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Scoping Review Protocol: Artificial Intelligence in Critical Care Education

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We use this protocol and it's working

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Keywords: Artificial intelligence, critical care education, intensive care, medical education, predictive analytics, clinical decision support, machine learning, ai applications in critical care education, artificial intelligence in critical care education introduction, critical care education introduction, challenges unique to intensive care training setting, critical care setting, intensive care training setting, ai, ai application, artificial intelligence, predictive analytics training, scoping review, scoping review protocol, icu scenario, healthcare provider, stakeholder consultation integrated throughout the process, predictive analytic, education, educational effectiveness, methodology, review protocol

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Abstract

Introduction: Critical care settings produce complex data that necessitates quick, accurate decisions in high-stress situations. In critical care education, artificial intelligence (AI) helps train healthcare providers to analyze detailed monitoring data, forecast patient decline, and improve workflow. AI-based teaching tools include decision support systems, predictive analytics training, and simulation environments that mimic ICU scenarios.

Purpose: This scoping review systematically investigates AI applications in critical care education, assesses their educational effectiveness, and explores implementation strategies and challenges unique to intensive care training settings.

Method: A scoping review will be conducted following the Arksey and O'Malley framework and JBI methodology. It will include studies published in English from 2020 to 2025 that focus on AI applications in critical care education. The literature search will encompass medical, educational, and technological databases, with stakeholder consultation integrated throughout the process.

Image Attribution

Created by Laila Bihmidine (LelleDesigns) for the NeuroInk initiative

Guidelines

- PRISMA Extension for Scoping Reviews (PRISMA-ScR) Checklist
- JBI Guide for Scoping Review
- Arksey and O'Malley Scoping Review Framework

Materials

Computers, Internet Connection, MS Word, MS Excel, Reference Manager (Mendeley/EndNote/Zotero), Covidence (optional)

Safety warnings

 There are no specific safety warnings for this protocol.

Ethics statement

This study is a scoping review of published and publicly available literature and does not involve the collection of primary data from human participants. As such, it does not require ethics approval according to our institution's guidelines. All data sources will be appropriately cited and acknowledged.

If the consultation phase with subject-matter experts is planned to inform the interpretation. In such cases, ethical approval will be obtained from the relevant institutional review board before data collection.

Objectives

- 1 Catalogue AI applications used for teaching, assessment, or curriculum management in Critical Care education.
- 2 Describe educational outcomes, implementation contexts, and learner populations.
- 3 Identify evidence gaps and priority areas for future research.

Review Questions

- 4 Types of AI technologies employed in Critical Care education
 - 4.1 What artificial intelligence applications are currently implemented in critical care medical education and training programs?
- 5 Competencies or outcomes targeted
 - 5.1 How do AI-enhanced educational tools improve clinical decision-making competencies in critical care settings?
- 6 Evidence regarding effectiveness, feasibility, and acceptability
 - 6.1
 - What educational outcomes, assessment methods, and effectiveness measures are reported for AI applications in critical care education?
 - What implementation barriers, facilitators, and strategies affect AI integration in critical care educational programs?
 - 6.2 Secondary research questions:
 - How do AI applications address competency-based education requirements in critical care training?
 - What ethical considerations emerge when implementing AI in high-stakes critical care education?
 - How do AI educational tools prepare learners for AI-assisted clinical practice in critical care?

Methodology Overview

7 Step 1: Protocol Registration

- 7.1 The research team develops and registers this protocol on protocols.io and submits it to the appropriate international registries for systematic review protocols.

8 Step 2: Stakeholder Consultation

- 8.1 Participants: Undergraduate, postgraduate, or continuing Critical Care learners.

- 8.2
- Medical students in critical care rotations
 - Critical care medicine residents and fellows
 - Intensive care nursing students and trainees
 - Practicing critical care physicians in continuing education
 - Critical care educators and faculty

- 8.3 Concept: AI-enabled educational tools (e.g., ML algorithms, intelligent tutoring, predictive analytics).

- 8.4 AI applications in critical care education, including:
- Predictive analytics training for patient deterioration
 - Intelligent clinical decision support system education
 - AI-powered simulation for critical care scenarios
 - Machine learning applications for sepsis recognition training
 - Natural language processing for clinical documentation
 - Computer vision for monitoring equipment interpretation
 - AI-assisted case-based learning systems
 - Intelligent tutoring for critical care protocols

- 8.5 Context: Any learning environment or modality.

- 8.6
- Intensive care units and critical care training environments
 - Medical schools with critical care curricula
 - Critical care residency and fellowship programs
 - Simulation centers specializing in critical care training
 - Continuing medical education programs

- 8.7 Exclusions: Purely clinical AI without educational focus; non-English abstracts prior to 2015.
- 9 Databases: MEDLINE, EMBASE, CINAHL, IEEE Xplore, Web of Science, and ERIC. Grey literature via ProQuest Dissertations, conference proceedings, and protocols.io.
- 10 PRESS-peer-reviewed strategy combining AI terms ("artificial intelligence", "machine learning", "deep learning") with education and Critical Care MeSH headings. Example MEDLINE syntax provided in step 10.1.
- 10.1 (("artificial intelligence"[MeSH Terms] OR "machine learning"[MeSH Terms] OR "artificial intelligence"[Title/Abstract] OR "machine learning"[Title/Abstract] OR "deep learning"[Title/Abstract] OR "predictive analytics"[Title/Abstract] OR "clinical decision support"[Title/Abstract] OR "AI"[Title/Abstract] OR "ML"[Title/Abstract])
AND
("critical care"[MeSH Terms] OR "intensive care"[MeSH Terms] OR "critical care"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract] OR "MICU"[Title/Abstract] OR "SICU"[Title/Abstract] OR "critical illness"[Title/Abstract])
AND
("education, medical"[MeSH Terms] OR "curriculum"[MeSH Terms] OR "medical education"[Title/Abstract] OR "training"[Title/Abstract] OR "curriculum"[Title/Abstract] OR "simulation"[Title/Abstract] OR "learning"[Title/Abstract] OR "competency"[Title/Abstract] OR "skill development"[Title/Abstract]))
Filters: Publication date 2020-2025, English language
- 10.2 Adapted search strategies for:
- EMBASE
 - CINAHL
 - IEEE Xplore Digital Library
 - Web of Science
 - ERIC (Education Resources Information Center)
- 11 Dual independent screening in Covidence with kappa ≥ 0.8 . Conflicts resolved by a third reviewer. Record reasons for exclusion at full-text stage.
- 11.1 Inclusion criteria:
- Studies examining AI applications in critical care education
 - Educational interventions using AI in intensive care training
 - Studies reporting learning outcomes from AI implementation
 - Implementation and evaluation studies of AI in critical care education
- Exclusion criteria:
- Clinical AI studies without educational focus

- Non-English publications
- Opinion pieces without empirical data
- Studies published before 2020

12 Use a REDCap form with compulsory fields for study, population, AI taxonomy, instructional design framework, outcomes (Kirkpatrick levels 1-4), and implementation details. Pilot on 5 studies.

12.1 **Study characteristics:**

- Citation and methodological details
- Setting (ICU type, institution, country)
- Participant characteristics and sample size
- Study design and duration

AI technology specifications:

- Type of AI system (machine learning, neural networks, etc.)
- Specific critical care application
- Integration with clinical systems
- Technical requirements and infrastructure

Educational intervention details:

- Target competencies and learning objectives
- Training duration and format
- Assessment methods and metrics
- Curriculum integration approach

Outcomes and effectiveness:

- Clinical decision-making improvements
- Knowledge acquisition and retention
- Skill development measures
- Learner satisfaction and engagement
- Patient care impact indicators

Implementation factors:

- Adoption facilitators and barriers
- Faculty training requirements
- Cost-effectiveness considerations
- Sustainability factors

13 If $\geq 30\%$ of included studies are experimental, apply MERSQI or ROBINS-I as appropriate. Not a mandatory scoping review element but increases interpretability.

14 Narrative synthesis supplemented by visual evidence maps showing AI categories versus educational outcomes. Identify clusters and gaps.

14.1 Analysis approach:

- Descriptive analysis of study characteristics
- Thematic synthesis of implementation experiences



- Mapping of AI applications across critical care education domains
- Evidence synthesis on educational effectiveness

15 Prepare PRISMA-ScR flow diagram, submit manuscripts to specialty education journals, and deposit dataset and code on GitHub under CC-BY 4.0.

15.1 Reporting format:

- Structured tables summarizing key findings
- Visual maps of AI technology applications
- Narrative synthesis addressing research questions
- Identification of research gaps and future directions

Timeline

16 Month 1: Registration & stakeholder meeting

17 Months 2-3: Search execution & import

18 Months 4-5: Screening

19 Months 6-7: Data extraction

20 Month 8: Synthesis workshop

21 Month 9: Draft manuscript

22 Month 10: Peer review & protocols.io publication

Quality Assurance Locks

23 Locks embedded at Steps 1, 2, 5, 6, 7, and 10 require dual-reviewer sign-off to proceed.

Protocol references

Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*. 2005;8(1):19-32.

Peters MDJ, Godfrey C, McInerney P, et al. Chapter 11: Scoping Reviews. In: Aromataris E, Munn Z (Editors). *JB I Manual for Evidence Synthesis*, JBI, 2020.

Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473.