BMJ Open

Capacity building for ethical use of artificial intelligence in health: protocol for a scoping review of training initiatives and gaps in Africa

Joseph Mwaka ,[1] Ronald Mulebeke,[2] Racheal Dedibo,[2] Jane Frank Nalubega,[3] Collins Ankunda,[2] Drake Musoki ,[4] Wandera Uthmaan Muluga ,[2] Jesca Nataliya,[2] Justine Kirabo,[3] Edrin Jjuuko,[4] Yvonne Karamagi,[5] Bella Imanzi,[6] Sylvia Nabukenya[7]

To cite: Mwaka J, Mulebeke R, Dedibo R, *et al*. Capacity building for ethical use of artificial intelligence in health: protocol for a scoping review of training initiatives and gaps in Africa. *BMJ Open* 2026;**16**:e111660. doi:10.1136/bmjopen-2025-111660

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2025-111660).

Received 30 September 2025
Accepted 11 March 2026

Check for updates

© Author(s) (or their employer(s)) 2026. 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
Dr Joseph Mwaka;
josemwaka02@gmail.com

ABSTRACT

Introduction Artificial intelligence (AI) is increasingly embedded in health systems, with applications spanning diagnostic imaging, clinical decision support, disease surveillance and health system planning. While international guidance frameworks outline principles for safe and ethical AI deployment, effective governance depends on the capacity of regulators, research ethics committees, policymakers, health technology assessment bodies and frontline health professionals to evaluate, supervise and implement AI tools in practice. Across African Union (AU) member states, training and capacity-building initiatives related to ethical AI use in health remain fragmented and unevenly documented. This scoping review aims to systematically map, characterise and synthesise evidence on training initiatives that support the ethical use and governance of AI in health across Africa.

Methods and analysis This scoping review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines and applies the Joanna Briggs Institute population–concept–context framework. We will search PubMed/MEDLINE, Scopus, Web of Science Core Collection, Embase, IEEE Xplore, SSRN and African Journals Online, alongside structured grey literature searches of African regional bodies (eg, AU, Africa Centers for Disease Control and Prevention, AUDA-NEPAD, WHO Regional Office for Africa), national regulatory authorities, ministries of health, professional councils and donor programme portals. Searches will cover 1 January 2015 to 31 December 2025 and will be limited to English-language materials. Eligible sources must describe identifiable training, education or capacity-building initiatives focused on ethical use and/or governance of AI in health, including software as a medical device and AI-enabled medical devices, delivered in or explicitly targeting at least one AU member state. Purely technical AI training without governance or clinical integration components will be excluded. Two reviewers will independently screen records and extract data. Findings will be synthesised using descriptive statistics and reflexive thematic analysis. Where feasible, stakeholder consultation will be undertaken to contextualise the results and refine the draft competency framework.

Ethics and dissemination The review will analyse publicly available documents and does not involve human participants; formal ethical approval is not required. Findings will be disseminated through a peer-reviewed open-access publication, a policy brief targeted at regional and national health governance stakeholders, and a public webinar. Search strategies, screening decisions and extraction tools will be deposited on the Open Science Framework (OSF) to enhance transparency.

Trial registration number https://osf.io/d2rcm/.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The review reporting will follow Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidance and applies a predefined Joanna Briggs Institute population–concept–context framework.
⇒ The search strategy includes multiple bibliographic databases and structured grey literature sources across African regional and national institutions.
⇒ Dual independent screening with planned inter-rater reliability assessment (Cohen's $\kappa \geq 0.70$) is incorporated into the protocol.
⇒ Restricting inclusion to English-language materials may exclude relevant initiatives reported in other official African Union languages.
⇒ As a scoping review, the study will map and characterise initiatives without formally assessing risk of bias or effectiveness.

INTRODUCTION

Artificial intelligence (AI) is increasingly embedded in health systems worldwide, with applications spanning diagnostic imaging, clinical decision support, disease surveillance, pharmacovigilance and health systems management.[1–3] In resource-constrained settings, AI has been proposed as a potential

catalyst for improving access, efficiency and quality of care, particularly where specialist workforces and diagnostic infrastructure are unevenly distributed.[1 2] In the African context, recent scholarship highlights both the transformative promise of AI for public health and the structural risks associated with poorly governed implementation.[2–4]

In this protocol, AI in health is operationally defined as computational systems that, on the basis of input data, generate outputs such as predictions, classifications, recommendations or decisions that may influence clinical, public health or administrative processes within health systems. This working definition captures both traditional rule-based systems and contemporary machine-learning approaches used in healthcare delivery and governance, and it provides a consistent basis for identifying training initiatives focused on ethical use and oversight across diverse settings.

While AI-enabled tools may enhance diagnostic reach and system responsiveness, their deployment introduces complex ethical, regulatory and governance challenges. Algorithmic systems may embed or amplify bias, obscure decision pathways, redistribute accountability between clinicians and developers, and create new risks related to data protection and cybersecurity if not appropriately governed.[5 6] Ethical principles alone are insufficient to guarantee trustworthy AI; operationalisation requires institutional capacity, technical literacy and enforceable governance mechanisms.[6] Governance must therefore extend beyond normative commitments to practical oversight infrastructures and professional competence.[5]

These governance challenges are particularly salient in the context of software as a medical device (SaMD) and AI-enabled medical devices (AIaMD), where oversight must extend across the full product lifecycle, including design, clinical evaluation, regulatory authorisation, deployment, postmarket surveillance and iterative updating.[7 8] Effective governance depends not only on the existence of regulatory frameworks but on the capacity of regulators, research ethics committees (RECs), health technology assessment (HTA) bodies, policymakers and frontline health professionals to interpret technical evidence and supervise implementation in real-world settings.[7]

Across African Union (AU) member states, capacity-building initiatives related to AI governance and ethical deployment are emerging but remain fragmented and unevenly documented. Existing literature describes expanding AI engagement across African health systems but does not systematically map who is being trained, in what competencies, through which modalities and with what institutional support.[2 3] Without consolidated evidence on training provision and competency coverage, regulatory and ethical frameworks risk remaining aspirational rather than operational.

This scoping review therefore aims to systematically map and characterise training initiatives that support the ethical use and governance of AI in health across Africa between 1 January 2015 and 31 December 2025. The review will examine target audiences, curriculum content, delivery modalities, accreditation status, assessment approaches, funding models, equity considerations and reported outcomes in order to identify patterns of provision and persistent gaps across AU member states. Findings will inform refinement of a draft competency framework for the ethical use and governance of AI in health (online supplemental appendix A).

Definitions and scope

AI in health: Computational systems, including machine-learning based approaches, that generate predictions, recommendations or decisions to inform clinical, public health or administrative processes within health systems.

Ethical use and governance: the design, evaluation, authorisation, deployment, monitoring and oversight of AI systems in accordance with principles of safety, effectiveness, transparency, accountability, privacy, equity and respect for human rights.

SaMD/AIaMD: software intended for one or more medical purposes that performs these functions without being part of a hardware medical device; AIaMD refers to SaMD incorporating machine-learning or other AI techniques.

Africa: the 55 AU member states. Cross-regional programmes are in scope if they have an explicit African delivery site or target audience.

Aim

To systematically map and synthesise training initiatives supporting ethical use and governance of AI in health across Africa.

Objectives

1. Identify and describe training initiatives, curricula and programmes aimed at strengthening capacity for ethical AI use and governance in health across Africa, including regulators, policymakers and frontline health professionals such as doctors, nurses and radiologists.
2. Analyse programme content, delivery modalities, funding sources, accreditation and continuing professional development (CPD) status, pedagogical approaches, assessment methods and competency domains across regulatory and clinical practice settings.
3. Assess reported outcomes, equity considerations, sustainability mechanisms and persistent gaps in training for diverse audiences, including oversight bodies and end users.
4. Inform the development of a draft competency framework and policy-relevant recommendations to guide future capacity-building initiatives across health systems.
5. Undertake stakeholder consultation, where feasible, to validate findings and refine the competency framework with input from regulators, REC chairs, ministries of health (MoH) digital units, HTA bodies and frontline clinical users of AI tools.

METHODS AND ANALYSIS

Review design and protocol

This scoping review will be reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines.[9]

A protocol was drafted and agreed on by the review team prior to screening and data extraction. The protocol was finalised before commencement of screening and data extraction and registered prospectively with the Open Science Framework (OSF) on 23 September 2025 (https://osf.io/d2rcm/). No study screening or data extraction had commenced at the time of journal submission.

The review aims to map and synthesise training initiatives supporting the ethical use and governance of AI in health across Africa, encompassing regulatory and oversight actors as well as frontline clinical users.

Eligibility criteria (population–concept–context)

Eligibility will be defined using the Joanna Briggs Institute population–concept–context framework for scoping reviews.[10] Eligible records must describe an identifiable training, education or capacity-building initiative related to ethical use and/or governance of AI in health and must be delivered in, or explicitly targeted to, at least one AU member state.

Population

We will include training initiatives targeting, or delivered by, the following groups:

- Regulatory and oversight actors: national medicines and medical devices regulators, data protection authorities, HTA units, RECs, institutional review boards, national ethics bodies and digital health units within MoH.
- Policy and system actors: policymakers, programme managers, procurement and health information system leaders, professional councils and implementers involved in adoption and governance of AI-enabled health technologies.
- Frontline clinical and public health users: clinicians (including doctors and clinical officers), nurses, midwives, radiologists/radiographers, laboratory professionals, pharmacists, public health practitioners and other health workers expected to use, supervise or interpret outputs from AI tools.
- Training providers and intermediaries: universities, professional associations, centres of excellence, regional bodies, donor programmes and non-governmental organisations that design or deliver training.

Programmes with mixed audiences (eg, regulators and clinicians) will be included, with audience-specific details extracted where reported. Initiatives solely targeting general audiences (eg, public AI literacy courses) will be excluded unless they explicitly focus on AI in health and include ethics or governance content.

Concept

The concept of interest is capacity building for the ethical use and governance of AI in health, including training relevant to SaMD and AIaMD across the product lifecycle (design, development, validation, authorisation, implementation, monitoring and updating).

We will include initiatives that meet the following criteria.

- The activity has an explicit educational or training intent (eg, curriculum, course, workshop, fellowship, mentorship, in-service training, regulatory sandbox training, certificate or CPD module, or training manual with defined learning objectives).
- The activity includes content related to ethical use and/or governance, including one or more of the following: transparency or explainability, accountability, fairness or equity, privacy and data governance, human rights, safety and effectiveness evaluation, regulatory pathways, clinical integration and supervision, postmarket surveillance or risk communication.
- Sufficient programme details are provided to enable extraction of at least two of the following: target audience, learning objectives or content scope, delivery modality or duration, provider or organiser, or assessment and evaluation approach.

We will exclude the following:

- Purely technical AI or machine-learning training (eg, coding and model development) without an explicit ethics, governance or clinical integration component.
- Vendor marketing materials that do not provide curriculum details or learning objectives.
- Opinion pieces or commentaries that do not describe a specific training initiative (although such sources may be used for citation chasing).

Context

We will include initiatives delivered in any AU member state across clinical, academic, regulatory and public health settings. Multicountry or global programmes will be included only if they report an African delivery site, African participants or an explicitly Africa-focused track.

Time frame and language

We will include records published between 1 January 2015 and 31 December 2025. Although AI methods were applied in health research prior to 2015, this period was selected because it coincides with sustained acceleration in the translation of deep learning techniques into clinical and health system applications, alongside increasing institutional and policy attention to digital health and AI governance. From approximately 2015 onwards, global health bodies and national regulators increasingly issued formal strategies, guidance and frameworks addressing digital health, data governance and AIaMD. This timeframe is therefore expected to capture the emergence and consolidation of structured training initiatives relevant to contemporary AI governance.

Inclusion will be limited to English-language materials due to feasibility constraints. This limitation will be acknowledged in the manuscript.

Types of evidence sources

We will include peer-reviewed publications and structured grey literature, such as policy briefs, curricula, training manuals, course webpages, evaluation reports, workshop programmes or agendas with learning objectives and institutional or donor reports.

We will exclude records that are not retrievable in full text, do not describe a training initiative or provide insufficient detail for extraction as defined above.

Information sources and search strategy

We will search the following bibliographic databases: PubMed/MEDLINE, Scopus, Web of Science Core Collection, Embase, IEEE Xplore, SSRN and African Journals Online.

Grey literature will be identified through structured searches of relevant institutional websites and repositories, including African regional bodies and technical agencies (eg, AU, Africa Centers for Disease Control and Prevention (CDC), AUDA-NEPAD, Smart Africa, WHO Regional Office for Africa), national regulators and ministries (medicines and medical devices regulators, data protection authorities, HTA units and MoH digital health units), professional councils and associations, and major donor and programme portals.

The search strategy will combine controlled vocabulary (where available) and free-text keywords across four core concepts:

1. AI and related terms (eg, machine learning).
2. Health and healthcare settings.
3. Ethics, governance, regulation and oversight (including SaMD/AIaMD where applicable).
4. Training and capacity building (eg, education, curriculum, CPD).

Geographical filtering will be implemented using a full list of AU member state names and regional descriptors. Searches will be limited to English-language materials and to the period 1 January 2015 to 31 December 2025.

The full reproducible database-specific search strategies, including exact search strings, field tags and applied limits for all databases and grey literature sources, are provided in online supplemental appendix B.

Study selection

All retrieved records will be imported into Zotero (V.6.0 or later; Corporation for Digital Scholarship, Vienna, Virginia, USA) for reference management and de-duplication prior to screening.

Title and abstract screening, followed by full-text screening, will be conducted independently by two reviewers using Covidence (Veritas Health Innovation, Melbourne, Australia).

An initial pilot screening of 50 records will be undertaken to refine the eligibility criteria and screening guide. Inter-rater reliability will be assessed using Cohen's κ. If Cohen's κ is <0.70, reviewers will meet to clarify inclusion and exclusion criteria and refine decision rules. The pilot process will be repeated until acceptable agreement (κ≥0.70) is achieved.

Discrepancies during both title/abstract and full-text screening will be resolved through discussion, with adjudication by a third reviewer where necessary. Reasons for exclusion at the full-text stage will be documented systematically.

The study selection process will be summarised using a PRISMA-ScR flow diagram.

Data charting and extraction

Data charting will be conducted iteratively, with refinement of the charting form during early stages of extraction. Two reviewers will independently extract data using a piloted extraction template, with disagreements resolved by consensus or third-reviewer arbitration.

Extracted variables will include bibliographic characteristics; country and setting; provider or organiser; funding source (where reported); target audience(s); accreditation or CPD status; delivery modality and pedagogy; duration or contact time where reported; curriculum content mapped to predefined competency domains; assessment and evaluation methods; reported outcomes; equity and accessibility features; sustainability mechanisms; and reported implementation barriers or enablers.

Data analysis and synthesis

Extracted data will be synthesised using descriptive and qualitative approaches. Descriptive statistics will summarise the distribution of initiatives by geography, target audience, delivery modality, provider type and competency domain. Visual summaries, including tables and heatmaps, will illustrate patterns in competency coverage across regions and professional groups.

Qualitative data will be analysed using reflexive thematic analysis to identify recurring barriers, enablers, equity considerations and sustainability mechanisms. Where data permit, a descriptive mapping of relationships between training providers, funders and beneficiary groups will be undertaken.

Consistent with scoping review methodology, risk of bias will not be formally assessed; however, completeness of reporting will be described narratively.

A draft competency framework, developed a priori as an analytical scaffold, is provided in online supplemental appendix A. The framework will be refined following evidence synthesis and stakeholder consultation.

Stakeholder consultation

Following completion of the evidence synthesis, and separate from the literature review component, we will undertake a structured stakeholder consultation to validate preliminary findings, identify additional training initiatives not captured in the published or grey literature, and refine the draft competency framework (online

supplemental appendix A). The consultation is intended to enhance contextual relevance, triangulate findings and identify implementation-sensitive considerations that may not be fully represented in documentary sources.

Subject to available resources, we aim to engage approximately 12–15 stakeholders drawn from key institutional roles relevant to AI governance and oversight in health. These may include national medicines and medical device regulators, REC chairs or administrators, MoH digital health or regulatory officials, HTA staff and frontline clinicians involved in the use, supervision or interpretation of AI-based health technologies.

Engagement will be conducted through short semi-structured interviews or, where feasible, a modified Delphi ('Delphi-lite') process designed to elicit structured feedback on identified competency domains, training gaps and implementation priorities. Recruitment will be purposive and guided by institutional function rather than demographic characteristics, reflecting the governance-focused objectives of the consultation.

Consultation notes will be synthesised using rapid content analysis, with attention to areas of convergence, divergence and practical implementation implications. Insights will inform refinement of the competency framework and interpretation of findings but will not alter the documented results of the literature synthesis.

Given the absence of dedicated project funding, the scope, depth and format of this consultation may be adjusted pragmatically while maintaining transparency regarding methodological decisions.

Data management and transparency

All search strategies, search logs, screening decisions and the final data charting codebook will be version-controlled and deposited in the OSF. The PRISMA-ScR flow diagram, a de-identified extraction dataset and analytic scripts used to generate descriptive summaries and figures will be made publicly available under a permissive licence to support transparency and reproducibility.

Patient and public involvement

None.

ETHICS AND DISSEMINATION

This study involves the analysis of publicly available documents and does not constitute human subjects' research. In accordance with institutional and national research ethics guidelines, formal ethical approval was not required.

The work is being conducted under the institutional stewardship of the Mildmay Research Centre Uganda, which hosts the Mildmay Uganda REC (MUREC), an accredited REC (UG-013) operating under the Uganda National Council for Science and Technology. Although REC review was not required for this scoping review, the committee may be contacted for institutional verification or governance-related inquiries at murec@mildmay.or.ug.

Results will be disseminated through a peer-reviewed open-access publication, an executive policy brief targeted at regional and national health governance stakeholders (including AUDA-NEPAD, Africa CDC and WHO Regional Office for Africa), and a public webinar, subject to resource availability. Findings from the scoping review will inform refinement of a draft competency framework for ethical AI use in health. The preliminary draft framework is provided as online supplemental appendix A and will be refined following evidence synthesis and stakeholder consultation.

Author affiliations
[1]Research Centre Uganda, Kampala, Uganda
[2]Research, Mildmay Uganda, Kampala, Central Region, Uganda
[3]Mildmay Institute of Health Science, Mildmay Uganda, Kampala, Central Region, Uganda
[4]Mildmay Hospital, Mildmay Uganda, Kampala, Central Region, Uganda
[5]Mildmay Uganda Group, Mildmay Uganda, Kampala, Central Region, Uganda
[6]Laboratory Science, Mbarara University of Science and Technology, Mbarara, Western Region, Uganda
[7]Public Health, Makerere University CHS, Kampala, Central Region, Uganda

Contributors JM conceived the review and led the framing and drafting of the protocol. RM contributed to conceptual development and institutional positioning. RD, JFN, CA, DM, WUM, JN, JK, EJ, YK and BI contributed substantive practice-based input from Mildmay Uganda REC operations and institutional governance processes. SN provided technical oversight on bioethics and regulatory alignment, refined the structure and verified consistency with national and international guidance. All authors critically revised the manuscript for important intellectual content and approved the final version. JM is the guarantor of the work. AI tools (Microsoft Copilot and ChatGPT) were used to improve grammar, clarity and readability and to support submission preparation. No AI was used to generate scientific content, undertake data extraction or perform analysis. All substantive methodological decisions and all future screening, extraction and synthesis will be conducted by the authors.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

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.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

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: https://creativecommons.org/licenses/by-nc/4.0/.

ORCID iDs
Joseph Mwaka https://orcid.org/0000-0002-7223-0679
Drake Musoki https://orcid.org/0009-0006-9558-0061
Wandera Uthmaan Muluga https://orcid.org/0009-0002-9011-4038

REFERENCES

1 Wahl B, Cossy-Gantner A, Germann S, *et al*. Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings? *BMJ Glob Health* 2018;3:e000798.
2 Tanui CK, Ndembi N, Kebede Y, *et al*. Artificial intelligence to transform public health in Africa. *Lancet Infect Dis* 2024;24:S1473-3099(24)00435-3.
3 Gwagwa A, Kraemer-Mbula E, Rizk N, *et al*. Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions. *AJIC* 2020;26:1–28.
4 Ismail O, Ahmad N. Ethical and Governance Frameworks for Artificial Intelligence: A Systematic Literature Review. *Int J Interact Mob Technol* 2025;19:121–36.
5 Owoyemi A, Owoyemi J, Osiyemi A, *et al*. Artificial Intelligence for Healthcare in Africa. *Front Digit Health* 2020;2:6.
6 Floridi L, Cowls J, Beltrametti M, *et al*. AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. *Minds & Machines* 2018;28:689–707.
7 Ebad SA, Alhashmi A, Amara M, *et al*. Artificial Intelligence-Based Software as a Medical Device (AI-SaMD): A Systematic Review. *Healthcare (Basel)* 2025;13:817.
8 Gilbert S, Fenech M, Hirsch M, *et al*. Algorithm Change Protocols in the Regulation of Adaptive Machine Learning-Based Medical Devices. *J Med Internet Res* 2021;23:e30545.
9 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.
10 Peters MDJ, Godfrey C, McInerney P, *et al*. Chapter 11: scoping reviews. In: Aromataris E, Lockwood C, eds. *JBI manual for evidence synthesis*. JBI, 2020.