



BMJ Open Using artificial intelligence to improve healthcare delivery in select allied health disciplines: a scoping review protocol

Kalpna Raghunathan,^{1,2,3} Meg E. Morris ,^{2,4,5} Tafheem A. Wani,^{2,6} Kristina Edvardsson,^{2,7} Casey Peiris,^{4,8} Sally Fowler-Davis,⁹ Jonathan P. McKercher ,^{2,10} Sharon Bourke,^{2,7} Saadia Danish,^{2,6} Jacqueline Johnston,^{2,7} Nompilo Moyo,^{2,7} Julia Gilmartin-Thomas,^{4,10,11} Hazel Wei Fen Heng ,¹² Ken Ho,^{2,7} Joanne Joyce-McCoach,¹³ Claire Thwaites^{2,4}

To cite: Raghunathan K, Morris ME, Wani TA, *et al*. Using artificial intelligence to improve healthcare delivery in select allied health disciplines: a scoping review protocol. *BMJ Open* 2025;**15**:e098290. doi:10.1136/bmjopen-2024-098290

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-098290>).

Received 20 December 2024
Accepted 28 February 2025



© Author(s) (or their employer(s)) 2025. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ Group.

For numbered affiliations see end of article.

Correspondence to

Professor Meg E. Morris;
m.morris@latrobe.edu.au

ABSTRACT

Introduction Methods to adopt artificial intelligence (AI) in healthcare clinical practice remain unclear. The potential for rapid integration of AI-enabled technologies across healthcare settings coupled with the growing digital divide in the health sector highlights the need to examine AI use by health professionals, especially in allied health disciplines with emerging AI use such as physiotherapy, occupational therapy, speech pathology, podiatry and dietetics. This protocol details the methodology for a scoping review on the use of AI-enabled technology in sectors of the allied health workforce. The research question is 'How is AI used by sectors of the allied health workforce to improve patient safety, quality of care and outcomes, and what is the quality of evidence supporting this use?'

Methods and analysis The review will follow the Joanna Briggs Institute scoping review guidelines. Databases will be searched from 17 to 24 March 2025 and will include PubMed/Medline, Embase, PsycINFO and Cumulative Index to Nursing and Allied Health Literature databases. Dual screening against inclusion criteria will be applied for study selection. Peer-reviewed articles reporting primary research in allied healthcare published in English within the last 10 years will be included. Studies will be evaluated using the Quality Assessment with Diverse Studies tool. The review will map the existing literature and identify key themes related to the use of AI in the disciplines of physiotherapy, occupational therapy, speech pathology, podiatry and dietetics.

Ethics and dissemination No ethics approval will be sought, as only secondary research outputs will be used. Findings will be disseminated through peer-reviewed publication and presentations at workshops and conferences.

Trial registration number Open Science Framework Protocol Registration <https://osf.io/r7t4s>

INTRODUCTION

Artificial intelligence (AI) is a technology revolutionising how allied health professionals

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The review analyses artificial intelligence (AI) adoption for the allied health disciplines of physiotherapy, occupational therapy, speech pathology, podiatry and dietetics, with a structured approach, noting the rapid increase in AI technologies worldwide.
- ⇒ Quality appraisal using the Quality Assessment with Diverse Studies tool strengthens the findings, yet the review relies on the quality of the included studies.
- ⇒ Searching multiple databases and primary research makes the review comprehensive, yet limiting to peer-reviewed articles in English may exclude some relevant research.
- ⇒ Focusing on five allied health disciplines allows for detailed analysis yet could miss insights from other health professional disciplines, especially nursing, midwifery, radiology, pharmacy, psychology and medicine.
- ⇒ The study provides timely insights into AI adoption in select allied health disciplines, noting that rapid technological changes may quickly outdate the findings.

deliver services.¹ AI uses computer systems capable of performing tasks that previously required human intelligence, such as visual perception, speech recognition, decision-making, generative works and language translation.^{1,2} It enables health professionals to work differently, by using data analytics to interpret diagnostic test results, formulate treatment plans and evaluate responses to therapy¹ as well as generating reports and educational material.³ AI encompasses a variety of technologies, including machine learning, natural language processing and deep learning where computerised systems perform tasks involving content generation, reasoning, learning and problem-solving.³ In

healthcare, AI is often used to streamline tasks, manage healthcare data, improve remote monitoring, create personalised treatment plans and enhance collaboration between healthcare professionals.⁴ Examples of AI technology in healthcare include the use of virtual assistants, predictive analytics, precision medicine, drug or treatment discoveries, robotics and AI-powered imaging and diagnostics.³

Although AI presents exciting opportunities and applications in healthcare, several challenges exist. AI systems may not always be well matched to the diverse health conditions and impairments experienced by patients, raising concerns about the ability of AI to deliver tailored care.⁵ The use of incomplete, biased or unrepresentative healthcare data to train AI models could undermine the validity and reliability of these tools, raising concerns about their effectiveness in real-world applications.⁶ Ethical implications, including trust issues due to bias in AI algorithms, lack of patient awareness or data privacy concerns add to the complexities of adopting this new technology.^{7,8}

The extent to which allied health disciplines have adopted AI in clinical practice is currently unclear. Given the rapid implementation of AI in hospitals, rehabilitation services, aged care, community health and other care settings, there is a need to map the uptake of AI-enabled technology by select allied health professional disciplines to optimise healthcare quality, safety and outcomes. The widening gap between the digital capability of the care workforce and the potential for technology-enabled healthcare delivery⁹ underscores the urgent need to examine the use of AI by some professional disciplines.^{2,10} Utilisation of AI and the factors impacting uptake in allied health sectors have not previously been investigated, including how it is implemented, the risks and implications.¹¹

Allied health disciplines provide therapeutic, technical and support services in connection with health, well-being, research and education. At least 27 allied health disciplines have been identified, including and not limited to physiotherapy, occupational therapy, speech pathology, podiatry and dietetics.^{12,13} Unlocking and leveraging the untapped potential of AI in disciplines such as these is a new opportunity, although health professionals sometimes lack large, standardised datasets needed to effectively train AI tools, and data are frequently siloed or not digitally integrated.^{10,14,15} The reliance on hands-on, empathetic interactions and the unique therapeutic relationships in healthcare disciplines also raise ethical concerns about the potential loss of human connection in AI-driven care.^{16,17} It is also essential that AI systems do not contain errors in their algorithms as this could adversely impact service delivery.¹⁸

A comprehensive review is required to identify barriers and opportunities for AI in sectors of the allied health workforce. It is not possible to review all of the allied health disciplines across the globe, given the very large number. Therefore, this scoping review will focus on the

disciplines of physiotherapy, occupational therapy, speech pathology, podiatry and dietetics, which are deployed in many countries. The review aims to collect and analyse current evidence on how these particular allied health disciplines use AI to enhance patient safety, quality and outcomes. The goal is to understand the present state of AI adoption, its benefits, the factors influencing its implementation, and the risks and implications associated with its use.

Main research question

‘How is AI used by select disciplines of the allied health workforce to improve patient safety, quality of care and outcomes, and what is the quality of evidence supporting this use?’

Research subquestions

1. How is AI technology currently being used in physiotherapy, occupational therapy, speech pathology, podiatry and dietetics clinical practice?
2. What are the benefits, impact and costs of AI implementation at scale for these disciplines?
3. What are the barriers and risks of AI implementation in physiotherapy, occupational therapy, speech pathology, podiatry and dietetics?
4. What is the quality of the evidence for AI use in physiotherapy, occupational therapy, speech pathology, podiatry and dietetics?

METHODS AND ANALYSIS

Scoping review framework

This scoping review employs Arksey and O’Malley’s (2005) initial framework, refined by Levac *et al.*¹⁹ It follows the consolidated Joanna Briggs Institute scoping review guidance.²⁰ A scoping review was chosen as a suitable methodology to map current evidence, identify key concepts and gaps, and facilitate rapid knowledge translation.²¹ This approach is particularly suitable for topics with emerging evidence.¹⁹ A protocol outlines methods and criteria in advance to ensure clarity, focus and scope of the review. Our review process and reporting are in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews²¹ and the Cooper *et al* steps for managing scoping reviews.²²

Eligibility criteria

The population, concept and context (PCC) elements for the scoping review were developed alongside eligibility criteria.²⁰ The population is allied health professionals, the concept is the use of AI and the context is a broad range of health and healthcare settings. Table 1 gives a detailed overview of the PCC elements and the inclusion and exclusion criteria for study screening and selection.

Given the diversity within the allied health sector and the very large number of allied health disciplines, not all could be reviewed. An a priori decision was made to focus on the disciplines of physiotherapy, occupational therapy, speech pathology, dietetics and podiatry, which will afford

Table 1 Search screening and eligibility criteria

	Include	Exclude
Population	Allied health professionals from physiotherapy, occupational therapy, speech pathology, dietetics or podiatry. A mix of allied health professions can be included provided that one of the five disciplines above is included.	Studies involving health professionals who are not from the disciplines of physiotherapy, occupational therapy, speech pathology, dietetics or podiatry.
Concept	Use of AI: encompasses studies that evaluate or describe any application of AI technologies in the practice of allied health professionals. AI applications might include diagnostic tools, decision support systems, treatment planning systems, patient monitoring systems, tasks or administrative support and other allied health interventions.	Studies not involving AI applications. Studies not addressing or involving direct patient care, clinical practice, clinical decision making, patient safety, quality or healthcare. Studies with a primary focus on theoretical, technical or non-healthcare-specific AI applications or without relevance to allied health clinical practice or clinical settings. Studies where AI has only been used for research participant outcome assessment, for example, monitoring blood pressure.
Context	Healthcare settings: includes hospitals, clinics, rehabilitation centres, community health services, community care, residential aged care and any other settings where allied health professionals practise.	Schools. Prisons. Workplaces.
Databases	Medline. Embase. PsycINFO. CINAHL.	
Publication	Peer-reviewed articles. Articles reporting primary research in quantitative, qualitative and mixed methods studies in healthcare.	Commentaries. Editorials. Protocols. Reports. Conference abstracts. Non-full text articles. Unpublished theses.
Timeline	Studies published in the last 10 years (from 2014).	
English	English language articles only.	
AI, artificial intelligence.		

a manageable review process yielding specific insights and trends. Other allied health disciplines were beyond the scope of the review, such as arts therapy, audiology, nutrition, chiropractic, counselling, exercise physiology, medical radiation, music therapy, optometry, orthotics, prosthetics, osteopathy, paramedics, pharmacy, psychology, social work and radiography. It is noted that radiology and pharmacy already have large bodies of research on AI implementation,^{23–28} and readers are referred to these existing sources of evidence. Due to resource limitations preventing access to translation services, English language articles will only be reviewed. The analysis of studies on wearables and wearable sensors will also be excluded as this is a large field with a focus on input data.

Search strategy

Search terms were scoped and identified through a search of PubMed and Medical Subject Heading (MeSH) terms. An iterative approach was used to develop the search strategy

in consultation with a university health sciences information specialist for peer review of the search strategy and optimisation of database searching.²⁹ Table 2 illustrates the search strategy using the PCC elements and keywords. At the time of the review, a comprehensive search of Medline, Embase, PsycINFO and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases will be undertaken over a course of one week, followed by an additional hand search of reference lists for included studies.

Study selection

Screening and study selection will be performed by pairs of reviewers using Covidence (Cochrane Collaboration's platform for systematic reviews software) against the review criteria (table 1). Included articles will be dual-screened at titles and abstracts and full text, with conflict resolution undertaken by a third reviewer.

Data extraction

Data extraction will be performed by four members of the research team. Data extraction for each study will

Table 2 Search strategy and keywords

Concept 1: population	Concept 2: concept	Concept 3: context
Allied health workforce ▶ “Allied Health*” ▶ Care workforce ▶ physiotherap* ▶ “physical therap*” ▶ “occupational therap*” ▶ “speech patholog*” ▶ “speech language patholog*” ▶ “speech and language therapist” ▶ dietetics ▶ dietician ▶ podiatr*	Artificial intelligence ▶ “Artificial Intelligence” ▶ “Machine Learning” ▶ Deep learning	Healthcare settings ▶ “Rehabilitation Centres” ▶ “Hospital” ▶ “Ambulatory Care” ▶ “Community Health” ▶ “Residential Aged Care” ▶ “Community Care” ▶ “Clinics”
Sample preliminary search strategy in Medline ((“Allied Health*” OR “Care workforce” OR Physiotherap* OR “Physical therap*” OR “occupational therap*” OR “speech patholog*” OR “speech language patholog*” OR dietetics OR dietician OR podiatr*) AND (“Artificial Intelligence” OR “machine learning” OR “Deep learning”) AND (“Healthcare delivery” OR “Health services” OR “Patient care” OR “Clinical practice” OR “Health management”))		
Further refinement of keywords from preliminary search in Medline Further filter keywords from concepts 1 and 2 to address research questions		

be verified by a second person to ensure accuracy and completeness. Disagreements will be resolved through discussion and group consensus. If consensus is not reached, then researcher MM will make the final ruling for the study in question. Data extraction will be completed in Covidence, and the data will be organised under the required data fields (see [box 1](#)). Extraction of data will be limited to key study characteristics and outcomes data, which may be further refined to focus on the research questions.

Quality appraisal

The Quality Assessment with Diverse Studies tool developed by Harrison *et al* will be used to evaluate the methodological and reporting quality of included studies.³⁰

Box 1 Sample data extraction fields

Criteria for extraction

Authors
 Origin/geographical location
 Year
 Purpose
 Study design
 Population
 Use of artificial intelligence (AI)
 Healthcare setting
 Benefits of AI use
 Barrier/challenges to AI use
 Practice outcomes of AI adoption
 Risks and implications
 Gaps/limitations in AI use

This tool uses a scoring system where each criterion is rated as ‘yes’, ‘no’, ‘unclear’ or ‘not applicable’, with one point awarded for each rating of ‘yes’. The final scores for each study will be expressed as a percentage based on the relevant criteria of the appraisal tool. Studies will not be excluded based on this quality appraisal. Instead, the appraisal outcomes will be used to assess the overall quality of the reported studies. Discrepancies between researcher ratings will be addressed through discussion within the research team.

Quality synthesis

The review findings will be presented descriptively, in line with the scoping review aims. A narrative summary will explain the tabulated results, which will be organised under key themes and categories. The results table will be refined after examining the selected studies and their findings. Presentation of findings will also be guided by the Patterns, Advances, Gaps, Evidence for practice and Research recommendations framework for reporting scoping reviews in health and social research.³¹

Other considerations for scoping reviews

The review process allows for post hoc modifications to the proposed protocol, including eligibility criteria, as part of an efficient and iterative approach. Any post hoc changes that are made and supported by decision-making will be documented in team meeting notes to monitor and track the review process. Any post hoc changes or protocol deviations will also be detailed in planned peer-reviewed journal publications. Patient and public involvement will occur after the review has been completed, when we shall

Table 3 Estimated review activity time frame

Review activity	Estimated time frame
Protocol development	2 weeks
Literature searching	1 week
Quality appraisal	2 weeks
Data extraction	2 weeks
Analysis and synthesis	3–4 weeks
Writing up	3–4 weeks

disseminate the findings through the La Trobe University Care Economy Research Institute Consumer Engagement Committee.

Our scoping review maintains methodological rigour while addressing the scientific need for timely and comprehensive evidence gathering. This approach ensures that credible and trustworthy findings can be integrated into healthcare decision-making. The outcomes of the review will be documented and disseminated through a peer-reviewed journal publication and conference presentations. The integration of AI into allied health roles appears to be increasingly necessary to tackle the complexity of patient care, the growing volume of health data and the demand for personalised treatment.^{32–33} AI can process large amounts of patient data to identify patterns, predict outcomes, provide evidence-based recommendations, improve diagnostic accuracy and potentially optimise treatment effectiveness.³⁴ AI also has the potential to streamline allied health administrative processes, resource allocation and operational efficiency.³⁴ Our review will identify the extent to which this potential has been realised, as well as emerging ethical concerns. It will also provide recommendations for how select allied health professions could consider integrating or using AI effectively.

Timeline

The timeline for this scoping review will be contingent on the volume of retrieved articles and studies included for data analysis. An estimate of the review timeline is illustrated in [table 3](#).

ETHICS AND DISSEMINATION

No ethics approval will be sought, as only secondary research outputs will be used. Findings will be disseminated through peer-reviewed publication and presentations at workshops and conferences.

Author affiliations

¹School of Computing, Engineering and Mathematical Sciences, La Trobe University, Bundoora, Victoria, Australia

²Care Economy Research Institute, La Trobe University, Bundoora, Victoria, Australia

³School of Nursing and Midwifery, Monash University, Clayton, Victoria, Australia

⁴Academic and Research Collaborative in Health, La Trobe University, Melbourne, Victoria, Australia

⁵The Victorian Rehabilitation Centre, Healthscope Limited, Melbourne, Victoria, Australia

⁶School of Psychology and Public Health, La Trobe University, Bundoora, Victoria, Australia

⁷School of Nursing and Midwifery, La Trobe University, Melbourne, Victoria, Australia

⁸Allied Health, Melbourne Health, Parkville, Victoria, Australia

⁹Health, Medicine and Social Care, Anglia Ruskin University, Cambridge, UK

¹⁰School of Allied Health, Human Services and Sport, La Trobe University, Bundoora, Victoria, Australia

¹¹Allied Health, The Alfred, Prahran, Victoria, Australia

¹²Allied Health, Northern Hospital Epping, Epping, Victoria, Australia

¹³La Trobe University, Melbourne, Victoria, Australia

X Sally Fowler-Davis @sallyfowlerdav and Claire Thwaites @ClaireKThwaites

Acknowledgements The authors would like to acknowledge Linda Whitby, La Trobe University librarian, for her contribution to the search strategy.

Contributors MM is the guarantor. KR, MM and CT led the authorship team in deriving the concept and design of the protocol, research questions and reporting of the work in this paper. KR and MM wrote the first draft of this protocol manuscript. All authors contributed to the subsequent drafts of this manuscript. The final draft was edited and approved by all authors prior to submission.

Funding Academic and Research Collaborative in Health, La Trobe University Care Economy Research Institute (CERI), La Trobe University.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design or conduct or reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Meg E. Morris <http://orcid.org/0000-0002-0114-4175>

Jonathan P. McKercher <http://orcid.org/0000-0002-8839-8353>

Hazel Wei Fen Heng <http://orcid.org/0000-0001-8662-7063>

REFERENCES

- Sharma R, Kshetri N. Digital healthcare: Historical development, applications, and future research directions. *Int J Inf Manage* 2020;53:102105.
- Reis FJJ, Carvalho MBL de, Neves G de A, et al. Machine learning methods in physical therapy: A scoping review of applications in clinical context. *Musculoskeletal Science and Practice* 2024;74:103184.
- Bohr A, Memarzadeh K. *Artificial intelligence in healthcare*. Academic Press, 2020.
- Reddy S. The impact of ai on the healthcare workforce: balancing opportunities and challenges. 2024.
- Duffourc M, Gerke S. Generative AI in Health Care and Liability Risks for Physicians and Safety Concerns for Patients. *JAMA* 2023;330:313–4.
- Aung YYM, Wong DCS, Ting DSW. The promise of artificial intelligence: a review of the opportunities and challenges of artificial intelligence in healthcare. *Br Med Bull* 2021;139:4–15.
- Gerke S, Minssen T, Cohen G. Chapter 12 - ethical and legal challenges of artificial intelligence-driven healthcare. In: Bohr A, Memarzadeh K, eds. *Artificial intelligence in healthcare*. Academic Press, 2020: 295–336.
- Rony MKK, Numan SM, Akter K, et al. Nurses' perspectives on privacy and ethical concerns regarding artificial intelligence adoption in healthcare. *Heliyon* 2024;10:e36702.
- Morris ME, Brusco NK, Jones J, et al. The Widening Gap between the Digital Capability of the Care Workforce and Technology-Enabled Healthcare Delivery: A Nursing and Allied Health Analysis. *Healthcare (Basel)* 2023;11:994.
- Ronquillo CE, Mitchell J, Alhuwail D, et al. The Untapped Potential of Nursing and Allied Health Data for Improved Representation

- of Social Determinants of Health and Intersectionality in Artificial Intelligence Applications: A Rapid Review. *Yearb Med Inform* 2022;31:94–9.
- 11 World Health Organization. Ethics and governance of artificial intelligence for health. 2021.
 - 12 National Health Service England. About AHPs England. 2025. Available: <https://www.england.nhs.uk/ahp/about>
 - 13 Department of Health and Aged Care. About allied health care. Australia; 2024.
 - 14 Pappachan JM, Cassidy B, Fernandez CJ, et al. The role of artificial intelligence technology in the care of diabetic foot ulcers: the past, the present, and the future. *World J Diabetes* 2022;13:1131–9.
 - 15 Sosa-Holwerda A, Park O-H, Albracht-Schulte K, et al. The Role of Artificial Intelligence in Nutrition Research: A Scoping Review. *Nutrients* 2024;16:2066.
 - 16 Alsobhi M, Sachdev HS, Chevidikunna MF, et al. Facilitators and Barriers of Artificial Intelligence Applications in Rehabilitation: A Mixed-Method Approach. *Int J Environ Res Public Health* 2022;19:15919.
 - 17 Naqvi WM, Naqvi I, Mishra GV, et al. The Dual Importance of Virtual Reality Usability in Rehabilitation: A Focus on Therapists and Patients. *Cureus* 2024;16:e56724.
 - 18 World Health Organization. The role of artificial intelligence in sexual and reproductive health and rights: technical brief. World Health Organization; 2024.
 - 19 Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010;5:69.
 - 20 Peters MDJ, Godfrey C, Mclnerney P, et al. Scoping reviews (2020). In: Aromataris E, Munn Z, eds. *JB I evidence synthesis*. 2020: 2119–26.
 - 21 Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med* 2018;169:467–73.
 - 22 Cooper S, Cant R, Kelly M, et al. An Evidence-Based Checklist for Improving Scoping Review Quality. *Clin Nurs Res* 2021;30:230–40.
 - 23 Chalasani SH, Syed J, Ramesh M, et al. Artificial intelligence in the field of pharmacy practice: A literature review. *Explor Res Clin Soc Pharm* 2023;12:100346.
 - 24 Hatzimanolis J, Riley B, El-Den S, et al. Applications of artificial intelligence in current pharmacy practice: A scoping review. *Res Social Adm Pharm* 2024.
 - 25 Al-Naser YA. The impact of artificial intelligence on radiography as a profession: A narrative review. *J Med Imaging Radiat Sci* 2023;54:162–6.
 - 26 Albano D, Galiano V, Basile M, et al. Artificial intelligence for radiographic imaging detection of caries lesions: a systematic review. *BMC Oral Health* 2024;24:274.
 - 27 Chen K, Stotter C, Klestil T, et al. Artificial Intelligence in Orthopedic Radiography Analysis: A Narrative Review. *Diagnostics (Basel)* 2022;12:2235.
 - 28 Yang L, Ene IC, Arabi Belaghi R, et al. Stakeholders' perspectives on the future of artificial intelligence in radiology: a scoping review. *Eur Radiol* 2022;32:1477–95.
 - 29 McGowan J, Sampson M, Salzwedel DM, et al. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol* 2016;75:40–6.
 - 30 Harrison R, Jones B, Gardner P, et al. Quality assessment with diverse studies (QuADS): an appraisal tool for methodological and reporting quality in systematic reviews of mixed- or multi-method studies. *BMC Health Serv Res* 2021;21:144.
 - 31 Bradbury-Jones C, Aveyard H, Herber OR, et al. Scoping reviews: the PAGER framework for improving the quality of reporting. *Int J Soc Res Methodol* 2022;25:457–70.
 - 32 Agarwal R, Gao G (Gordon), DesRoches C, et al. Research Commentary — The Digital Transformation of Healthcare: Current Status and the Road Ahead. *Inform Syst Res* 2010;21:796–809.
 - 33 Ho KHM, Cheng HY, McKenna L, et al. Nursing and midwifery in a changing world: Addressing planetary health and digital literacy through a global curriculum. *Nurs Open* 2024;11:e2075.
 - 34 Kraus S, Jones P, Kailer N, et al. Digital Transformation: An Overview of the Current State of the Art of Research. *Sage Open* 2021;11.