Artificial Intelligence-Enabled Digital Auscultation and Phonocardiography for Clinically Significant Adult Valvular Heart Disease: A Systematic Review and Meta-Analysis

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Reporting Checklist 1. PRISMA-DTA checklist for diagnostic test accuracy systematic reviews and meta-analyses

Section / topic	Item #	Checklist item	Location in manuscript
Title	1	Identify the report as a systematic review, with or without meta-analysis, of diagnostic test accuracy studies.	Title page
Abstract	2	Abstract: see PRISMA-DTA for Abstracts.	Abstract
		INTRODUCTION	
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction
Clinical role of index test	D1	State the scientific and clinical background, including the intended use and clinical role of the index test; if applicable, state the rationale for minimally acceptable test accuracy or minimum difference in accuracy for comparative designs.	Introduction, final paragraph
Objectives	4	Provide an explicit statement of the review question in terms of participants, index test(s), and target condition(s).	Introduction, final sentence
		METHODS	
Protocol and registration	5	Indicate whether a review protocol exists; state where it can be accessed and provide registration information, including registration number when available.	Methods: Protocol, registration, and reporting framework
Eligibility criteria	6	Specify study characteristics used as eligibility criteria, including participants, setting, index test(s), reference standard(s), target condition(s), study design, and report characteristics such as years, language, or publication status; provide rationale.	Methods: Eligibility criteria
Information sources	7	Describe all information sources, including databases, date coverage, author contact, or other sources, and state the date last searched.	Methods: Information sources and search strategy; Supplementary Table S1
Search	8	Present full search strategies for all electronic databases and other sources searched, including limits, so that they could be repeated.	Supplementary Table S1
Study selection	9	State the process for selecting studies, including screening, eligibility assessment, inclusion in systematic review, and inclusion in meta-analysis.	Methods: Study selection
Data collection process	10	Describe data extraction methods, including forms, duplicate extraction, and processes for obtaining or confirming data from investigators.	Methods: Data extraction and coding of diagnostic estimates
Definitions for data extraction	11	Provide definitions used in data extraction and classification of target condition(s), index test(s), reference standard(s), and other characteristics such as study design and clinical setting.	Methods: Data extraction and coding of diagnostic estimates

Risk of bias and applicability	12	Describe methods for assessing risk of bias and applicability concerns in individual studies.	Methods: Risk of bias, applicability, and AI-specific reporting
Diagnostic accuracy measures	13	State the principal diagnostic accuracy measures reported, such as sensitivity and specificity, and state the unit of assessment, such as per-patient or per-lesion.	Methods: Outcomes and diagnostic accuracy measures
Synthesis of results	14	Describe methods for handling data, combining results, and describing between-study variability, including multiple target definitions, thresholds, readers, indeterminate results, grouped tests, or reference standards when relevant.	Methods: Statistical analysis
Meta-analysis	D2	Report the statistical methods used for meta-analyses, if performed.	Methods: Statistical analysis
Additional analyses	16	Describe methods for additional analyses, such as sensitivity analyses, subgroup analyses, or meta-regression, and state which were prespecified.	Methods: Subgroup and meta-regression analyses
RESULTS			
Study selection	17	Provide numbers of studies screened, assessed for eligibility, and included in the review and meta-analysis, with reasons for exclusions at each stage, ideally using a flow diagram.	Results: Study selection; Figure 1
Study characteristics	18	For each included study, provide citations and key characteristics, including participant characteristics, clinical setting, study design, target condition definition, index test, reference standard, sample size, and funding sources.	Results: Participants, settings, and target conditions; Table 1; Table 2
Risk of bias and applicability	19	Present risk-of-bias and applicability assessments for each study.	Results: Risk of bias and applicability; Figure 2; Supplementary Figure S1
Results of individual studies	20	For each analysis in each study, report 2×2 data with diagnostic accuracy estimates and confidence intervals, ideally with a forest or ROC plot.	Figure 3; Supplementary Data 1; Supplementary Figures S5–S7
Synthesis of results	21	Describe test accuracy and variability; if meta-analysis was performed, include summary estimates and confidence intervals.	Results: Primary diagnostic accuracy; Results: Lesion-specific diagnostic accuracy; Table 3
Additional analyses	23	Provide results of additional analyses, such as sensitivity analyses, subgroup analyses, meta-regression, index-test failure rates, inconclusive results, or adverse events.	Results: AS subgroup analyses; Results: MR subgroup analyses; Tables 4–5; Supplementary Tables S3–S5; Supplementary Figures S3–S10
DISCUSSION			
Summary of evidence	24	Summarize main findings, including the strength of evidence.	Discussion, opening paragraphs
Limitations	25	Discuss limitations of included studies and of the review process, including risk of bias,	Discussion: Limitations and certainty of evidence

		applicability concerns, and incomplete retrieval of identified research.	
Conclusions	26	Provide a general interpretation of results in the context of other evidence and discuss implications for future research and clinical practice, including the intended use and clinical role of the index test.	Discussion, final paragraphs
		OTHER	
Funding	27	Describe funding and other support for the systematic review, and the role of funders.	Acknowledgements

Reporting Checklist 2. PRISMA 2020 checklist

Section / topic	Item #	Checklist item	Location in manuscript
Title	1	Identify the report as a systematic review.	Title page
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract
		INTRODUCTION	
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) addressed by the review.	Introduction, final sentence
		METHODS	
Eligibility criteria	5	Specify inclusion and exclusion criteria and how studies were grouped for syntheses.	Methods: Eligibility criteria
Information sources	6	Specify all databases, registers, websites, organisations, reference lists, and other sources searched or consulted, and the date each was last searched.	Methods: Information sources and search strategy; Supplementary Table S1
Search strategy	7	Present full search strategies for all databases, registers, and websites, including filters and limits.	Supplementary Table S1
Selection process	8	Specify methods used to decide whether studies met inclusion criteria, including number of reviewers, independent screening, and any automation tools.	Methods: Study selection
Data collection process	9	Specify methods used to collect data from reports, including number of reviewers, independent extraction, confirmation with investigators, and automation tools if used.	Methods: Data extraction and coding of diagnostic estimates
Data items	10a	List and define all outcomes for which data were sought, and state whether all compatible results were sought or how results were selected.	Methods: Data extraction and coding of diagnostic estimates
Data items	10b	List and define all other variables sought, including participant, intervention/index-test, comparator, setting, funding, or other	Methods: Data extraction and coding of diagnostic estimates; Table 1; Table 2

		characteristics; describe assumptions about missing or unclear information.	
Study risk-of-bias assessment	11	Specify methods used to assess risk of bias, including tool, number of reviewers, independent assessment, and automation tools if applicable.	Methods: Risk of bias, applicability, and AI-specific reporting
Effect measures	12	Specify effect measures or diagnostic accuracy measures used for each outcome.	Methods: Statistical analysis
Synthesis methods	13a	Describe processes used to decide which studies were eligible for each synthesis.	Methods: Statistical analysis
Synthesis methods	13b	Describe methods required to prepare data for presentation or synthesis, including missing data handling and data conversion.	Methods: Statistical analysis; Supplementary Data 1
Synthesis methods	13c	Describe methods used to tabulate or visually display individual-study and synthesis results.	Methods: Statistical analysis; Figures 3–4; Tables 3–6
Synthesis methods	13d	Describe methods used to synthesize results and provide rationale; if meta-analysis was performed, describe model, heterogeneity assessment, and software.	Methods: Statistical analysis
Synthesis methods	13e	Describe methods used to explore possible causes of heterogeneity, such as subgroup analysis or meta-regression.	Methods: Subgroup and meta-regression analyses
Synthesis methods	13f	Describe sensitivity analyses used to assess robustness of synthesized results.	Methods: Sensitivity analyses
Reporting-bias assessment	14	Describe methods used to assess risk of bias due to missing results in a synthesis.	Methods: Publication bias and small-study effects
Certainty assessment	15	Describe methods used to assess certainty or confidence in the body of evidence.	Methods: Certainty of evidence: GRADE-DTA
		RESULTS	
Study selection	16a	Describe search and selection results from records identified to studies included, ideally using a flow diagram.	Results: Study selection; Figure 1
Study selection	16b	Cite studies that might appear to meet inclusion criteria but were excluded, and explain why they were excluded.	Results: Study selection; Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	Results: Participants, settings, and target conditions; Table 1; Table 2
Risk of bias in studies	18	Present risk-of-bias assessments for each included study.	Results: Risk of bias and applicability; Figure 2; Supplementary Figure S1
Results of individual studies	19	For all outcomes, present summary statistics and effect estimates with precision for each study, ideally using structured tables or plots.	Figure 3; Supplementary Data 1; Supplementary Figures S5–S7
Results of syntheses	20a	For each synthesis, briefly summarize characteristics and risk of bias among contributing studies.	Results: Primary diagnostic accuracy; Results: Lesion-specific diagnostic accuracy
Results of syntheses	20b	Present results of all statistical syntheses, including summary estimates, precision, heterogeneity, and direction of effect when comparing groups.	Table 3; Tables 4–5; Figure 3

Results of syntheses	20c	Present results of investigations of possible causes of heterogeneity.	Results: AS subgroup analyses; Results: MR subgroup analyses; Tables 4–5
Results of syntheses	20d	Present results of sensitivity analyses.	Supplementary Figure S3; Methods/Results sensitivity-analysis paragraph
Reporting biases	21	Present assessments of risk of bias due to missing results for each synthesis assessed.	Results: AS subgroup analyses; Supplementary Figure S8
Certainty of evidence	22	Present certainty or confidence assessments for each outcome assessed.	Supplementary Table S6; Discussion: Limitations and certainty of evidence
		DISCUSSION	
Discussion	23a	Provide a general interpretation of results in the context of other evidence.	Discussion
Discussion	23b	Discuss limitations of evidence included in the review.	Discussion: Limitations and certainty of evidence
Discussion	23c	Discuss limitations of the review processes used.	Discussion: Limitations and certainty of evidence
Discussion	23d	Discuss implications for practice, policy, and future research.	Discussion, final paragraphs
		OTHER	
Registration and protocol	24a	Provide registration information, including registry name and registration number, or state that the review was not registered.	Methods: Protocol, registration, and reporting framework
Registration and protocol	24b	Indicate where the review protocol can be accessed or state that no protocol was prepared.	Methods: Protocol, registration, and reporting framework
Registration and protocol	24c	Describe and explain amendments to information provided at registration or in the protocol.	Methods: Protocol, registration, and reporting framework
Support	25	Describe financial or non-financial support and the role of funders or sponsors.	Acknowledgements
Competing interests	26	Declare competing interests of review authors.	Competing interests
Availability of data, code, and materials	27	Report which data, analytic code, templates, and other materials are publicly available and where they can be found.	Data availability; Code availability; Supplementary Data 1

Reporting Checklist 3. PRISMA-S checklist for reporting literature searches in systematic reviews

Section / topic	Item #	Checklist item	Location in manuscript
		Information sources and methods	
Database name	1	Name each individual database searched and state the platform used for each.	Methods: Information sources and search strategy; Supplementary Table S1

Multi-database searching	2	If databases were searched simultaneously on a single platform, state the platform and list all databases searched.	Supplementary Table S1
Study registries	3	List study registries searched.	Methods: Information sources and search strategy; Supplementary Table S1
Online resources and browsing	4	Describe online or print sources purposefully searched or browsed, such as conference proceedings, websites, or tables of contents, and how this was done.	Methods: Information sources and search strategy; Supplementary Table S1
Citation searching	5	State whether cited references or citing references were examined and describe methods for locating cited or citing references.	Methods: Information sources and search strategy; Supplementary Table S1
Contacts	6	State whether additional studies or data were sought by contacting authors, experts, manufacturers, or others.	Methods: Information sources and search strategy/ Data extraction and coding of diagnostic estimates
Other methods	7	Describe any additional information sources or search methods used.	Methods: Information sources and search strategy; Supplementary Table S1
Search strategies			
Full search strategies	8	Include search strategies for each database and information source, copied and pasted exactly as run.	Supplementary Table S1
Limits and restrictions	9	Specify that no limits were used, or describe limits or restrictions such as date, language, study design, or publication type, and justify them.	Methods: Information sources and search strategy; Supplementary Table S1
Search filters	10	State whether published search filters were used, originally or modified, and cite them if used.	Supplementary Table S1
Prior work	11	State whether search strategies from previous literature reviews were adapted or reused, and cite prior reviews if applicable.	Supplementary Table S1
Updates	12	Report methods used to update searches, such as rerunning searches or email alerts.	Methods: Information sources and search strategy; Supplementary Table S1
Dates of searches	13	For each search strategy, provide the date when the last search occurred.	Methods: Information sources and search strategy; Supplementary Table S1
Peer review			
Peer review	14	Describe any search peer-review process.	Not performed. Search strategies were developed by the review team and are reported in full in Supplementary Table S1.
Managing records			
Total records	15	Document the total number of records identified from each database and other information source.	Results: Study selection; Figure 1; Supplementary Table S1

Deduplication	16	Describe processes and software used to deduplicate records from multiple database searches and other sources.	Methods: Study selection; Results: Study selection