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Mapping the integration of artificial intelligence and digital technologies in health technology assessment: a scoping review protocol of global knowledge and practices

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Abstract

Background Health Technology Assessment (HTA) is a cornerstone of evidence for informing health policy and resource allocation globally. Rapid advancements and the proliferation of digital health technologies and artificial intelligence (AI) have prompted the re-examination of HTA processes and methods. While traditional approaches are manual and labor-intensive, HTA processes are now exploring the use of AI and other digital technologies for automation, decision support, and evidence synthesis. To date, however, there have been very limited studies that map the innovative technological solutions of HTA, the models of integration, and the associated barriers, facilitators, and governance considerations. As such, this scoping review aims to address this critical gap by mapping the landscape of the global knowledge and practices related to AI and DTs used in and for HTA and identifying the key barriers and enablers influencing their adoption, integration, and effective application within HTA processes.

Methods A scoping review will be conducted between August and November 2025, following the Arksey and O'Malley framework, enhanced by Joanna Briggs Institute (JBI) recommendations, and reported according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. Literature searches will be performed in electronic databases such as Medline (Ovid), Embase (Ovid), Global Health (Ovid), CINAHL (Ebsco), Scopus, Web of Science, and all regional indexes in the World Health Organization's Global Index Medicus, and other region-specific sources for studies published between 2020 and 2025. Eligible studies will include peer-reviewed articles and grey literature describing the integration of digitization, automation, and AI in global HTA processes. Dual independent screening, data extraction, and quality appraisal will be employed.

Discussion Findings from this review will provide a map of how digitization, automation, and AI are integrated into HTA practice, highlighting key enablers, barriers, and knowledge gaps. The insights will be used to better guide researchers, policymakers, HTA agencies, and AI developers, further supporting future research and implementation strategies for better informed decision-making.

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Keywords Health Technology Assessment (HTA), Artificial Intelligence, Digital Technologies, Scoping Review Evidence

Background

Health Technology Assessment (HTA) is widely recognized as a foundational tool for evidence-informed health policy and resource allocation worldwide. HTA is a systematic process for evaluating the characteristics, outcomes, and broader consequences of healthcare interventions and technologies [1]. HTA serves as a vital link between research evidence and health policy, involving various disciplines such as medicine, economics, epidemiology, ethics, and social sciences [1]. By guiding decisions on the adoption, reimbursement, and implementation of health technologies, HTA promotes optimal resource use, policy transparency, and patient-focused care.

Traditionally, HTA processes have relied on extensive manual work for the synthesis and appraisal of evidence. However, the widespread expansion of Digital Technologies (DTs) – including digital platforms, dashboards, data analytics, and automation tools – alongside the increasing use of Artificial Intelligence (AI) has prompted a re-examination of HTA processes [2]. According to the World Health Organization (WHO), digital health is “the field of knowledge and practice associated with the development and use of digital technologies to improve health. This encompasses eHealth, Internet of Things, advanced computing, big data analytics, artificial intelligence (including machine learning), robotics, software applications for data collection, analytics, and modeling, and the use of physical therapeutic devices and sensors” [3]. AI, as one component within this broader digital health landscape, is described by WHO as the capability of algorithms integrated into systems and tools to learn from data to perform automated tasks without explicit programming of every step by a human [4]. Within HTA, these innovations present real opportunities to make HTA procedures more efficient, timely, transparent, and comprehensive as part of broader digitization efforts [5].

Despite growing interest from policymakers, government bodies, healthcare providers, and HTA agencies, there remains a significant gap in synthesized evidence on how diverse DTs are being implemented and integrated into HTA systems globally. The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) Working Group report reveals that stakeholders see generative AI as a transformative force in HTA, especially in (i) automating systematic literature review tasks (e.g., search term suggestion,

abstract screening, data extraction, meta-analysis coding), (ii) accelerating real-world evidence insights from large and unstructured datasets (e.g., clinical notes, imaging), and (iii) enhancing health-economic modeling from model design through validation—while also underscoring the need for human oversight amid concerns about scientific validity, bias, equity, and regulatory/ethical compliance [6]. Notably, AI has significant potential to improve economic evaluation in HTA by enabling faster and more efficient analyses of cost-effectiveness and budget impact, as well as supporting value-based decision making, allowing for more data-driven and context-specific recommendations [7].

However, the field still lacks a comprehensive and up-to-date synthesis that maps global practices in the integration of DTs and AI across diverse HTA settings and domains. A systematic understanding of the scope, nature, and impact of these innovations is essential to inform policy, refine methodologies, and guide ethical governance and capacity-building efforts. In response, this review will map the global landscape of digital and automated innovations transforming HTA processes, providing actionable insights to support effective and responsible digital transformation. Drawing on the expertise of a geographically diverse team, including representation from the United Arab Emirates, Tunisia, and Jordan, the review will also examine how digitization can help address regional disparities in HTA capacity and resources, promoting more equitable development and implementation across contexts.

The main aim of this scoping review is to comprehensively map global knowledge and practice on the use of AI and DTs in and for HTA and identify key factors that enable or hinder their effective application. Specifically, the review will:

1. Map the use of AI and DTs in HTA, including tools and models that streamline processes and reported applications demonstrating AI integration across HTA functions.
2. Identify the key barriers and enablers to the adoption, integration, and effective application of AI and DTs in HTA processes.
3. Provide strategic, evidence-based recommendations for enhancing the adoption, integration, and effective application of AI and DTs in HTA systems, in alignment with the WHO guiding framework on AI and DTs [4].

Methodology

Scoping review framework

This study will employ the scoping review methodology framework described by Arksey and O'Malley [8], with methodological enhancements from the Joanna Briggs Institute (JBI) guidelines for scoping reviews [9]. Reporting will adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) to ensure transparency and reproducibility [10].

Research question

The primary research question for this study is:

“What are the reported use cases, applications, and models for digitizing HTA systems – including the development and integration of AI and DTs within and for HTA globally—and what are the key barriers, facilitators, and governance considerations?”

Search strategy and identification of relevant studies

Systematic literature searches will be conducted across major electronic databases, including Medline (Ovid), Embase (Ovid), Global Health (Ovid), CINAHL (Ebsco), Scopus, and Web of Science.

To capture broader global evidence, grey literature searches will also be undertaken through: (i) specialized databases (e.g., the International Network of Agencies for Health Technology Assessment (INAHTA), and the HTAi portal); (ii) search engines (e.g., Google Scholar, limited to the first five pages of results); and (iii) region-specific databases (e.g., all indexes of the World Health Organization's Global Index Medicus). Studies published prior to January 2020 will be excluded to focus only on recent advances, and the search will only include studies published between 2020 and 2025, during which AI in healthcare entered a phase of rapid maturity. This timeframe captures critical developments, including the accelerated adoption of AI tools during the COVID-19 pandemic [11], the surge in regulatory and policy frameworks, such as WHO guidance [4], the Organization for Economic Co-operation and Development (OECD) [12], and the European Union (EU) [13], and the growing body of evidence addressing bias, equity, and responsible AI.

The search will be conducted by a librarian, author (AQ), who has experience in knowledge synthesis projects, including systematic and scoping reviews. This search will use a comprehensive set of keywords and controlled vocabulary terms related to AI and HTA to identify the most relevant studies, ensuring a robust and systematic search strategy. Screening will be conducted in two stages using Covidence™ software. First, titles and

abstracts will be independently screened by two reviewers based on the predefined eligibility criteria. Studies deemed as relevant or unclear by either reviewer will proceed to full-text screening, which will also be carried out in parallel with the two reviewers. Any discrepancies will be resolved through discussion, and if needed, adjudication by a third reviewer.

Search keywords/terms include:

- AI and Digital Health/Health Technology terms:
 - “Artificial Intelligence” OR “AI” OR “Machine Learning” OR “Deep Learning” OR “DL” OR “Natural Language Processing” OR “NLP” OR “Large Language Models” OR “Generative AI” OR “Predictive Analytics” OR “Automation” OR “Digitization” OR “Digital Transformation” OR “Prescriptive Analytics” OR “Advanced Analytics” OR “Digital Innovation”
- HTA terms:
 - “Health Technology Assessment” OR “HTA” OR “Technology Appraisal” OR “Technology Assessment” OR “Health Economic Assessment” OR “Health Economics Evaluation” OR “Medical Technology Assessment” OR “Healthcare Technology Assessment” OR “Health Innovation Assessment” OR “Horizon Scanning”
- HTA Function and Evaluation terms:
 - “Economic Evaluation” OR “Cost-Effectiveness Analysis” OR “CEA” OR “Cost Utility Analysis” OR “CUA” OR “Budget Impact Analysis” OR “Value Assessment” OR “Clinical Effectiveness” OR “Clinical Evaluation” OR “Evidence-Informed Decision Making” OR “Systematic Reviews” OR “Meta-Analysis”

Inclusion criteria

To be selected, studies must meet the following criteria:

- Peer-reviewed, quantitative, qualitative, or mixed-methods studies published in English between 2020 and 2025;
- Grey literature, including policy documents, regulatory drafts, and reports from HTA agencies or recognized international bodies;
- Conference proceedings, editorials, policy briefs, and opinion pieces will be included if they report relevant pilots, implementation experiences, frameworks, or governance models related to the digitization of HTA systems, automation in HTA processes, or the integration of AI and digital technologies in HTA;
- Studies describing or assessing digital solutions – such as digital platforms, dashboards, data analytics tools, automation systems, and AI applications – at any stage or dimension of HTA frameworks, pro-

cesses, or system-level implementation at national, regional, or global levels.

For this review, *integration* refers to the systematic or routine usage, adoption, or incorporation of DTs into established HTA activities.

AI applications considered include conventional machine learning and deep learning, natural language processing (NLP), generative AI (e.g., large language models), and AI-driven automation applied within HTA contexts.

Exclusion criteria

Studies with any of the following characteristics will be excluded:

- Non-English language publications;
- Studies published outside the data range 2020–2025;
- Commentaries, editorials, policy briefs, and conference proceedings that do not report empirical data, relevant information, or structured frameworks will be excluded.

Although preliminary mapping efforts, such as the ISPOR report [6], have offered important insights into the use of AI and DTs in HTA, this review significantly expands on these works by providing a comprehensive, global synthesis that integrates both peer-reviewed and grey literature. By systematically capturing diverse initiatives, applications, tools, models, and use cases across multiple contexts (countries and regions), the review not only maps the landscape more extensively but also

identifies critical barriers and enablers. This approach delivers a unique and essential contribution, informing evidence-based strategies for the adoption, integration, and effective application of AI and DTs in HTA systems worldwide.

Standardizing the data

Standardizing, aligning, and validating the data in the context of this study refers to piloting of screening forms, reviewer training, or inter-rater reliability assessments.

Charting the data

A standardized data charting table will be used to electronically record relevant information from each included study, ensuring consistency and transparency in the extraction process. Study screening and data extraction will be conducted using Covidence™ software, enabling efficient collaboration and organization of review data. The data charting form will be piloted and refined as needed. The extracted data will include the following fields in Table 1.

Quality assessment tool

Given the heterogeneity of the study types expected, using a single assessment tool may be insufficient. The study will adopt the Joanna Briggs Institute (JBI) Critical Appraisal Tools, which are designed for multiple study designs and are well-accepted in evidence synthesis methodology.

Table 1 Data Charting

Domain	Data Elements
Bibliographic Details	Author(s), year, title, journal, citation
Study Design	Quantitative, qualitative, mixed-methods, review, case study
Context/Setting	Country, region, HTA agency/hospital, policy, regulatory, or clinical context
Objective	Main aim(s) or research question(s) of the study
AI Technology Type/Digital Solution	Machine learning, deep learning, large language models, natural language processing, digital platforms, etc
AI/Digital solution Use	Literature review automation, modeling, horizon scanning, decision support
HTA Function	Evidence synthesis, economic evaluation, effectiveness, ethics, decision support
AI Integration Level	Conceptual, development and validation stage, pilot, routine/system-wide use
Methods/Frameworks	other HTA/AI frameworks
Data Source	Electronic Health Records, registries, trials, real-world data, literature
Barriers/Facilitators	Technical data, regulatory, ethical, organizational, and transparency
Outcomes	Cost reduction in HTA processes, time-to-decision improvements, resource allocation efficiency, and quality of economic models
Ethics/Legal	Privacy, bias, accountability, governance, compliance
Gaps/Recommendations	Evidence gaps, methodological needs, standardization, and future research
Limitations	Limitations, if mentioned

Collating, summarizing, and reporting the results

To summarize the extracted data, a narrative report will be produced focusing on key domains, including study characteristics, types of AI and digital technologies applied, HTA functions addressed, levels of integration, and ethical and governance considerations. The results will be presented in relation to the research questions and the broader objectives of the review.

This synthesis of findings will discuss existing practices, integration models, facilitators, and barriers to the adoption and use of innovative digital technologies, including AI in HTA across various settings. Gap identification will indicate underrepresented regions, HTA domains, AI methodologies, and areas where evidence, implementation, capacity, or governance frameworks may remain lacking. This will serve to drive future research goals, policy development, and capacity building to enable effective digital transformation of HTA systems globally.

Discussion

The proposed scoping review constitutes the first comprehensive effort to systematically map the global landscape of digitization in HTA, examining the breadth of adoption, integration, and application of AI and DTs across diverse contexts. By synthesizing existing knowledge and practices, it catalogs current applications, identifies critical gaps, barriers, and enablers, and highlights emerging best practices, offering actionable insights for researchers, policymakers, and practitioners. The use of a rigorous, transparent, and reproducible protocol ensures methodological robustness, supports contextual adoption, integration, and application across diverse healthcare settings, and provides a structured framework to guide future research and implementation in this rapidly evolving field, addressing a significant gap in the literature. The rapid growth of AI and other digital health technologies, coupled with shifting health policy demands and rising complexity in health technologies, presents both significant opportunities and challenges for HTA worldwide. To date, the extent, nature, and implications of AI adoption, integration, digitization, and automation of HTA remain insufficiently explored and synthesized, despite growing momentum around digital innovation and AI integration. Addressing this gap is crucial, given the increasing reliance on digital tools to enhance HTA's efficiency, transparency, and decision-support capacity [5].

The study is positioned to contribute valuable evidence to the HTA field by providing a comprehensive knowledge base to inform the integration of digital solutions at local and global levels. Specifically, it aims to systematically map key digitization tools, AI applications, adoption models, and related barriers and enablers across HTA

functions, while evaluating their alignment with ethical, legal, and governance principles to inform actionable strategic recommendations. This foundational understanding will illuminate how digital innovations reshape HTA processes by systematically identifying and charting evidence on the (i) types of digital tools and innovations applied, including AI; (ii) HTA functions impacted; (iii) levels of adoption; and (iv) associated barriers, facilitators, and governance considerations. The inclusion of both peer-reviewed literature and relevant grey literature will further enhance the evidence base's comprehensiveness.

Methodological rigor is ensured through adherence to established scoping review frameworks and PRISMA-ScR reporting standards. Furthermore, the involvement of a multidisciplinary team and the use of dual independent screening, data extraction, and quality appraisal procedures will assist in mitigating bias and enhancing the validity of findings. This approach ensures robust, transparent, and reproducible synthesis.

Given the varying resource levels across regions, this review will also focus on the economic implications of adopting digital and AI tools for resource-constrained HTA agencies, particularly in middle-income countries or regions such as the Middle East and North Africa (MENA). The coexistence of high-income nations alongside low- and middle-income countries within this region, each facing various budgetary and infrastructure limitations, creates unique challenges to the widespread adoption and effective implementation of AI and digital health technologies within HTA frameworks. These economic gaps complicate efforts to leverage digital transformation in an equitable and sustainable manner [14].

Ultimately, this study's outcomes will serve as a catalyst for innovation, opening new avenues for developing advanced digital HTA platforms and systems. By providing an evidence-based overview of technologies and approaches used to digitize HTA, the review will help identify systemic barriers and enablers shaping AI adoption and guide strategies to optimize its benefits for decision-making. The findings will support policymakers, regulators, HTA agencies, practitioners, and AI developers in adopting digital technologies effectively and responsibly, while promoting greater transparency, consistency, and reproducibility in HTA. For healthcare organizations, the evidence can further enhance efficiency and enable timely access to high-quality assessments.

However, limitations exist. The potential exclusion of some regional or local studies due to the studies' focus on English-language publications may limit the comprehensiveness and inclusiveness of findings.

This approach also risks missing interesting and valuable experiences reported in other languages, potentially overlooking relevant insights and best practices that may not be captured in English-language literature. Additionally, older foundational work may be underrepresented or missed due to the concentration on literature from 2020; however, this timeframe was deliberately selected to capture the most current and relevant advancements reflecting recent technological advances.

Abbreviations

HTA	Health Technology Assessment
AI	Artificial Intelligence
DTs	Digital Technologies
JBI	Joanna Briggs Institute
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
WHO	World Health Organization
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
INAHTA	International Network of Agencies for Health Technology Assessment
OECD	Organization for Economic Co-operation and Development
EU	European Union
NLP	Natural Language Processing
MENA	Middle East and North Africa

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Authors' contribution

Mohammed Alkhalidi made a significant contribution to the conception, study design, project leadership, supervision, coordination, editing, review, and publication process. Malak Alrubaie took part in drafting the first version of the protocol. Rima Kachach, Malak Alrubaie, Wissam Ghach, Sara Al Dallal, Nuriya Musina, Shadi Albarqouni, Sulafa Ahmed, Dalia Dawoud, Abeer A. Al-Rabayah, Mouna Jameleddine, Ahmad Nader Fasseeh, and Sara Ahmed contributed to the conception, study design, and took part in revising the final protocol version. Andrea Quaiattini contributed to reviewing and advancing the search strategy. All authors gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Data availability

All generated or analyzed data during this study will be included in the published scoping review article.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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