Heat, lactation, and the medical curriculum: a global call to teach the health costs of a warming world

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Abstract

Extreme heat is rapidly becoming a routine clinical stressor that influences presentation patterns, health system capacity, and health inequities worldwide. Yet many medical curricula still treat climate-related health as peripheral, leaving trainees underprepared to recognize and prevent heat-associated harms. This commentary argues that health care in pregnancy and lactation should be taught as core climate-health content because they represent universal, high-stakes physiologic windows where anticipatory guidance and timely clinical action can reduce morbidity for both mother and infant. Drawing on physiologic principles and an expanding body of observational and synthesis evidence, the article highlights how real-world heat exposure interacts with pregnancy thermoregulation, cardiovascular and fluid demands, and fetal vulnerability, particularly in settings marked by humidity, exertion, limited shade, and constrained access to safe water and cooling. It further emphasizes that lactation and early infant feeding are climate-relevant clinical domains: heat can destabilize postpartum routines, heighten dehydration risk, and amplify misinformation, including persistent advice to supplement exclusively breastfed infants with water despite lack of supportive evidence. The commentary proposes a feasible, competency-based blueprint for curricular integration across pre-clinical teaching, clinical skills training, and clerkships, coupled with assessment strategies such as case-based exams and OSCEs. A final focus is global equity, calling for co-developed, locally adaptable teaching that aligns clinical practice with high heat preparedness and public health systems.

Keywords: Extreme heat, lactation, pregnancy, medical education, climate health, heat preparedness

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Introduction

Extreme heat is no longer a seasonal inconvenience. It is an increasingly routine physiologic stressor, one that shapes clinical presentations, disrupts health systems, and widens health inequities. The Intergovernmental Panel on Climate Change (IPCC) has concluded with high confidence that human influence has warmed the planet´s climate system and that hot extremes are becoming more frequent and intense in many regions.[1]

Medical education has not kept pace with this reality. Climate change is often treated as a "special topic," disconnected from core physiology and bedside decision-making. Yet heat exposure already contributes to avoidable illness and death, including cardiovascular decompensation, kidney injury, mental health crises, and occupational harms, while straining emergency response and inpatient capacity.[2] Many curricula overlook the intersections of climate change, heat stress, and human lactation, and the need to take these relationships seriously as medical education priorities.

This commentary argues for a specific, global curricular imperative: Given escalating heat exposure globally, medical schools have a responsibility to train future clinicians to understand, and mitigate, the physiological and public health consequences of heat stress in pregnancy and lactation. These life stages are universal, clinically consequential, and deeply connected to intergenerational health. They also sit at the junction of individual care and population-level prevention, where clinicians can reduce risk through anticipatory guidance, targeted screening, and systems-based advocacy, or allow preventable harms to accumulate through omission.

Why pregnancy and lactation belong in "core" climate–health teaching

Pregnancy and lactation are not niche topics restricted to obstetrics and pediatrics. They are encountered in emergency medicine, family medicine, internal medicine, psychiatry, and public health. They also demand exactly the kind of integrative reasoning that climate–health education should sharpen: physiology linked to social and structural determinants of risk.

Pregnancy modifies thermoregulation in ways that can become clinically relevant during heat exposure. Cardiovascular and volume changes, shifts in skin blood flow, and altered sweating responses influence heat exchange and internal temperature control. A scoping review of thermoregulatory responses in pregnancy synthesized evidence that evaporative and dry heat loss responses change across gestation and highlights persistent concern about maternal hyperthermia as a potentially teratogenic exposure.[3] Controlled studies often reassure that healthy pregnant individuals can avoid dangerous core temperature elevations under supervised conditions. But heat-related harm in real life frequently emerges from conditions that lab protocols rarely replicate: prolonged exertion, high humidity, limited shade, restricted access to safe water, and constrained ability to rest or cool.

Field evidence is increasingly important here because it connects heat exposure to plausible physiologic pathways of harm. In an observational cohort study of pregnant subsistence farmers in The Gambia, higher environmental heat stress and maternal heat strain were associated with markers of fetal strain, strengthening the biological plausibility of heat-related obstetric risk.[4] At the same time, epidemiologic evidence has grown. A recent systematic review and meta-analysis in *Nature Medicine* synthesized a large body of data linking heat exposure with adverse maternal, fetal, and neonatal outcomes.[5] The clinical implication is straightforward: heat exposure in pregnancy is not speculative. It is a foreseeable risk factor that clinicians should recognize and address.

Lactation is similarly inseparable from climate conditions, yet it is rarely framed as climate-relevant physiology in medical curricula. Exclusive chestfeeding for the first six months is a widely endorsed global recommendation because of its benefits for infant health and survival.[6] Importantly, in hot environments, especially where water quality is compromised and diarrheal risk rises, chestfeeding can be protective precisely because it reduces reliance on unsafe water sources. Still, heat can create barriers: maternal dehydration and fatigue, reduced privacy in crowded cooling spaces, disruptions to routines during heatwaves, and increased household labor when infrastructure fails.

The evidence base on heat and infant feeding is smaller than for pregnancy outcomes, but it is already clinically instructive. A prospective cohort study of postpartum women in Burkina Faso examined how high ambient temperatures relate to infant feeding practices, emphasizing that climate stressors can destabilize early postpartum routines and decisions.[7] A systematic review of hot-weather impacts on infant feeding practices in low- and middle-income countries found no evidence that exclusively breastfed infants under six months require supplemental water in hot conditions, while also documenting persistent advice and cultural pressure to provide water or other fluids; practices that may increase exposure to unsafe water and undermine exclusive breastfeeding.[8] These are not abstract questions: they are daily counseling moments for clinicians, and the counseling is high-stakes.

The clinical triad that curricula rarely teach: heat, hydration, and human milk

Clinicians equate ‘heat’ with temperature, but heat stress is a composite shaped by temperature, humidity, radiant load, clothing, exertion, and acclimatization; humidity blunts evaporative heat loss. Occupational guidance uses wet-bulb globe temperature (WBGT), which better estimates physiologic strain than air temperature alone.[9]

For education, the practical takeaway is not that every student must calculate WBGT in clinic. Rather, students should understand why a humid 32°C day may be more dangerous than a dry 38°C day, why exertion amplifies risk, and why “just drink water” is often an inadequate plan when the problem is structural (work demands, housing quality, transportation barriers, power outages, water insecurity).

In pregnancy, heat stress intersects with cardiovascular workload and fluid balance in ways that plausibly affect placental perfusion. In lactation, fluid balance is equally central. Evidence from the Amazon, for example, suggests lactating individuals in hot-humid, water-limited contexts can face substantially higher risk of dehydration than non-lactating individuals.[10] Even when dehydration does not immediately reduce milk volume in well-resourced settings, it can meaningfully affect maternal wellbeing, feeding frequency, and vulnerability to heat illness; mechanisms that clinicians should recognize and anticipate.

Heat also intersects with misinformation and culturally reinforced practices. When healthcare workers advise water supplementation for very young infants during hot weather, despite the lack of evidence that exclusively breastfed infants require it, well-intentioned counseling

can inadvertently increase infection risk and erode chestfeeding.[2,8] This is a curriculum problem: clinicians counsel according to what they were taught and assessed on.

Medical schools should treat this as a competency problem

If clinicians are to protect pregnant and lactating patients from heat-related harms, they need more than awareness. They need competencies: risk stratification, counseling, recognition of heat illness, and coordination with public health resources.

Encouragingly, climate–health education infrastructure is expanding. The Global Consortium on Climate and Health Education (GCCHE) has developed a "knowledge bank" and curricular resources intended for broad adaptation across health professions schools.[17] The Association of American Medical Colleges has curated educational resources to support integration of climate change and health into training.[13] Competency and framework synthesis work is also emerging; for example, a scoping review in *The Journal of Climate Change and Health* highlights the need for more standardized climate and planetary health competencies across medical education systems.[14]

Yet even where climate content is increasing, pregnancy and lactation are often "mentioned" rather than taught as skill-based, assessable clinical content. That omission matters because these are time-sensitive windows. Counseling delayed is counseling denied. A clinician who can explain why exclusive chestfeeding remains recommended during hot weather, and can help families plan feeding frequency, maternal hydration, and safe cooling, offers more than reassurance: they offer measurable risk reduction. Likewise, clinicians trained to ask about heat exposure and working conditions during prenatal care, recognize early heat illness, and help patients access occupational protections or social supports can prevent downstream complications.

A practical blueprint for global medical curricula

1) Pre-clinical integration: physiology with climate context

Thermoregulation belongs in physiology; it should explicitly connect to pregnancy, postpartum physiology, and lactation. Students should learn:

- mechanisms of heat production and dissipation, and why humidity changes risk;
- physiologic adaptations in pregnancy that influence heat tolerance; and
- foundational concepts of heat illness prevention and recognition.

Evidence from pregnancy thermoregulation reviews and real-world field studies can anchor these lessons in clinical relevance.[3,4]

2) Clinical skills: counseling and risk stratification as core competencies

Heat counseling should be taught in the same way as smoking cessation or contraception counseling: structured, practiced, and assessed. Students should be able to identify high-risk patients, including those who are pregnant, postpartum, or lactating; those with comorbidities; those with occupational heat exposure; and those lacking cooling or safe water, then provide actionable guidance on hydration strategies, cooling plans, timing of outdoor work, and recognition of early heat illness, and counsel on infant feeding in hot weather using evidence-based messaging that protects exclusive breastfeeding while avoiding unsafe water supplementation.[2,8] Clinician-oriented guidance can serve as a teaching scaffold; for example, the CDC's clinical heat overview emphasizes practical counseling and patient heat action planning, and although health systems differ globally, this core structure of anticipation, counseling, early recognition, and clear escalation criteria translates across settings.[15]

3) Clerkship embedding: make heat exposure a routine part of history-taking

In obstetrics and family medicine clerkships, students should routinely document heat exposure and heat-mitigating resources such as cooling access, work conditions, and recent heatwaves alongside other social determinants of health, including housing and food security, and they should learn how heat can plausibly contribute to dehydration, syncope, worsening edema, preterm symptoms, and fetal stress, with appropriate responses in both clinic and triage settings.[5] In pediatrics, students should be trained to explain clearly that breast milk provides sufficient water for infants under six months even in hot climates, while learning to address culturally common supplementation practices respectfully and safely.[2,8]

4) Public health and health systems: heat as preparedness and equity work

Heat-related harms are predictable and often preventable through coordinated interventions such as heat–health action plans and early warning systems.[2] Medical students should understand how clinicians interface with these systems: referral to cooling centers, coordination with social services, occupational protections, and consistent community messaging. They should also be

taught to recognize inequitable heat exposure: urban heat islands, precarious labor, overcrowded housing, and water insecurity, and to understand why "individual behavior change" is an insufficient solution to structural heat risk.

5) Assessment and accountability: if it's taught it will be assessed

Climate–heat competence should be explicitly assessed. Schools can implement OSCE stations focused on prenatal counseling during a heatwave, postpartum lactation support in extreme heat, and evaluation of heat illness in pregnancy; incorporate case-based exams that integrate heat exposure into differential diagnosis and management; and support quality-improvement projects aligned with local heat preparedness efforts. Institutional accountability can be strengthened through tools such as the Planetary Health Report Card, which evaluates planetary health content and broader institutional engagement.[16]

What "global" requires

A global call must confront an uncomfortable truth: the highest heat exposures and the greatest constraints on adaptation often occur where medical schools have fewer resources, not more. Severe risks arise where air conditioning is scarce, outdoor labor is unavoidable, water is unsafe, and health systems are under-resourced. Yet curricular innovation is often led by institutions in high-income settings. If medical education is serious about equity, climate–heat–lactation teaching must be co-created with partners in the Global South, using locally relevant cases and feasible interventions. Resource-sharing networks can support this. GCCHE and similar repositories offer learning objectives and teaching materials intended for adaptation rather than one-size-fits-all export.[17] The goal is not curricular uniformity, but competency consistency: regardless of country, graduates should be able to recognize heat-related risk, counsel effectively, and connect clinical practice to public health preparedness.

Conclusion

Climate change is altering the clinical landscape faster than most medical curricula are adapting. Heat stress represents one of the clearest, most immediate, and most preventable pathways through which a warming world harms human health. Pregnancy and lactation are high-stakes physiologic windows in which timely, evidence-informed clinical guidance can rapidly translate into meaningful protection or, if absent or inconsistent, into missed opportunities for prevention. Medical schools worldwide should therefore commit to graduating physicians who can explain the physiology of heat stress in pregnancy and postpartum states, recognize and manage heat-related illness, counsel families confidently on chestfeeding in hot weather without undermining exclusive chestfeeding, and connect individual clinical care to broader public health preparedness and equity-oriented adaptation. This is not enrichment content; it is a modern expression of medicine's core mandate to anticipate predictable threats, protect the vulnerable, and prevent avoidable harm.

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