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Can Google Scholar Serve as a Sufficient Source for Systematic Reviews? Reconsidering the Need for Multiple Database Searches

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Abstract

Systematic reviews derive their credibility from the comprehensive identification of relevant evidence. In medical science research, systematic reviews have traditionally been pursued through searches of multiple curated bibliographic databases, a practice reinforced by methodological convention and consensus reporting frameworks. However, this approach developed in an earlier era of scientific communication, when dissemination was slower, more journal-centered, and more tightly bounded by selective indexing systems. The contemporary scientific literature has evolved substantially, with research now disseminated rapidly across preprint servers, institutional repositories, open-access platforms, and multilingual digital venues that are variably represented in subscription-based databases. Google Scholar reflects a different model of evidence retrieval. Rather than relying on journal-level selection, it aggregates scholarly content across disciplines, languages, and publication formats with greater immediacy and broader accessibility than traditional databases. This *Opinion* article re-examines the assumption that multiple curated databases are methodologically necessary for systematic reviews and advances a specific proposition: that, under transparent, systematic, and rigorous search and screening practices, Google Scholar may be sufficient solely to support evidence identification for systematic and related reviews. This proposition is examined across four domains: comprehensiveness, timeliness, accessibility, and methodological adaptability. Google Scholar may reduce structural omission of non-English studies, gray literature, preprints, and regionally disseminated research; improve capture of rapidly emerging evidence; and remove access barriers associated with subscription-based tools. Its limitations—including reduced search transparency, increased screening burden, and the absence of controlled vocabularies—are acknowledged. However, these limitations can be mitigated through transparent reporting, structured keyword selection strategies, citation tracking, and the use of complementary tools such as Publish or Perish software and emerging artificial intelligence-assisted screening approaches. The central question, therefore, is not whether Google Scholar has limitations, but whether those limitations outweigh its advantages in approximating the primary objective of systematic reviews, namely the broad and timely identification of relevant evidence. Reconsidering this balance is warranted to ensure that evidence retrieval practices remain aligned with the contemporary landscape of scientific communication while upholding methodological rigor.

Keywords: Systematic Reviews; Information Storage and Retrieval; Bibliographic Databases; Evidence-Based Medicine; Publication Bias; Access to Information

Introduction

Systematic reviews are predicated on the assumption that the relevant body of evidence addressing a defined question can be identified, critically appraised, and synthesized with minimal risk of systematic omission [1-3]. As defined by Ahn and Kang, systematic reviews are intended to identify and synthesize all relevant studies addressing a given research question [4]. Accordingly, the validity of systematic reviews depends less on the generation of new data than on the completeness and integrity of the evidence base from which conclusions are drawn [3, 5, 6]. Incomplete retrieval following systematic review search is not a procedural limitation but a source of potential bias, as the selective absence of studies—whether by publication status, language, or indexing—may distort estimates of effect and alter interpretation [3, 7, 8]. Hence, the methodological strength of a systematic review depends essentially on the extent to which its search strategy captures the full range of relevant evidence [9].

It is important to highlight that completeness is not an intrinsic property of the scientific literature but a function of the retrieval methods used to identify it [10, 11]. In practice, the evidence available for synthesis is determined by what has been studied as well as by what can be located within bibliographic databases, each of which is governed by its own inclusion criteria, language representation, and indexing practices [12, 13]. As a result, the evidence base of a systematic review is shaped by the selection of databases, which influences which studies are retrieved and which remain unobserved [9, 14, 15]. This process introduces the potential for systematic bias, as evidence that is less visible—by virtue of publication format, language, or indexing status—may be underrepresented [8, 16]. The choice of bibliographic databases is therefore a methodological decision that directly affects the scope and validity of the review conclusions [3, 17].

Current practice in systematic review methodology commonly involves searching multiple curated bibliographic databases, most notably those maintained by Clarivate (Web of Science) and Elsevier (Scopus) [9, 18]. This approach is reflected in widely adopted reporting frameworks such as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which recommend the use of more than one database to reduce the risk of incomplete retrieval [19]. The rationale for this practice arises from the recognition that individual databases provide partial and selectively indexed coverage of the literature, such that no single source has historically been considered sufficient to capture all relevant studies [17, 20, 21]. Consequently, the use of multiple databases has been adopted as a pragmatic strategy to approximate comprehensiveness under conditions of incomplete and heterogeneous indexing [22, 23].

This approach of searching multiple databases developed within a specific historical context. Early bibliographic databases were developed as selective indexes of journals, reflecting both the technological limitations of large-scale indexing at the time and the use of predefined criteria for journal inclusion [24-26]. Clarivate's Web of Science, originally developed as a citation index in the mid-20th century, focused on a defined set of journals considered influential within established scientific disciplines [27]. Elsevier's Scopus, introduced later with expanded coverage, retained a similar model based on journal-level selection, editorial oversight, and structured inclusion criteria [28]. These databases introduced important methodological advances, including citation tracking, standardized metadata, and controlled vocabularies, which improved the organization and retrieval of indexed literature [24]. However, their underlying design remained selective, such that inclusion was contingent on predefined criteria rather than comprehensive aggregation of all available scholarly outputs [24, 29].

The database selectivity confers methodological advantages, including structured indexing, standardized metadata, and improved accuracy of search queries. However, it also introduces inherent limitations. Inclusion within these databases depends on journal-level selection criteria, which define the scope of indexed content and thereby exclude material that falls outside those criteria [30]. Consequently, portions of the scholarly record—including regional journals, non-English publications, and emerging or interdisciplinary fields—may be underrepresented or absent [25]. In addition, gray literature, defined as information produced by governments, academia, and industry in formats not controlled by commercial publishing, may not be consistently identified [31]. Moreover, the incorporation of newly disseminated research, particularly preprints and early online publications, may be delayed due to the requirements of formal indexing processes [32, 33]. Together, these characteristics reflect the design of curated databases and give rise to systematic incompleteness in systematic reviews that stems from the indexing process rather than from random omission.

The expansion of digital scientific communication has altered the conditions under which evidence is disseminated and retrieved. Research outputs are now distributed across preprint servers, institutional repositories, open-access platforms, conference proceedings, government and institutional reports, clinical trial registries, and other digital sources of scholarly communication that are variably indexed within curated databases [34, 35]. As a result, relevant evidence may not be fully captured by traditional indexing systems at the time a systematic review is conducted [36, 37]. Under these conditions, the assumption that combining multiple selective databases ensures adequate coverage warrants re-examination.

In this context, Google Scholar represents a different model of evidence retrieval. Introduced in 2004, it was designed as a broad search engine for scholarly content rather than a curated index of selected journals [38-42]. Its indexing approach relies on automated aggregation, enabling the inclusion of diverse sources such as peer-reviewed articles, preprints, theses, books, conference proceedings, and institutional outputs [43, 44]. This model facilitates coverage across disciplines and languages and often allows more rapid inclusion of newly disseminated material compared with traditional indexing systems [45, 46].

This retrieval model of Google Scholar offers several potential advantages. By reducing *a priori* exclusion at the indexing stage, Google Scholar increases the likelihood that relevant studies—across diverse publication formats, languages, and dissemination channels—are retrievable within a single search environment [42, 47]. Its accessibility, as a freely available platform, further enables broad use across research settings that may lack access to subscription-based databases [38, 48].

At the same time, important Google Scholar limitations are

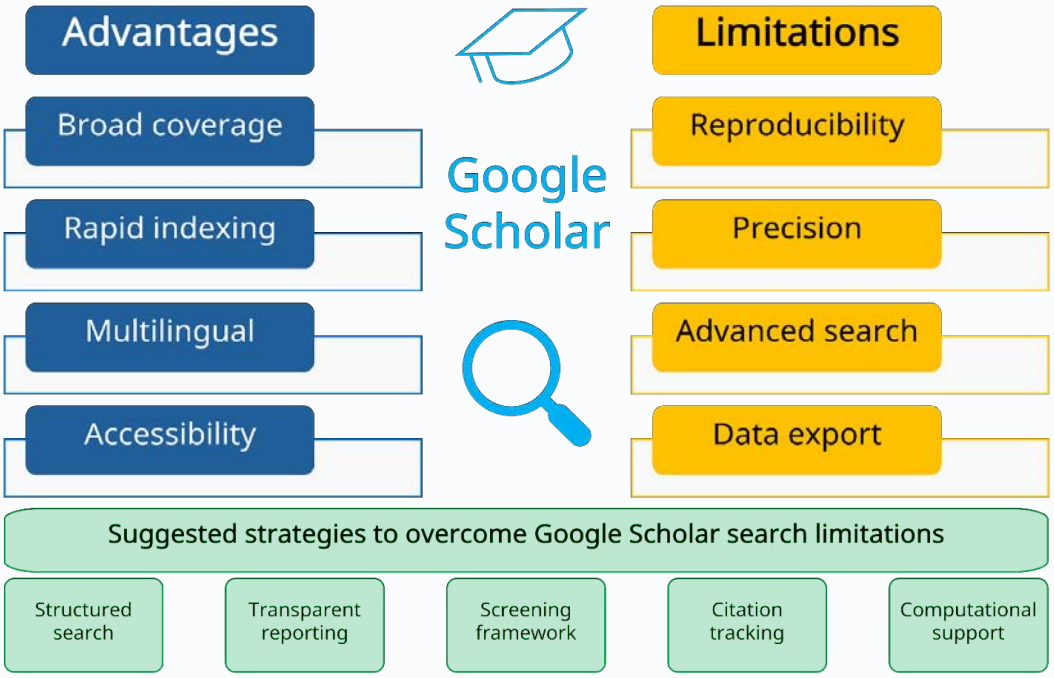

Figure 1: Advantages, limitations, and mitigation strategies for the use of Google Scholar in systematic review search.
The left blue panel highlights key advantages, including broad coverage of scholarly materials across publication formats, rapid indexing of newly disseminated research, inclusion of multilingual and regionally distributed literature, and unrestricted access without subscription barriers. The right orange panel outlines commonly cited limitations, including reduced reproducibility due to dynamic and non-transparent ranking algorithms, lower precision resulting in large volumes of retrieved records, limited advanced search functionality compared with curated databases, and constraints in bulk data export and workflow integration. The lower green panel presents methodological strategies to mitigate these limitations, including the use of structured and iterative keyword-based search approaches, transparent reporting of search procedures, application of predefined screening frameworks (including dual independent review), citation tracking to identify additional relevant studies, and the use of computational tools to support prioritization, deduplication, and data management.

recognized. These include limited transparency in indexing criteria, constraints in advanced search functionality compared with curated databases, and challenges in achieving exact reproducibility of search results due to dynamic ranking algorithms [49-51]. These features have contributed to its positioning within current methodological guidance as a supplementary rather than primary resource. However, this positioning reflects established practice as well as methodological necessity. The relevant question is therefore not whether Google Scholar has limitations, but whether those limitations outweigh its advantages when combined with transparent and systematic search practices in meeting the central objective of systematic reviews, namely the comprehensive identification of relevant evidence.

This *Opinion* article re-examines the assumption that multiple curated databases are necessary for systematic reviews, drawing on several interrelated considerations, including comprehensiveness, the implications of selective indexing, timeliness of evidence capture, accessibility, methodological limitations, and practical approaches to implementation. Figure 1 complements this analysis by summarizing the principal advantages, limitations, and mitigation strategies associated with the use of Google Scholar in evidence retrieval.

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This *Opinion* article does not dispute the historical contributions or continued utility of curated bibliographic databases but evaluates their role in relation to a retrieval model based on broad aggregation rather than selective inclusion. The central proposition is that, when applied with transparent and rigorous search and screening practices, Google Scholar may be sufficient as a sole source for evidence identification in systematic and related reviews. This proposition follows from a single methodological premise: if completeness is the primary determinant of validity in systematic reviews, then retrieval tools should be assessed according to their capacity to approximate that completeness. On this basis, the necessity of combining multiple selectively indexed databases warrants critical re-evaluation.

The Principle of Comprehensiveness

The defining objective of a systematic review is the identification of all evidence relevant to a predefined research question [52, 53]. This objective directly determines the validity of the resulting synthesis, as incomplete retrieval introduces the potential for selection bias before critical appraisal is undertaken [3, 54]. Bias arising from incomplete

retrieval is well documented and is best understood as dissemination bias, whereby the visibility of studies depends on factors such as publication status, language, and dissemination format rather than their relevance to the research question [16, 55, 56]. This includes selective publication of studies with statistically significant or positive results, preferential indexing of English-language research, and reduced visibility of studies available only in formats such as reports, theses, or conference proceedings [57, 58]. A search strategy constrained by selective indexing systems may therefore yield an evidence base that is systematically unrepresentative.

Curated databases are designed to optimize structure and precision through standardized indexing, controlled vocabularies, and journal-level selection [59]. These features improve search specificity but also define the boundaries of what is indexed [53]. As a result, journal coverage is incomplete, language representation is uneven, and the inclusion of conference proceedings, theses, reports, and preprints is variable [60]. These characteristics arise from the design of curated systems and are not incidental limitations.

Google Scholar employs a retrieval model based on automated aggregation of scholarly content from diverse web sources, rather than selective inclusion through curated indexing, allowing broader capture of materials across publication formats, disciplines, and languages [42, 61]. Although no retrieval system is exhaustive, the relevant methodological standard is the reduction of systematic omission. By this criterion, a retrieval strategy that minimizes *a priori* exclusion is more closely aligned with the objective of comprehensive identification of records in systematic reviews. Such inclusivity may reduce accuracy and increase the volume of records requiring screening. However, systematic review methodology prioritizes sensitivity over specificity at the search stage, as irrelevant records can be excluded during screening, whereas relevant studies omitted during retrieval cannot be readily recovered [17]. A retrieval approach that favors inclusivity, when combined with rigorous screening procedures, may therefore be methodologically advantageous [9].

Real-World Implications of Selective Indexing

The consequences of selective indexing are most evident when evidence is rapidly evolving or unevenly distributed across publication venues. During the early phases of the COVID-19 pandemic, a substantial proportion of emerging research was disseminated through preprints prior to formal journal publication [62-64]. Such studies were often identifiable in Google Scholar shortly after dissemination, whereas their inclusion in curated databases frequently depended on subsequent publication and indexing [65]. Under these conditions, reviews restricted to selectively indexed databases risked temporal incompleteness, capturing an evidence base that lagged behind contemporaneous research.

Similar limitations arise in geographically and linguistically diverse fields, where research relevant to outbreak response and local intervention strategies is often disseminated through regional journals, institutional documents, or government reports, frequently in languages other than English [66, 67]. These sources are variably represented in curated databases, such that retrieval may be influenced by indexing practices rather than by relevance to the research question.

The role of gray literature provides an additional illustration. Theses, technical reports, and conference abstracts may contain data not subsequently incorporated into indexed journal publications [31]. Inclusion of such material has been shown to influence pooled estimates and reduce the effects of publication bias [36, 68]. Retrieval systems that underrepresent gray literature may therefore yield systematically biased summaries of evidence [5]. Taken together, these examples demonstrate that the validity of a systematic review depends on the opportunity to evaluate the full range of relevant evidence, rather than on the subset that is most visible within selectively indexed systems. Absence from a database reflects limitations of indexing rather than absence of evidence and should be interpreted accordingly.

Timeliness and the Dynamics of Modern Science

Comprehensiveness in systematic reviews has both spatial and temporal dimensions. The interval between dissemination of research and its inclusion in searchable indexing systems can influence which studies are available for retrieval at the time a review is conducted. Curated databases, owing to their structured indexing processes, may introduce delays before newly available studies—particularly preprints, early online publications, and repository-based outputs—are incorporated into searchable records [69, 70].

By contrast, Google Scholar, through its aggregation-based indexing model, often reduces the delay between dissemination and discoverability [44, 61]. In rapidly evolving fields such as infectious diseases, oncology, and vaccine research, this difference may affect whether recently generated evidence is included in a review. A search strategy that excludes contemporaneously available studies because they have not yet entered curated indexes results in temporal incompleteness, even when it conforms to established methodological conventions. The inclusion of rapidly disseminated material does not obviate the need for critical appraisal. Preprints and preliminary reports require careful evaluation, and sensitivity analyses may be necessary to assess their influence on conclusions [71]. However, these considerations pertain to appraisal rather than retrieval. The methodological sequence remains clear: comprehensive identification of potentially relevant studies followed by rigorous assessment of their validity.

Accessibility and Epistemic Equity

Accessibility of retrieval systems has methodological implications for evidence synthesis. Subscription-based databases are not universally available and typically require institutional licensing, leading to variability in access across regions and research settings [72]. As a result, the capacity to conduct comprehensive database-based searches may be unevenly distributed. Google Scholar provides a freely accessible alternative that removes this specific barrier to evidence retrieval. Although it does not eliminate broader disparities in research capacity, it enables investigators without subscription access to perform wide-ranging literature searches [38].

Given that systematic reviews inform clinical guidelines, policy decisions, and research priorities, differential access to retrieval tools may influence which questions are addressed and which evidence is synthesized [18]. From a methodological perspective, a retrieval system that is broadly accessible may facilitate more inclusive participation in evidence synthesis and reduce dependence on restricted resources. In this context, accessibility is not solely a practical consideration but a factor that may influence the distribution and representation of synthesized knowledge.

Addressing Methodological Critiques of Google Scholar

The principal methodological concerns regarding Google Scholar relate to reproducibility, precision, and the absence of controlled vocabulary [49]. These limitations are substantial but are more appropriately interpreted as operational constraints rather than grounds for exclusion. Reproducibility is often cited as a limitation, as search results may vary over time due to non-transparent ranking algorithms and continuous updating of indexed content. However, in systematic reviews, reproducibility is defined primarily by the transparency of the search strategy rather than by exact duplication of retrieved records. Detailed reporting of search terms, combinations, dates, and screening procedures allows independent evaluation and reasonable replication of the approach. Moreover, curated databases are also dynamic, with ongoing changes in indexing and content that may affect reproducibility.

Precision represents a second concern. Searches conducted in Google Scholar may retrieve large volumes of records, including many that are not directly relevant [49]. This increases the burden of screening but is consistent with the methodological prioritization of sensitivity over specificity at the search stage. Irrelevant records can be excluded during screening, whereas relevant studies omitted during retrieval cannot be readily recovered.

The absence of controlled vocabularies, such as Medical Subject Headings (MeSH), may limit the precision of search queries [73]. However, controlled vocabularies are themselves constrained by the scope and timing of indexing. Comprehensive keyword-based strategies, incorporating synonyms and iterative refinement, can achieve adequate retrieval performance, particularly when combined with citation tracking and reference checking [17]. Taken together, these considerations indicate that the limitations of Google Scholar can be addressed through transparent and structured methodology. They do not negate its principal advantage, namely the broad and inclusive retrieval of potentially relevant evidence.

Enhancing Google Scholar-Based Methodology

The use of Google Scholar as a primary retrieval source requires a structured and transparent approach to searching and screening. Tools such as Publish or Perish can facilitate more systematic querying, enable retrieval and export of larger result sets, and support integration with reference management workflows [74, 75]. Although such tools do not alter the underlying indexing system, they improve the traceability and organization of the search process.

Artificial intelligence (AI)-assisted tools may further enhance this approach by supporting prioritization of records during screening, identification of duplicate entries, and structured data extraction [76, 77]. These tools do not replace critical appraisal but may reduce the operational burden associated with high-sensitivity search strategies [78]. A rigorous Google Scholar-based workflow typically includes iterative development of keyword strategies, systematic retrieval and deduplication of records, dual independent screening, citation tracking, and explicit reporting of search dates and procedures. When applied in this manner, Google Scholar is incorporated within a disciplined methodological framework that supports transparent and reproducible evidence identification.

Reconsidering Current Approaches to Evidence Retrieval

The expectation that systematic reviews should search multiple curated databases reflects a methodological standard developed under earlier conditions of scientific communication. At that time, scholarly output was concentrated within selected journals, and no single retrieval system provided broad coverage across formats, disciplines, and languages [79, 80]. Under these conditions, combining multiple selective databases was a rational strategy to reduce the risk of incomplete retrieval.

The contemporary literature environment is materially different. Relevant evidence is now disseminated across preprint servers, institutional repositories, open-access platforms, conference archives, and multilingual digital venues that extend beyond the boundaries of traditional journal-based indexing. In this context, the methodological justification for combining multiple selective databases cannot be assumed to remain unchanged.

The relevant question is not whether such an approach was historically justified, but whether it remains necessary when a more inclusive retrieval model is available. Reconsidering this assumption relocates methodological rigor to its proper foundation. The validity of a systematic review depends principally on the completeness and transparency of evidence identification, not on adherence to inherited conventions regarding database number or type. If the central objective is the comprehensive identification of relevant evidence, then retrieval strategies should be judged primarily by their capacity to minimize systematic omission.

On that basis, inclusivity is a core methodological consideration. The argument, therefore, is not that curated databases lack value, nor that long-standing practices should be discarded without evidence. It is that methodological standards should remain responsive to changes in the way scientific knowledge is produced, disseminated, and indexed. A retrieval strategy centered on a broadly inclusive system such as Google Scholar deserves evaluation on methodological grounds rather than dismissal by convention alone.

Conclusion

The validity of systematic reviews depends on the completeness of evidence retrieval, yet commonly used databases are based on selective indexing. Google Scholar represents an alternative tool based on broad aggregation of scholarly content across formats, languages, and dissemination pathways. Its limitations are recognized but can be addressed through transparent and structured methodology. Under conditions of transparent and rigorous search and screening practices, a broadly inclusive retrieval system such as Google Scholar may be sufficient to support evidence identification for systematic and related reviews. Alternatively, it may serve as a complementary resource that enhances retrieval breadth when used alongside curated databases. This position does not imply that curated databases lack value but challenges the assumption that their combined use is methodologically necessary in all contexts. Retrieval strategies should be evaluated according to their capacity to minimize systematic omission rather than by adherence to established conventions. In the context of contemporary scientific communication, a broadly inclusive retrieval system may fulfill this requirement and warrant reconsideration of current methodological practice in systematic reviews.

Declarations

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The authors declare that Generative AI was used in the creation of this manuscript. ChatGPT-5 was employed for language refinement (improving grammar, sentence structure, and readability of the manuscript) and technical writing assistance (providing suggestions for structuring complex technical descriptions more effectively). We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

Author contributions

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical approval

Not applicable.

Availability of data and materials

The authors confirm that the data supporting the findings of this study are available within the article.

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