Supplementary Materials

Deep learning for automated spinopelvic parameter measurement from radiographs: a meta-analysis

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Supplementary Table 1. Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Click here to enter text.
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	2, 3
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	3
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	4
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	3
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	3
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	4

Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	4
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	5
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	5
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	6, figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	6
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Table 2, Page 7
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Table 1
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	6,7,8
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	9
Limitations	20	Discuss the limitations of the scoping review process.	10
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	9,10
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the	NA

		scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Supplementary Table 2

Title	Year	Included	Reason
Direct automated quantitative measurement of spine by cascade amplifier regression network with manifold regularization	2019	No	Does not discuss imaging parameters
Deep learning system for Meyerding classification and segmental motion measurement in diagnosis of lumbar spondylolisthesis	2021	No	Does not discuss imaging parameters
Deep Learning based Vertebral Body Segmentation with Extraction of Spinal Measurements and Disorder Disease Classification	2022	No	
Artificial neural networks for the recognition of vertebral landmarks in the lumbar spine	2016	No	Does not discuss imaging parameters
Automated Measurement of Lumbar Lordosis on Radiographs Using Machine Learning and Computer Vision	2020	No	Does not contain model metrics
Computer- Aided Diagnosis for Determining Sagittal Spinal Curvatures Using Deep Learning and Radiography	2022	No	Does not discuss imaging parameters
a deep learning based fully automated program for efficient and reliable quantifications of the vertebrae and discs on sagittal lumbar spine MR images	2019	No	Does not discuss imaging parameters
Artificial Intelligence for Automatic Measurement of Sagittal Vertical Axis Using ResUNet Framework	2019	No	Does not discuss imaging parameters
Institution-wide Shape Analysis of 3D Spinal Curvature and Global Alignment Parameters	2021	No	Does not discuss imaging parameters
Development and Multi-institutional Validation of a Convulational Neural Network to Detect Vertebral Body Mis-alignments in 2D X-ray Setup Images	2023	No	Does not discuss imaging parameters
Artificial intelligence X-ray measurement technology of anatomical parameters related to lumbosacral stability	2022	No	Does not discuss imaging parameters
Automated Vertebral Segmentation and Measurement of Vertebral Compression Ratio Based on Deep Learning in X- Ray Images	2021	No	Does not discuss imaging parameters

2- step deep learning model for landmarks localization in spine radiographs	2021	No	Does not discuss imaging parameters
Temporal Trends in Cervical Spine Curvature of South Korean Adults Assessed by Deep Learning System Segmentation, 2006-2018	2020	No	Does not discuss imaging parameters
An Application of Artificial Intelligence to Diagnostic Imaging of Spine Disease: Estimating Spinal Alignment From Moiré Images	2019	No	Review Article
Automatic recognition of whole- spine sagittal alignment and curvature analysis through a deep learning technique	2022	No	Does not discuss imaging parameters