



Integrating Climate and Planetary Health into Medical Education in Iran: A Scoping Review and Comparative Synthesis of International Evidence

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Abstract

Background: Climate change and environmental degradation are major health determinants requiring reform in medical education. This study mapped evidence on integrating climate and planetary health into undergraduate medical curricula and compared Iran with international developments to identify context-specific strategies for localization and improvement.

Materials and Methods: This scoping review examined integration of climate change and planetary health into undergraduate medical curricula. PubMed, Scopus, Web of Science, and ERIC were searched through April 2026, alongside grey literature from WHO, AMEE, and GCCHE. Two independent reviewers screened records and extracted data. Findings were synthesized using descriptive-thematic analysis and compared to identify implementation barriers and contextual strategies relevant to Iran.

Results: International evidence indicates a relatively mature educational landscape for climate and planetary health, grounded in competency-based models that prioritize climate literacy, systems thinking, environmental justice, advocacy, and the delivery of sustainable healthcare. Integration commonly spans both preclinical and clinical phases of training, promotes interprofessional learning, and is reinforced through structured assessment strategies and longitudinal curricular threads. In contrast, Iranian medical education remains at an early developmental stage. Although student awareness and academic initiatives are increasing, substantial gaps persist, including the absence of a national competency framework, fragmented curricular content, limited faculty preparedness, and a lack of standardized evaluation. Given Iran's high vulnerability to climate-related health risks, embedding climate and planetary health concepts into existing courses represents a pragmatic and scalable approach.

Conclusion: Integrating climate and planetary health into Iranian medical education is essential for strengthening health system resilience. A phased, context-sensitive approach—encompassing competency definition, targeted faculty development, and longitudinal curriculum integration—can accelerate national progress in this critical educational domain.

Key Words: Climate change; Planetary Health; Medical Education; Curriculum; Scoping review.

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1- INTRODUCTION

Climate change and the degradation of natural systems are increasingly recognized as fundamental threats to human health, health equity, and the resilience of healthcare systems (1, 2). These changes impose a substantial burden on public health by increasing heat-related morbidity and mortality, exacerbating respiratory and cardiovascular diseases, altering infectious disease patterns, affecting mental health, and disrupting food, water, and healthcare infrastructure (1, 3). In this context, the concept of “planetary health” provides a conceptual framework to explain the interdependence between human health and natural systems; as the 2015 Rockefeller Foundation–Lancet Commission emphasized, the health of human civilization depends on the state of natural systems (2).

In response, medical education in many countries has moved beyond the limited scope of “environmental health” toward a systematic integration of climate health, planetary health, and sustainable healthcare (4, 5). Future physicians are expected not only to understand the scientific basis of climate–health impacts but also to apply this knowledge to clinical decision-making, patient communication, advocacy for vulnerable populations, policy engagement, and the promotion of healthcare sustainability (4). However, evidence indicates that the integration of this field into medical curricula remains heterogeneous, with significant variation across countries and institutions in core competencies, pedagogical approaches, assessment methods, and faculty development (5, 6).

This issue holds particular importance for Iran. The country faces multiple environmental and climatic challenges, including rising temperatures, heatwaves, air pollution, water scarcity, dust storms, and food insecurity—all of which pose

direct and indirect risks to population health and healthcare system performance (3, 7). Despite this, published evidence on the structured integration of climate and planetary health into Iran’s medical curriculum appears limited. While limited literature does not necessarily imply an absence of educational activities—as initiatives may exist through localized academic projects or non-indexed events (8)—a realistic assessment of Iran’s status requires an examination of international literature, competency frameworks, and consensus documents alongside local evidence.

Accordingly, this scoping review was conducted to map the extent and nature of existing evidence on integrating climate and planetary health into medical education. By identifying international frameworks, approaches, and gaps, this study aims to provide an overview of the status in Iran and to offer insights for addressing knowledge gaps, setting national priorities, and proposing practical pathways for medical curriculum reform (9–11).

The aim of this scoping review is to map existing evidence on integrating climate and planetary health into medical education, with a focus on situating Iran within evolving international frameworks and practices. It examines global competencies, curricular models, and pedagogical approaches, alongside the current status, opportunities, and gaps in Iranian medical education. The review also seeks to generate context-specific implications to support the development and effective integration of these concepts into the Iranian medical curriculum.

2- MATERIALS AND METHODS

2-1. Study design

This study was conducted as a scoping review to map the breadth, nature, and characteristics of existing evidence

regarding the integration of climate change, climate health, and planetary health concepts into medical education. Given the emerging nature of this field and its conceptual and methodological heterogeneity, a scoping review was deemed the most appropriate approach to identify patterns, pedagogical strategies, and knowledge-to-practice gaps, particularly with respect to the Iranian context (9, 10).

2-2. Search Strategy

A systematic search was conducted across PubMed/MEDLINE, Scopus, Web of Science Core Collection, and ERIC. Additionally, grey literature was identified through searches of relevant organizational websites, including the World Health Organization (WHO), Association for Medical Education in Europe (AMEE),

and the Global Consortium on Climate and Health Education (GCCHE). The search covered literature published up to April 2026.

The search strategy was structured around three conceptual clusters: 1) climate change, climate health, and planetary health; 2) medical education; and 3) curriculum, competencies, and educational processes. To ensure comprehensiveness, a combination of free-text terms and controlled vocabulary (e.g., MeSH) was employed. While the conceptual logic remained consistent, the syntax and search fields were adapted to the technical requirements of each database. Geographic terms, such as “Iran” and “Eastern Mediterranean,” were included to capture regional evidence. A sample search strategy for PubMed is provided in **Table 1**.

Table -1: PubMed search strategy for identifying studies on climate and planetary health in medical education.

Concept	Keywords / Search terms	Field
Climate and planetary health	"climate change" OR "climate crisis" OR "climate health" OR "planetary health" OR "environmental sustainability" OR "sustainable healthcare"	Title/Abstract
Medical education	"medical education" OR "medical curriculum" OR "medical student*" OR "undergraduate medical education" OR "graduate medical education" OR "continuing medical education"	Title/Abstract
Educational processes/outcomes	"curriculum" OR "competenc*" OR "teaching" OR "learning" OR "assessment" OR "evaluation"	Title/Abstract

2-3. Eligibility Criteria

Studies were included if they:

- Directly addressed climate change, climate health, planetary health, or sustainable healthcare within medical education;
- Focused on undergraduate, postgraduate/specialized, or continuing professional medical education;
- Consisted of empirical studies, review articles, curriculum reports, competency

frameworks, consensus statements, policy documents, or institutional reports;

- Were available in full text and published in English or Persian.

Editorials, letters, news items, and texts lacking sufficient educational content, as well as studies focusing solely on health outcomes without educational relevance or those targeting non-medical disciplines, were excluded.

2-4. Study Selection

Records were imported into EndNote (version 21.0), and duplicates were removed. Selection proceeded in two stages: title/abstract screening followed by full-text review. Both stages were performed independently by two reviewers, with discrepancies resolved through discussion or, if necessary, consultation with a third reviewer.

2-5. Data Extraction

Data were extracted using a structured, investigator-developed form (10). The form captured study characteristics corresponding to the domains presented in **Table 2**, including conceptual orientation, competency frameworks, curricular integration patterns, teaching methods, assessment strategies, learner perspectives, implementation barriers and facilitators, and overarching interpretations. For the Iranian context, data were extracted through a targeted review of local literature and institutional documents, focusing on relevance and current educational status (8, 10).

2-6. Data Synthesis

Extracted data were synthesized using a descriptive–thematic approach (10, 11). Findings were organized into the key domains presented in **Table 2** (conceptual orientation, competency frameworks, curricular integration, teaching methods, assessment and evaluation, learner perspectives, barriers, facilitators, and overall interpretation). Subsequently, a qualitative comparative analysis was performed to map international evidence against the Iranian educational context, thereby identifying existing gaps and opportunities for contextualization (10, 11).

2-7. Methodological Rigor

Consistent with scoping review methodology, formal critical appraisal of study quality was not performed as an inclusion criterion. However, the

methodological characteristics of primary studies and the credibility of institutional documents were considered during the interpretation of findings (9, 10).

2-8. Ethical Considerations

Because this was a literature-based study that analyzed published articles and other publicly available documents, no primary data were collected from human participants and institutional review board or ethics committee approval was not required. All sources cited are publicly accessible, and any identifying details drawn from case reports or media accounts were treated with caution and included only as necessary for analysis to protect privacy. The research adhered to applicable ethical guidelines for secondary research and scholarly reporting.

3- RESULTS

This scoping review identified a steadily expanding body of literature indicating that climate and planetary health education has gained increasing recognition within health professions education, particularly in undergraduate medical training. Internationally, the field appears to be transitioning from conceptual justification toward more structured curricular design, competency-based frameworks, and emerging evaluation strategies. In contrast, the Iranian literature remains limited and reflects an earlier developmental stage, characterized primarily by contextual urgency, student awareness, and fragmented institutional attention rather than documented curricular integration. **Table 2** summarizes the principal domains identified in the reviewed studies and their implications for curriculum development in Iran.

3-1. International trends in climate and planetary health education

The international literature consistently positions climate change and planetary

health as core determinants of health rather than peripheral environmental concerns. Foundational reports and consensus-driven publications have established the conceptual basis for this shift by framing climate change, ecological degradation, and sustainability as major drivers of current and future health outcomes (1–4). Notably, the Rockefeller Foundation–Lancet Commission defined planetary health as a systems-oriented discipline linking human health to the integrity of natural systems (2), while the AMEE Consensus Statement translated this perspective into a concrete educational agenda for health professions training (4).

More recent evidence suggests that this conceptual foundation is increasingly being operationalized within medical curricula. Scoping and synthesis reviews consistently highlight key competency domains, including climate and ecological literacy, systems thinking, environmental justice, advocacy, interdisciplinary collaboration, and sustainable healthcare practice (12–16). These studies further emphasize that effective curriculum design favors longitudinal integration across preclinical, clinical, and community-based phases rather than isolated or elective teaching formats (12–15). Although implementation remains heterogeneous, the overall trajectory indicates increasing curricular coherence and professionalization.

The literature also reflects growing methodological sophistication in educational design. Active and applied pedagogical approaches—such as case-based learning, experiential education, interprofessional training, and socially accountable teaching models—are frequently reported (12–15). Concurrently, the field is progressing beyond calls for inclusion toward structured evaluation. For instance, Rosen et al. introduced the Climate Health Curriculum Tool (CHCT) as a practical framework for assessing the

extent of climate-health integration in undergraduate medical curricula (16), marking a shift from advocacy to measurable implementation.

Learner expectations and disciplinary expansion further reinforce this trend. Final-year medical students report expecting more comprehensive preparation in climate change and planetary health, reflecting its perceived relevance to future clinical practice (17). Interprofessional education has also been identified as a key approach for planetary health training (18). Moreover, climate-health education is increasingly extending into specialty-specific contexts, indicating expansion beyond general curricular discourse into more targeted professional training (19).

3-2. Current status, gaps, and opportunities in Iran

In comparison, the Iranian literature remains limited and does not demonstrate the presence of a systematically integrated undergraduate medical curriculum in climate or planetary health. Existing studies instead describe an emerging field in which environmental and climate-related health challenges are highly relevant, yet insufficiently translated into structured educational frameworks. As summarized in **Table 2**, the primary distinction lies not in the recognized importance of the topic, but in the extent to which this importance has been operationalized into competencies, curricula, and assessment strategies.

This gap is particularly significant given Iran's substantial environmental health burden. The country faces interconnected challenges—including air pollution, dust storms, water scarcity, ecological instability, and heat-related risks—all of which have direct implications for population health and health system resilience (1, 3, 7). Evidence from southeastern Iran illustrates how environmental hazards such as dust storms

contribute not only to physical morbidity but also to broader social vulnerability (7). These conditions underscore that climate and planetary health education is not merely desirable, but essential for contextually relevant medical training.

Available educational evidence further suggests that student awareness may be emerging ahead of institutional reform. Heydari et al. reported that medical students recognize climate change as a health-related issue, yet demonstrate important gaps in knowledge, understanding, and educational exposure (20). This pattern indicates that current deficiencies are less attributable to learner disengagement than to insufficient curricular opportunities. At the institutional level, initiatives such as the International Conference on Planetary Health Education in Nursing and Midwifery hosted by Tehran University of Medical Sciences reflect increasing academic visibility (8); however, these efforts appear to represent early agenda-setting rather than sustained curricular implementation.

3-3. Implications for contextualized curriculum development

Collectively, the findings suggest that curriculum development in Iran should prioritize contextual adaptation rather than direct replication of international models. Global evidence consistently supports competency-based design, longitudinal integration, interprofessional education,

and alignment between training and real-world health challenges (4, 12–18). In the Iranian context, this implies that curricula should be explicitly linked to nationally relevant issues such as dust storms, air pollution, water scarcity, heat exposure, ecological disruption, and health system preparedness.

Integration within existing courses may represent a more feasible initial strategy than introducing stand-alone modules. Embedding climate and planetary health content across disciplines—including public health, community medicine, environmental health, internal medicine, pediatrics, emergency medicine, and primary care—would enable more sustainable implementation. This approach aligns with the international shift toward longitudinal, distributed learning rather than isolated or elective instruction (12–16).

Finally, the literature indicates that effective curriculum development requires more than content inclusion; it depends on clearly defined competencies, faculty development, and robust assessment strategies. Internationally, there is a growing emphasis on curriculum mapping and structured evaluation (14, 16). Accordingly, a critical next step for Iran would be the development of a localized competency framework that integrates global standards with national priorities. Without such a framework, educational efforts are likely to remain fragmented and difficult to evaluate.

Table-2: Analytical summary of climate and planetary health education and relevance to Iran.

Domain	International evidence	Iranian context / relevance to Iran	References
Conceptual orientation	Climate and planetary health are increasingly framed as core determinants of health and as legitimate components of professional medical education rather than optional environmental topics.	The conceptual rationale for inclusion is strong in Iran because environmental change already affects population health; however, this rationale has not yet been consistently translated into undergraduate curricular policy.	(1–4, 7)

Domain	International evidence	Iranian context / relevance to Iran	References
Competency frameworks	Recurrent competency areas include climate literacy, systems thinking, environmental justice, advocacy, interdisciplinary collaboration, and sustainable healthcare.	No well-documented national or institutionally embedded competency framework for undergraduate medical education was identified in the Iranian literature.	(4, 12–16, 20)
Curricular integration	International literature favors longitudinal integration across preclinical, clinical, and community settings over stand-alone or isolated sessions.	In Iran, integration into existing courses and clerkships is likely to be more feasible than launching a separate course in the early phases of reform.	(4, 12–16)
Teaching methods	Commonly recommended approaches include case-based teaching, experiential learning, interprofessional education, and community-oriented instruction.	These approaches could be localized by linking teaching to dust storms, air pollution, water scarcity, heat-related illness, and health system preparedness.	(12–15, 18, 20)
Assessment and evaluation	The field is increasingly incorporating curriculum mapping and structured evaluation, including tools such as the CHCT.	Clear evidence of standardized assessment of climate- and planetary health-related learning outcomes in Iranian undergraduate medical curricula is currently lacking.	(14, 16)
Learner perspectives	Students increasingly expect meaningful education on climate-health issues and view them as relevant to future practice.	Iranian students also appear to recognize the relevance of climate change to health, but report insufficient educational exposure and preparedness.	(17, 20)
Barriers to implementation	Frequently reported barriers include limited curriculum time, lack of trained faculty, conceptual inconsistency, and weak institutional support.	Similar barriers are likely in Iran, particularly given the absence of formal curricular frameworks and limited published evidence of faculty development in this area.	(4, 12–16, 20)
Enablers and future directions	Institutional leadership, student engagement, interprofessional collaboration, and competency-based planning support successful implementation.	Emerging academic attention in Iran may provide a starting point for reform if followed by institutional commitment, curriculum design, and faculty support.	(8, 16–18, 20)
Overall interpretation	Internationally, the field has entered a more mature implementation-oriented phase, although unevenness persists across institutions and countries.	In Iran, climate and planetary health education remains at an early developmental stage, with a substantial gap between environmental urgency and formal educational response.	(1–4, 7, 8, 12–20)

4- DISCUSSION

4-1. Principal findings

This scoping review shows a clear divergence between the international

evolution of climate and planetary health education and its current status in Iran. Internationally, the field has progressed from conceptual advocacy to more structured educational planning, including

competency-oriented curriculum design, longitudinal integration, active teaching strategies, and early forms of formal evaluation (4, 12–18). In Iran, by contrast, the literature suggests that although the health relevance of climate and environmental change is considerable, the educational response remains limited, fragmented, and insufficiently institutionalized (7, 8, 20).

One of the central findings of this review is that the main problem in Iran is not lack of justification for climate-health education, but lack of educational translation. In other words, the environmental and public health relevance of climate change is already evident, yet this urgency has not been systematically converted into curricular structures, learning outcomes, faculty preparation, or assessment strategies. This distinction is important because it shifts the discussion from whether climate and planetary health should be taught to how they can be integrated effectively and contextually within undergraduate medical education.

4-2. Comparison with the literature

The present findings are consistent with broader international literature indicating that climate and planetary health are increasingly recognized as essential educational priorities in medicine and health professions education (1–4). Previous work has emphasized that future physicians must be prepared not only to understand climate-related disease burdens, but also to respond to the social, ecological, and ethical dimensions of environmental change (4–6). The studies reviewed here support that perspective and further show that educational models are becoming more structured, with emphasis on competencies, system-based understanding, and practical application (12–16).

At the same time, the review confirms that progress internationally remains uneven.

Even in settings where climate-health content has entered curricula, implementation is not always comprehensive or standardized (14, 15). This suggests that Iran is not alone in facing barriers such as limited faculty expertise, curricular overload, and conceptual ambiguity. However, the difference is that many international institutions have already moved from recognition to experimentation and structured implementation, whereas the Iranian literature still provides little evidence of such transition (12–16).

Another important point of comparison concerns evaluation. The emergence of tools such as the Climate Health Curriculum Tool (CHCT) indicates that some educational systems are beginning to treat climate-health integration as something that can be mapped, reviewed, and improved through measurable processes (16). This is a significant marker of curricular maturity. The apparent absence of comparable assessment frameworks in Iran therefore reflects not only a practical gap, but also a developmental gap in how the educational problem itself is being framed.

4-3. Implications for undergraduate medical education in Iran

The findings of this review suggest several implications for curriculum development in Iran. First, climate and planetary health should be approached as cross-cutting themes that can be integrated into existing curricular structures rather than necessarily introduced as a stand-alone course. Such an approach would likely be more feasible within crowded medical curricula and would align with international evidence favoring longitudinal and distributed integration (12–16). Public health, environmental health, community medicine, internal medicine, pediatrics, emergency medicine, and primary care offer particularly relevant entry points.

Second, curriculum development in Iran should be grounded in a localized competency framework. Although international literature offers useful guidance, direct transplantation of external models would likely be less effective than adaptation to national conditions. In the Iranian context, competencies should explicitly address climate-sensitive disease patterns, dust storms, air pollution, water scarcity, heat-related illness, vulnerability assessment, risk communication, prevention, and health system resilience (3, 7, 20). A national or institutionally endorsed framework could also help unify content, teaching expectations, and assessment practices across medical schools.

Third, faculty development is likely to be essential. One of the recurrent barriers identified in international studies is insufficient educator preparedness (4, 12–16). This challenge may be even more pronounced in Iran, where formal climate-health education has not yet been widely established. Without investment in faculty capacity, curriculum reform risks remaining rhetorical or fragmented.

Fourth, student engagement may represent an important enabling factor. Both international and Iranian evidence suggest that learners increasingly recognize the relevance of climate and planetary health to future practice (17, 20). This creates an opportunity for bottom-up support of educational reform, particularly if student interest is matched by institutional leadership and curriculum planning.

4-4. Strengths and limitations

This review has several strengths. It synthesizes both international and Iranian literature in order to situate the national educational context within a broader global trajectory. It also moves beyond simple description by comparing domains such as competencies, teaching methods, barriers, and assessment, thereby

identifying practical implications for future curriculum development. In addition, the review is timely, given the increasing salience of climate-related health threats and the corresponding need for educational preparedness.

Several limitations should also be acknowledged. First, the Iranian literature in this field remains limited, which restricts the extent to which firm conclusions can be drawn about national curricular practices. Second, as a scoping review, the purpose was to map the breadth and characteristics of the literature rather than formally assess study quality or estimate effectiveness (9–11). Third, some of the international literature reflects diverse educational settings and health professions contexts, which may limit direct comparability (12–16). Finally, because the field is evolving rapidly, additional initiatives or curriculum developments may emerge after the review period.

5- CONCLUSION

Climate and planetary health education has entered a more mature and implementation-oriented phase internationally, with increasing emphasis on competency frameworks, longitudinal integration, interprofessional learning, and curriculum evaluation. In Iran, however, the field remains at an earlier stage, characterized by strong contextual relevance but limited evidence of systematic integration into undergraduate medical education.

The key challenge is therefore not establishing the importance of the topic, but developing a coherent educational response to it. Future progress in Iran will likely depend on three interrelated steps: development of a localized competency framework, longitudinal integration of climate and planetary health across existing medical courses and clerkships, and creation of faculty development and

assessment strategies that support sustainable implementation. Bridging the gap between environmental urgency and medical education is essential if future physicians are to be adequately prepared for the health consequences of climate and ecological change.

6- AUTHORS' CONTRIBUTIONS

Study conception or design: RV, MS; Data analyzing and draft manuscript preparation: SM, FB, and KS; Critical revision of the paper: MS; Supervision of the research: RV and MS; Final approval of the version to be published: RV, FB, SM, KS, and MS.

7- CONFLICT OF INTEREST: None.

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