Beyond the AJR

Kwee, Robert M.; Kwee, Thomas C.

Published in:
American Journal of Roentgenology

DOI:
10.2214/AJR.22.28675

Publication date:
2023

Beyond the *AJR*: Beware of Publication Bias

Robert M. Kwee, MD, PhD[1], Thomas C. Kwee, MD, PhD[2]

Version of record: Mar 15, 2023

The authors declare that there are no disclosures relevant to the subject matter of this article.

Commentary on Lu L, Phua QS, Bacchi S, et al. Small study effects in diagnostic imaging accuracy: a meta-analysis. *JAMA Netw Open* 2022; 5:e2228776; doi.org/10.1001/jamanetworkopen.2022.28776. **Abstract available at** pubmed.ncbi.nlm.nih.gov/36006641/

Summary of the Investigation

A recent study by Lu et al. [1] in *JAMA Network Open* investigated the presence and extent of small study effects in diagnostic imaging accuracy meta-analyses. Using 2 × 2 contingency data from 668 primary studies that were included by 31 meta-analyses published between 2010 and 2019, the authors found an inverse association between effect size estimate and precision (natural log of the diagnostic OR against the standard error of the natural log of the diagnostic OR of 2.19 [95% CI, 1.49–2.90; $p < .001$]). In other words, evidence indicates that published studies with smaller sample sizes tend to show more positive estimates than published studies with larger sample sizes. This trend was similar for all examined imaging modalities, including CT, MRI, PET, and ultrasound. Furthermore, Lu et al. revealed that 21 of 26 (80.8%) meta-analyses that used funnel plots and statistical tests to test for funnel plot asymmetry found no evidence for these small study effects.

Critical Analysis

A meta-analysis is traditionally considered the highest level of scientific evidence [2]. However, any meta-analysis should be critically reviewed because the validity of estimated pooled values strongly depends on the quality and generalizability of the included primary studies [3]. Another important aspect and widely acknowledged problem that may compromise the pooled estimates of a meta-analysis is publication bias [4, 5]. Publication bias refers to the phenomenon that studies with positive results are more likely to be published compared with studies with negative results [4, 5]. The small study effects in the diagnostic imaging literature, as revealed by Lu et al. [1], are likely caused by publication bias. Other factors may also underlie small study effects, including poor study quality, heterogeneity of populations studied, and possibly practices such as data manipulation and selective reporting. A limitation of the Lu et al. study is that the contribution of each of these factors was not determined. For instance, they did not explore whether studies with smaller sample sizes and more positive estimates had poorer quality as determined by the QUADAS-2 tool [3]. Importantly, however, Lu et al. showed that the presence of small study effects generally remains undetected by meta-analyses despite the authors having performed formal analysis, including visual assessment of funnel plots and the Egger test.

Takeaway Point

Readers who interpret the results of diagnostic accuracy meta-analyses should be aware that reported diagnostic accuracy values may be overestimated owing to undetected small study effects that could be caused by publication bias.

Provenance and review: Solicited; not externally peer reviewed.

References

1. Lu L, Phua QS, Bacchi S, et al. Small study effects in diagnostic imaging accuracy: a meta-analysis. *JAMA Netw Open* 2022; 5:e2228776
2. Murad MH, Asi N, Alsawas M, Alahdab F. New evidence pyramid. *Evid Based Med* 2016; 21:125–127
3. Whiting PF, Rutjes AW, Westwood ME, et al.; QUADAS-2 Group. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med* 2011; 155:529–536
4. McInnes MD, Bossuyt PM. Pitfalls of systematic reviews and meta-analyses in imaging research. *Radiology* 2015; 277:13–21
5. Kwee RM, Almaghrabi MT, Kwee TC. Scientific integrity and fraud in radiology research. *Eur J Radiol* 2022; 156:110553

[1]Department of Radiology, Zuyderland Medical Center, Henri Dunantstraat 5, 6419 PC, Heerlen, The Netherlands. Address correspondence to R. M. Kwee (rmkwee@gmail.com).

[2]Department of Radiology, Nuclear Medicine, and Molecular Imaging, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands.

doi.org/10.2214/AJR.22.28675 *AJR* 2023; 220:907 ▪ ISSN-L 0361–803X/23/2206–907 ▪