidance is more discipline-focused and specific. Dealing with the uses and misuses of meta-analysis in plant ecology, Koricheva and Gurevich[12] proposed a "checklist of quality criteria for meta-analysis for research synthesis, peer reviewers, and editors." Inspired by Koricheva and Gurevich,[12] Fohrafellner et al[16] devised a detailed list of 17 quality criteria that is relevant to meta-analyses related to soils and agriculture but could serve as a blueprint for lists in other disciplines.

Some scholarly publications, such as the journal *Environmental Evidence*, provide extensive instructions to authors about reporting meta-analyses or systematic reviews. However, it is more typical, among the few journals that provide explicit guidance to authors in that respect, simply to include a statement that "completed PRISMA Checklist and Flow Diagram *may* be uploaded as Supplementary Information/Appendices" (emphasis added). Arguably, the fact that authors are not requested to provide evidence that they tried to meet minimal

reporting standards removes much, if not all of the benefit that could result from such a statement. Similarly, as with the declaration of potential conflicts of interest, it does not stipulate that this requirement would be checked at any time during the review process.

A way to improve the reliability of meta-analyses is to make it mandatory for authors to complete the PRISMA checklist and flow diagram, and to include it in Supplementary Information so that reviewers and readers can determine what the authors have done. Alternatively, journals could solicit help from researchers to develop discipline-focused reporting checklists following those of Koricheva and Gurevich[12] or Fohrafellner et al[16] and systematically request authors to document (again in the Supplementary Information) how their manuscript fares on them. This might discourage authors from submitting manuscripts describing meta-analyses that are lacking in too many respects.

Authors should also be encouraged, as a standard practice, to search the "grey literature" for unpublished studies containing negative or non-significant data, in order to complement the data set analyzed in their text.

Precise recommendations to reviewers

Editors should give reviewers clear guidance as to what the journal expects from them to ensure that meta-analyses and systematic reviews described in manuscripts under review meet acceptable standards. If journals request authors to provide a completed checklist, reviewers should be instructed to use this information.

Reviewers should also consider the soundness of the underlying data provided by the primary articles compiled in systematic Reviews and meta-analyses, and whether the topics being meta-analyzed are sufficiently similar for this to be valid. A criticism of meta-analyses

ever since the method was conceived is that the need to have a sufficient number of primary studies can encourage researchers to combine studies that are not necessarily related to each other – so-called apples and oranges (e.g., 5, 6, 8). The implicit assumption that seems to warrant this mixing of heterogeneous data is that the meta-analysis method performs some kind of upscaling, from which a superseding reality emerges, applicable as it were to both apples and oranges. That might be true in specific cases, but is not intrinsically so in general.

Perhaps most crucially, reviewers should be tasked with assessing whether sufficient attention is paid to the possibility of publication bias in the literature that the manuscript synthesizes. Publication bias, also referred to as the "file drawer problem,"[8] results from the tendency of many authors and scholarly journals to publish only positive or statistically significant results. Both the PRISMA checklist and Fohrafellner et al's[16] list consider publication bias explicitly. Following Rothstein,[18] one might argue, however, that this issue is critical, determines the credibility or lack thereof of the meta-analysis method, and therefore should be given more attention than a single line item in files located in Supplementary Information. Indeed, in disciplines where, systematically, only positive or statistically significant results are ever published, the potential to carry out a meaningful meta-analysis, let alone any kind of unbiased systematic literature review, may be virtually non-existent. Authors should alert readers to that possibility and explain in detail why they still consider a meta-analysis or systematic review worthwhile in the specific case they study.

At a minimum, therefore, manuscripts should contain a visualization or even a quantification of the bias present in the literature they reviewed. The difficulty in this context is that many techniques have been developed for this purpose, and they all have significant

drawbacks (e.g., 11, 18-21). In the absence of a consensus on the best way to deal with the problem, reviewers should check whether the manuscript points out that publication bias, if present, could undermine the conclusions of the research, and that the authors have attempted to address the issue.

A final recommendation could be made by editors and associate editors to all reviewers of manuscripts that cite meta-analyses or systematic reviews. Reviewers should be requested to ensure, as much as possible, that citations to these types of articles found to be of low quality in surveys like those of Haidich,[11] Koricheva and Gurevich,[12] Philibert et al,[13] Bellouin et al,[14] Krupnik et al,[15] and Fohrafellner et al[16] be either absent or accompanied by cautionary statements. This issue is pertinent for all articles and not just meta-analyses or systematic reviews: many articles that have been withdrawn by their authors or by the journals in which they were published continue to be heavily cited years later.[22] One might argue that it would be difficult to ask already over-solicited reviewers to take care of this weeding of inappropriate references. To solve this problem, what would be needed is for publishers to use some of their financial resources to create a common registry of articles that were either withdrawn or demonstrated in the peer-reviewed literature to be methodologically flawed in some way. Technical editors of journals, during their initial screening of manuscripts to check for plagiarism or poor language quality, could systematically use text processing or artificial intelligence tools, in conjunction with that registry, to flag potentially problematic references and point them out to reviewers.

Editors should foster a change of the publishing culture

The measures suggested in the preceding sections have the potential to cause future

meta-analyses and systematic reviews to be far more sound than they are now. However, they still leave largely open the difficult issue of publication bias, which fundamentally calls into question the credibility of these types of efforts. Two decades ago, it was suggested that the only long-term solution to the problem of publication bias was for scholarly journals to publish research results regardless of the direction and magnitude of the observed effects (e.g., 18). One could argue that very little has been done in this sense, and that now, given the proliferation of problematic meta-analyses and systematic reviews in recent years, it has become urgent to take action to change the current publishing culture.

By posting announcements on social media, through direct contacts with authors, or, in disciplines where they have an impact, by writing unequivocal editorials, editors could let it be known that they now view manuscripts reporting negative or non-significant results as contributing substantially to the advancement of science and that they are welcoming them wholeheartedly. Another approach would be to adopt widely the pre-registration procedure that some medical journals have put in place (in part to prevent p-hacking) and guarantee that the results of pre-registered experiments would be given full consideration for publication, regardless of outcome.

Take-home message

In the short run, journal and book editors can significantly improve the quality of published meta-analyses and systematic literature reviews by giving specific instructions to authors on how to report their results accurately and by requiring them to document explicitly that they followed suitable reporting guidelines. Precise recommendations can also be given to reviewers about what to pay attention to specifically in manuscripts.

In the long run, as various authors pointed out already years ago, the most reliable way to ensure the quality of meta-analyses and systematic reviews of the literature is to eliminate publication bias, i.e., change the publishing culture so that manuscripts describing negative or non-significant results are routinely submitted by researchers for publication and given full consideration. If we do not take action along those lines at this juncture, what is at stake is the public's trust in science, which would risk being further catastrophically eroded when large numbers of research syntheses turn out eventually to be fundamentally erroneous and misleading.

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