Editorial

eISSN 2005-8330
https://doi.org/10.3348/kjr.2021.0963
Korean J Radiol 2022;23(3):295-297

Korean Journal of Radiology
KJR

Guides for the Successful Conduct and Reporting of Systematic Review and Meta-Analysis of Diagnostic Test Accuracy Studies

Seong Ho Park, Editor-in-Chief

Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea

Systematic review and meta-analysis has become important method for generating evidence-based systematic summaries of diagnostic test accuracy (DTA) studies. Recently, this method appears to have become more frequently used. For instance, most articles reporting systematic reviews and meta-analyses of DTA studies published in the *Korean Journal of Radiology* (*KJR*) were published in the last five years [1-5]. However, as exemplified by the study by Park et al. [6] published in this month's issue of *KJR*, systematic reviews and meta-analyses of DTA studies with suboptimal methodological or reporting quality remain commonly reported.

The *KJR* has been paying attention to the adequacy of study methods and reporting when reviewing the manuscripts of systematic reviews and meta-analyses of DTA studies. Consequently, the *KJR* published articles to provide the corresponding guidance [7-9] and also recommends that authors refer to the Equator Network's reporting guidelines (https://www.equator-network.org). Congruently, this editorial intends to provide up-to-date practical guides for the successful conduct and reporting of systematic reviews and meta-analyses of DTA studies by augmenting the preceding version [9] with recent updates using the step-wise format listed below.

Received: December 22, 2021 **Accepted:** December 22, 2021
Corresponding author: Seong Ho Park, MD, PhD, Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, 88 Olympic-ro 43-gil, Songpa-gu, Seoul 05505, Korea.
• E-mail: parksh.radiology@gmail.com

Step 1: Defining the research questions and developing inclusion/exclusion criteria. The research questions should be specified clearly before beginning the systematic review, and the inclusion/exclusion criteria for the literature search should be identified accordingly. The structured Patient/Population, Intervention, Comparator, and Outcome (PICO) framework is recommended, although it may not apply seamlessly to some DTA studies due to their differences in design from those of therapeutic/interventional studies.

Step 2: Systematic search and selection of the literature. The literature search should include multiple resources extensively and should at least include the MEDLINE and EMBASE databases. Presenting the specific search queries improves the transparency of the literature search. Specific reasons for the inclusion and exclusion of articles and the corresponding article numbers should be clearly recorded. The literature search should also include recent literature, as far as possible.

Step 3: Assessing the quality of studies. The Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) [10] is recommended for the general quality assessment of articles included in a systematic review of DTA studies (Table 1). As artificial intelligence (AI) is currently an area of active research, numerous studies assessing the performance of various AI algorithms have been published, and reports of their systematic reviews and meta-analyses are emerging. Although such AI studies belong to the larger category of DTA studies, they have some methodological uniqueness. Therefore, several guides designed specifically for assessing the quality of studies of AI in medicine are published or are currently under development, including the

Table 1. Recommended Methods for the Meta-Analysis of Diagnostic Test Accuracy Studies

Quality assessment tool	QUADAS-2 and AI-specific tools such as RQS, PROBAST-AI, or QUADAS-AI
Result synthesis	Fixed-effects model: not recommended Random effects model: bivariate model or HSROC model
Non-reporting/publication bias assessment tool	Deeks' funnel plot Deeks' asymmetry test
Evaluation of study heterogeneity	Chi-squared test (Cochrane Q statistics) Higgins I^2 statistic Analysis of threshold effect - Visual evaluation of coupled forest plot - Spearman's correlation analysis between sensitivity and specificity
Additional analysis for study heterogeneity	Subgroup analysis or meta-regression Sensitivity analysis
Certainty of evidence evaluation	GRADE approach

Adapted from Park et al. Korean J Radiol 2022;23:355-369 with permission of The Korean Society of Radiology [6]. AI = artificial intelligence, GRADE = Grading of Recommendations, Assessment, Development and Evaluations, HSROC = hierarchical summary receiver operating characteristic, PROBAST = Prediction model Risk Of Bias ASsessment Tool, QUADAS = Quality Assessment of Diagnostic Accuracy Studies, RQS = radiomics quality score

radiomics quality score (RQS) for the quality evaluation of radiomics studies [11], the Prediction model Risk Of Bias ASsessment Tool (PROBAST)-AI for quality evaluation of studies undertaking development (or update) or testing of a diagnostic or prognostic model using machine learning techniques [12], and QUADAS-AI for quality evaluation of AI-centered DTA studies (Table 1) [13]. These specific guides should be referred to appropriately. Examples elucidating RQS use can be found elsewhere [14,15].

Step 4: Data extraction and management. Data should be extracted from individual articles using a standardized form to ensure that all relevant data are collected, to minimize any errors, and permit the assessment of the data's accuracy.

Step 5: Analysis and data synthesis. The recommended methods are summarized in Table 1, as proposed by Park et al. [6].

Step 6: Presentation of results for publication. Reporting a systematic review and meta-analysis of DTA studies should follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An updated version of the PRISMA statement was published in 2020 to replace the 2009 statement [16,17]. The PRISMA statement comprises generic guidelines and focuses on therapeutic/interventional studies. Although DTA studies share multiple common elements with therapeutic/interventional studies, DTA studies also have distinctive features. The PRISMA-DTA statement was developed to address these differences as an extension of the generic PRISMA statement specifically for systematic reviews and meta-analyses of DTA studies [18-20]. Therefore, authors who conduct systematic reviews and meta-analyses of DTA studies should follow the PRISMA 2020 in general and PRISMA-DTA for DTA-specific requirements.

Following these steps will substantially facilitate the successful conduct and reporting of systematic reviews and meta-analyses of DTA studies.

Conflicts of Interest

The author has no potential conflicts of interest to disclose.

ORCID iD

Seong Ho Park
https://orcid.org/0000-0002-1257-8315

Funding Statement

None

REFERENCES

1. Ko MJ, Park DA, Kim SH, Ko ES, Shin KH, Lim W, et al. Accuracy of digital breast tomosynthesis for detecting breast cancer in the diagnostic setting: a systematic review and meta-analysis. *Korean J Radiol* 2021;22:1240-1252

2. Park SH, Cho SH, Choi SH, Jang JK, Kim MJ, Kim SH, et al. MRI assessment of complete response to preoperative chemoradiation therapy for rectal cancer: 2020 guide for practice from the Korean Society of Abdominal Radiology. *Korean J Radiol* 2020;21:812-828
3. Kim TH, Woo S, Han S, Suh CH, Ghafoor S, Hricak H, et al. The diagnostic performance of the length of tumor capsular contact on MRI for detecting prostate cancer extraprostatic extension: a systematic review and meta-analysis. *Korean J Radiol* 2020;21:684-694
4. Chung SR, Choi YJ, Suh CH, Lee JH, Baek JH. Diffusion-weighted magnetic resonance imaging for predicting response to chemoradiation therapy for head and neck squamous cell carcinoma: a systematic review. *Korean J Radiol* 2019;20:649-661
5. Liao XL, Wei JB, Li YQ, Zhong JH, Liao CC, Wei CY. Functional magnetic resonance imaging in the diagnosis of locally recurrent prostate cancer: are all pulse sequences helpful? *Korean J Radiol* 2018;19:1110-1118
6. Park HY, Suh CH, Woo S, Kim PH, Kim KW. Quality reporting of systematic review and meta-analysis according to PRISMA 2020 guidelines: results from recently published papers in the Korean Journal of Radiology. *Korean J Radiol* 2022;23:355-369
7. Kim KW, Lee J, Choi SH, Huh J, Park SH. Systematic review and meta-analysis of studies evaluating diagnostic test accuracy: a practical review for clinical researchers-part I. General guidance and tips. *Korean J Radiol* 2015;16:1175-1187
8. Lee J, Kim KW, Choi SH, Huh J, Park SH. Systematic review and meta-analysis of studies evaluating diagnostic test accuracy: a practical review for clinical researchers-part II. Statistical methods of meta-analysis. *Korean J Radiol* 2015;16:1188-1196
9. Suh CH, Park SH. Successful publication of systematic review and meta-analysis of studies evaluating diagnostic test accuracy. *Korean J Radiol* 2016;17:5-6
10. Whiting PF, Rutjes AW, Westwood ME, Mallett S, Deeks JJ, Reitsma JB, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med* 2011;155:529-536
11. Lambin P, Leijenaar RTH, Deist TM, Peerlings J, de Jong EEC, van Timmeren J, et al. Radiomics: the bridge between medical imaging and personalized medicine. *Nat Rev Clin Oncol* 2017;14:749-762
12. Collins GS, Dhiman P, Andaur Navarro CL, Ma J, Hooft L, Reitsma JB, et al. Protocol for development of a reporting guideline (TRIPOD-AI) and risk of bias tool (PROBAST-AI) for diagnostic and prognostic prediction model studies based on artificial intelligence. *BMJ Open* 2021;11:e048008
13. Sounderajah V, Ashrafian H, Rose S, Shah NH, Ghassemi M, Golub R, et al. A quality assessment tool for artificial intelligence-centered diagnostic test accuracy studies: QUADAS-AI. *Nat Med* 2021;27:1663-1665
14. Won SY, Park YW, Park M, Ahn SS, Kim J, Lee SK. Quality reporting of radiomics analysis in mild cognitive impairment and Alzheimer's disease: a roadmap for moving forward. *Korean J Radiol* 2020;21:1345-1354
15. Park CJ, Park YW, Ahn SS, Kim D, Kim EH, Kang SG, et al. Quality of radiomics research on brain metastasis: a roadmap to promote clinical translation. *Korean J Radiol* 2022;23:77-88
16. 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
17. Page MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ* 2021;372:n160
18. McInnes MDF, Moher D, Thombs BD, McGrath TA, Bossuyt PM, Clifford T, et al. Preferred reporting items for a systematic review and meta-analysis of diagnostic test accuracy studies: the PRISMA-DTA statement. *JAMA* 2018;319:388-396
19. Salameh JP, Bossuyt PM, McGrath TA, Thombs BD, Hyde CJ, Macaskill P, et al. Preferred reporting items for systematic review and meta-analysis of diagnostic test accuracy studies (PRISMA-DTA): explanation, elaboration, and checklist. *BMJ* 2020;370:m2632
20. Cohen JF, Deeks JJ, Hooft L, Salameh JP, Korevaar DA, Gatsonis C, et al. Preferred reporting items for journal and conference abstracts of systematic reviews and meta-analyses of diagnostic test accuracy studies (PRISMA-DTA for abstracts): checklist, explanation, and elaboration. *BMJ* 2021;372:n265