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Editorial

Systematic reviews and meta-analysis: A brief overview and some guiding principles for authors, reviewers, and editors

The first scientific review of the literature on a topic in clinical medicine is commonly attributed to James Lind, for his "Treatise of the Scurvy" published in 1753 [1]. While the subsequent centuries saw development of concepts and methods for literature review, it came down to Archie Cochrane in the late 20th century to truly implement the systematic review as an essential element of biomedical research and clinical medicine [2,3]. However, the number of systematic reviews has increased dramatically in the past two decades [4]. This exponential rise has been driven by a number of factors, including the increasing substrate of primary biomedical research upon which to draw, increased recognition of the value of systematic reviews for clinical decision-making, and the availability of software tools that make it significantly easier to compile and analyze data for a review paper. Unfortunately, increasing quantity has not translated into equivalent quality [5]. Many reviews seem to be driven not by clinical need or readiness of the literature for systematic assessment, but rather by other incentives such as financial relationships with industry and by academic pressures to publish regardless of quality. In this context, there are number of essential take-home messages about systematic reviews that we would like to emphasize.

Systematic reviews should be performed only when appropriate, and should start with a specific and relevant research question (typically driven by clinical imperatives), and proceed using well-described and reproducible methodology

A specific research question is essential because without this, the volume of included literature will quickly balloon to unwieldly size and will lose clinical relevance. Only with a clear and specific research question can the search methodology be necessarily focused and rigorous, and thus reproducible. Depending on the research question, authors should first consider what type of review they intend to perform. Not all reviews are "systematic". Narrative reviews, scoping reviews, and systematic reviews require different criteria and intent. Narrative reviews provide broad overviews with personal insights; while informative, they lack systematic methods for selecting and evaluating literature. A scoping review can be thought of as a preliminary investigation to determine available evidence, clarify the key questions in a field, and identify knowledge gaps; this is a tool for hypothesis generation. If the goal is to answer a clinical question or inform practice, a systematic review is preferable. Unlike narrative and scoping reviews, systematic reviews include a detailed methods section that allows reproducibility (Table 1).

We would encourage readers to obtain and use the PRISMA checklist which provides a comprehensive summary of the elements used during the review [6]. In the PRISMA criteria, a number of critical issues are addressed in a highly systematic way. However, adhering to the PRISMA guidelines and checklists does not automatically validate a systematic review's conclusions. Particularly when topics involving rare and complex conditions are addressed (as is often the case in pediatric urology), there is still room left for errors to be made affecting quality and reliability of the results. Therefore, the mere mention of the PRISMA checklists in a paper does not automatically translate into clinically meaningful conclusions. This leads to an important paradox: a well-written, thoughtful and critical narrative review might be a better foundation for conclusion than a sloppy, biased and underpowered systematic review or meta-analysis.

In pediatric urology, due to the rarity of many conditions, it is often the case that only small observational studies are available for

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Table 1 Differences between narrative and systematic reviews.

Narrative Review	Systematic Review
Research question often broad	Well-focused clinical question
Search strategy not defined	Detailed search strategy with inclusion/exclusion criteria
Article selection not systematic	Article selection based on criteria
No quality appraisal	Critical appraisal of strengths and weaknesses
Qualitative summary only	Qualitative or quantitative synthesis

review, comprising heterogenous groups of patients and with varying definitions. Systematic reviews undertaken under such conditions may be minimally informative; often very few of the available studies can be included. For the reader, attention to the parameters for inclusion and exclusion of individual papers needs to be critically appraised before coming to conclusions.

Having said this, there are certain steps that should be expected to be undertaken in any systematic review. These include:

a. Identify a research question; the PICOT format [Population, Intervention, Comparison, Outcome, Time] [7] or FINER format [Feasible, Interesting, Novel, Ethical, Relevant] [8] can help define the question.
b. Search and review the literature using well-defined reproducible search strategy.
c. Extract and assess the data, reviewing each source for elements such as study population, intervention/exposure, endpoints.
d. Determine which evidence sources meet protocol criteria for inclusion, and assess for study quality and risk of bias and confounding.
e. Evaluate for publication bias (statistically or graphically e.g., funnel plots).
f. Collate and report the findings (narrative summary, statistical summary, graphical summary).
g. Assess ability to perform meta-analysis, and perform if appropriate.
h. Enter the review with a recognized registry (e.g. PROSPERO; https://www.crd.york.ac.uk/prospero/)

There is a difference between systematic review and meta-analysis, and the decision of whether to do both, or systematic review alone, must be driven by the research question and the available data

A systematic review assembles and reports the existing data as it was presented in the primary research studies. Meta-analysis, in contrast, pools the results from primary studies to increase precision through larger combined sample sizes; the result is the creation of "new" data.

Pooling data can be a powerful tool to address the shortcomings of the literature when available studies are too small or underpowered to produce reliable conclusions. However, we should be strongly discouraged from pooling data from studies that used different research designs, different inclusion and exclusion criteria, different interventions, or conflicting or heterogenous outcomes (or outcome definitions). In such cases, one is simply amalgamating data that cannot be meaningfully combined. This situation is common in pediatric urology.

Tests of heterogeneity have been developed to assist investigators in determining whether their source evidence is too disparate to incorporate into a meta-analysis [9]. While there is considerable disagreement among statisticians as to the best way to measure this, metrics such as Cochran's Q (which provides a yes/no outcome for significant heterogeneity) and the I2 statistic (which reports the percentage of variance attributable to study heterogeneity, with >50 % considered "significant") are the most commonly used. Others advocate for the use of prediction intervals [10]. Prediction intervals provide estimates of the variation in treatment effects in different settings, and the interval within which the effect size of a new study would likely fall (if such a study were performed). Enlisting the assistance of a statistician with experience in these methodologies is highly recommended. Furthermore, while such tests quantify statistical heterogeneity to a certain degree, they do not address clinical heterogeneity, which must be assessed by content experts.

Meta-analysis was developed to be applied to data from randomized controlled trials (RCT's); analysis of observational data should be undertaken with extreme caution, if at all

RCT's are the preferred substrate for meta-analysis because the randomization process eliminates or limits the bias that confounds virtually all observational studies of association.

When observational studies are undertaken, the association between the exposure (treatment) and outcomes is typically confounded by multiple variables that can impact the apparent results. For this reason, multivariate analysis is necessary to adjust for the known variables that might confound the association (unknown confounders cannot be adjusted for at all). For the investigators conducting such primary research, such multivariate analysis is relatively straightforward because the investigators have access to the raw data and can build the necessary models. However, the meta-analyst attempting to combine observational studies typically does not have access to the primary data, and only has summary findings (e.g., odds ratios) to work from. Without the primary data from all of the included studies, there is no way to adjust for all of the confounders.

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Add to this the fact that different studies often do not even collect or report the same variables, and it quickly becomes extremely difficult to appropriately combine data from such heterogenous sources.

Review papers can be incorporated into systematic reviews, and the methodology for these is similar to that of original research articles, with the key difference being quality assessment. Validated tools such as the Oxman and Guyatt index [11] evaluate search rigor, article selection, appraisal, and data synthesis.

Bayesian analysis is sometimes used in meta-analysis, permitting one to update existing knowledge from previous studies with the data obtained from new studies [12]. Bayesian meta-analysis has the potential to incorporate available data regardless of sample size, account for heterogeneity, and handle sparse negative outcomes. In addition, Bayesian methods generate posterior distributions, which represent the updated knowledge after considering the new evidence, enabling direct probability statements about diagnostic accuracy parameters.

In summary, pediatric urology is a field for which traditional systematic reviews and meta-analysis can be challenging, due to: 1) the small number of RCT's, 2) a literature in which small observational studies predominate, and 3) practice scope composed of rare and ill-defined conditions which lead to heterogenous data reporting. While systematic reviews clearly have an important role to play in pediatric urology, investigators should think carefully before conducting such work. The availability of software tools that seem to facilitate and enable "quick and dirty" review manuscripts does not change the underlying weaknesses in the pediatric urology literature, nor alter the fact that in most cases, meta-analysis will be ill-advised and inappropriate.

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References

[1] Bartholomew M. James Lind's treatise of the scurvy (1753). Postgrad Med J 2002;78(925):695—6.
[2] Starr M, Chalmers I, Clarke M, Oxman AD. The origins, evolution, and future of the cochrane database of systematic reviews. Int J Technol Assess Health Care 2009;25(Suppl 1):182—95.
[3] Shah HM, Chung KC. Archie cochrane and his vision for evidence-based medicine. Plast Reconstr Surg 2009;124(3):982—8.
[4] Hoffmann F, Allers K, Rombey T, Helbach J, Hoffmann A, Mathes T, et al. Nearly 80 systematic reviews were published each day: observational study on trends in epidemiology and reporting over the years 2000-2019. J Clin Epidemiol 2021;138:1—11.
[5] Ioannidis JP. The mass production of redundant, misleading, and conflicted systematic reviews and meta-analyses. Milbank Q 2016;94(3):485—514.
[6] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Bmj 2021;372:n71.
[7] Rios LP, Ye C, Thabane L. Association between framing of the research question using the PICOT format and reporting quality of randomized controlled trials. BMC Med Res Methodol 2010;10:11.
[8] Willis LD. Formulating the research question and framing the hypothesis. Respir Care 2023;68(8):1180—5.
[9] Cordero CP, Dans AL. Key concepts in clinical epidemiology: detecting and dealing with heterogeneity in meta-analyses. J Clin Epidemiol 2021;130:149—51.
[10] IntHout J, Ioannidis JP, Rovers MM, Goeman JJ. Plea for routinely presenting prediction intervals in meta-analysis. BMJ Open 2016;6(7):e010247.
[11] Guyatt G, Oxman AD, Akl EA, Kunz R, Vist G, Brozek J, et al. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. J Clin Epidemiol 2011;64(4):383—94.
[12] Sutton AJ, Abrams KR. Bayesian methods in meta-analysis and evidence synthesis. Stat Methods Med Res 2001;10(4):277—303.

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