Guide to Statistics and Methods | REPORTING GUIDELINES

PRISMA Reporting Guidelines for Meta-analyses and Systematic Reviews

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Systematic reviews and meta-analyses are important ways to summarize the scientific literature with a priori–specified criteria to answer a specific research question. When evidence accumulates with increasing numbers of trials and results sometimes seem contradictory or different in magnitude of effect, a state-of-the-art statistical summary is needed to reach an aggregated conclusion. They are increasingly important in developing clinical practice guidelines, collating empirical evidence from studies to investigate controversial research questions, informing policy makers, and justifying future research. Approximately 2500 new systematic reviews and meta-analyses are published and indexed annually.[1] However, systematic reviews and meta-analyses are only as good as the included literature and may be biased if an inadequate search strategy results in inclusion of poor-quality literature.

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In 1999, to address the suboptimal reporting of meta-analyses, an international group developed a guidance called the Quality of Reporting of Meta-Analyses (QUORUM) Statement, mainly focused on the reporting of meta-analyses of randomized clinical trials.[2] In 2009, the guideline was updated and renamed Preferred Reporting Items of Systematic Reviews and Meta-analyses (PRISMA)[3] after the group incorporated several conceptual and practical considerations, such as outcome level assessments, risk of bias, and reporting of observational study data (**Box**).

Box. Summary of Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)

- What is it used for?
  - Systematic reviews.
  - Meta-analyses.
- How is it used?
  - A 25-item checklist and flow diagram.
- Why is it used?
  - It improves quality of reporting and methodology for systematic reviews and meta-analyses.
  - It provides transparent, complete, and reproducible methodology.
  - It demonstrates quality of review to journals and readers.
  - It allows assessment of study strengths and weaknesses.

Use of the Reporting Guideline

The PRISMA guidelines were initially published mainly to improve reporting of systematic reviews and meta-analyses to standardize methodology to include all relevant evidence to date and avoid reporting biased results or analytic estimates. Over the years, PRISMA extensions have been published for developing review protocols (PRISMA-P); writing abstracts; and conducting equity-focused, adverse event–focused, or diagnostic test accuracy–focused systematic reviews and meta-analyses. The guidelines also now outline how to conduct individual patient data meta-analyses (PRISMA-IPD) and network meta-analysis (PRISMA-NMA). The PRISMA statement is endorsed by a number of journals and health care organizations. Adherence to PRISMA guidelines has been associated with improved quality and methodology, as well as higher numbers of bibliographic citations of systematic reviews and meta-analyses.[4,5]

Required Items

The PRISMA statement includes a 27-item checklist and a 4-phase flow diagram. These are essential elements to conduct and report systematic reviews and meta-analyses.

Title and Abstract

The title should identify the manuscript as a systematic review or meta-analysis. The structured abstract should include elements normally required in Original Investigation abstracts, such as background, objectives, results, and conclusions. The several key elements that are different include data sources, study selection criteria and methods, data extraction and synthesis methods, and a systematic review registration number (if applicable).

Introduction

The introduction should provide a clear rationale for the review by describing the current literature and the knowledge gap addressed. It should then include an explicit objective being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).

Methods

The methods require detailed information on study inclusion and exclusion criteria, such as study characteristics (eg, PICOS, length of follow-up) and report characteristics (eg, years considered, language, publication status). The authors should provide a detailed outline of the databases used, as well as the search terms and secondary search strategies, so that the search is easily reproducible. Additionally, the authors should describe all of the following: registration information (eg, URL or weblink, Cochrane database), the data collection process, how disagreements between data extractors were handled, the risk of bias, heterogeneity of the included studies (eg, I^2, Cochrane Q), summary measures used (eg, risk ratios) used, methods of data syntheses or aggregation (eg, random-effects vs fixed-effects modeling, τ^2 between study variance), assessment of publication bias, as well as any planned additional subgroup or sensitivity analyses.

Results

The results describe (1) the identification of studies (referencing the search strategy and databases, as well as types of study designs included, such as randomized clinical trials, prospective cohort studies, and retrospective cohort studies), (2) the number of studies

screened, (3) full texts assessed for eligibility, (4) reasons for exclusions at each stage, and ideally, a PRISMA 4-phase flow diagram. The included studies are then described in terms of study characteristics (eg, patient population, details of intervention and control, outcome parameters), risk of bias within each study, and results of each study, followed by the synthesis of results for meta-analyses, additional sensitivity or subgroup analyses (eg, metaregression), and an assessment of publication bias.

Discussion and Funding

The discussion summarizes the main findings, including the strength of the evidence, and provides context for interpretation, as well as to which key groups these findings are most relevant. The sources of heterogeneity as well as the limitations at the study or outcome level and the review level should be discussed. Finally, the authors should describe the funding source and the role of the funders (eg, acquisition of data, manuscript writing) in the systematic review.

The types of studies that are included is important in assessing the level of evidence provided by the meta-analysis, since a synthesis of meta-analyses of randomized clinical trials or prospective cohort studies will likely be less prone to bias than retrospective studies. Other considerations in assessing the validity of a meta-analyses or systematic review include whether (1) the article search was comprehensive, (2) the study inclusion criteria were adequately described, (3) 2 investigators independently conducted the search and study selection, (4) the quality of the individual studies was adequately described, (5) appropriate methods were used to assess heterogeneity, (6) appropriate methods were used to combine the results, (7) justification for the choice of fixed-effects vs random-effects modeling was given, and (7) a sensitivity analysis or regression modeling was used to account for study differences. Note that fixed-effects modeling is only appropriate if there is little variation between studies and the I^2 is low. Random-effects modeling is preferred because it allows study outcomes to vary in a normal distribution between studies. However, more data are required for random-effects modeling to achieve the same statistical power as fixed-effects models. If the I^2 value is high (usual cutoff >75%), it suggests considerable heterogeneity; in this case, pooling of study results is discouraged, and only the individual study results are reported.

Limitations of the Reporting Guideline

The PRISMA guidelines provide an excellent framework for authors to report systematic reviews and meta-analyses. However, they do not directly address or provide details on how to conduct a systematic review or meta-analysis. There are other resources to guide that process.[6,7] Additionally, the guidelines do not provide guidance as to when to use fixed-effects vs random-effects modeling or what degree of heterogeneity should serve as a relative contraindication to meta-analyses. The guidelines also do not ensure that a study is novel or answers an important research question. Finally, PRISMA has limited applicability to reviews that involve qualitative or mixed-methods research.

Checklist and Flow Diagrams

PRISMA guidelines, statements, and extensions can be found at http://www.prisma-statement.org. Detailed descriptions are also available there.

Conclusions

In summary, the PRISMA guidelines describe an evidence-based minimum set of items to report systematic reviews and meta-analyses to ensure transparent, complete, and accurate summarization of published literature. Use of these guidelines demonstrates the quality of the review to journals and readers. It allows readers to assess strengths and weaknesses of the study, as well as replicate the study methods.

ARTICLE INFORMATION

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