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SHORT COMMUNICATION

The physician as a catalyst: Reimagining medical education for an AI era

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ABSTRACT

Current medical education is caught in a paradox: it aims to train compassionate patient advocates yet its structure often fosters compliance and burnout, ill-equipping physicians to challenge the systemic drivers of poor health. The rapid integration of artificial intelligence (AI) into clinical practice is automating the cognitive-diagnostic tasks that have long defined physician training, from pattern recognition to data synthesis. This shift presents a specific, time-limited opportunity: rather than simply adopting AI as an efficiency tool within the existing transactional model, medical education can use this moment to fundamentally reimagine the physician's role and the training that shapes it. This requires moving beyond traditional competency-based models to embrace a pedagogy of advocacy, grounded in critical consciousness and systems-level thinking. By transforming curricula to address structural determinants of health, reassessing how we evaluate competence, and creating protected space for advocacy, we can train a new generation of physicians prepared not only to treat disease but to partner in transforming the systems that perpetuate it, through a phased approach aligned with AI maturity in clinical practice.

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Introduction

Medical education is facing a profound crisis of purpose. For decades, a persistent paradox has defined our training systems: we espouse the importance of patient advocacy while the 'hidden curriculum' of medical training socializes physicians-in-training into roles as 'cogs in the wheel' of a complex, often dysfunctional, healthcare system [1]. This dissonance between stated objectives and lived experience contributes significantly to professional burnout. Burnout should be understood not merely as a workforce issue but as an educational outcome: the predictable result of training systems that teach compassion in theory while rewarding compliance in practice [2]. This crisis is now compounded by the rapid integration of artificial intelligence (AI) into clinical practice. If medical schools adopt AI primarily as an efficiency tool within the current transactional model, the technology will accelerate productivity demands on trainees without addressing the structural conditions that produce burnout and inequity. Conversely, as AI automates cognitive-diagnostic tasks that currently dominate training, from pattern recognition to differential generation, it creates discretionary capacity that could be deliberately redirected toward advocacy, structural competency, and systems-level thinking. The central question is no longer *if* AI will change medicine, but *how* we will adapt our educational models in response. We propose that this moment invites more than incremental updates to an outdated curriculum; it offers a rare opportunity to resolve the paradox of physician training. However, this shift is not about ideological indoctrination but about evidence-based adaptation. By educating physicians to be agents of systemic change, we can bridge the gap between clinical reality and health outcomes, acknowledging that true health equity requires navigating complex political and social landscapes.

The hidden curriculum and structural barriers to catalysis

The formal curriculum of medical school—the lectures, clinical rotations, and examinations—is only part of a physician's education. The hidden

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curriculum, comprising the implicit values, norms, and power structures within the medical environment, arguably plays a more powerful role in professional identity formation [3]. This unstated curriculum often teaches deference to hierarchy, acceptance of systemic inefficiencies, and an individualistic approach to patient problems, thereby reinforcing compliance over advocacy. Trainees learn to navigate broken systems rather than challenge them, and the intense pressure to master vast amounts of clinical information leaves little room for engaging with the social and political contexts of health [4]. Furthermore, we must candidly acknowledge that structural advocacy will often conflict with institutional interests. The efficiency models that drive hospital margins are frequently at odds with the time-intensive work of addressing root causes, placing the physician-advocate in a precarious position between their employer's financial imperatives and their patient's long-term health. The gap between learning to advocate for an individual patient's insurance coverage and developing the skills to dismantle the policies that create such barriers remains vast.

Burnout, in this context, is a predictable consequence of moral injury, arising from the knowledge that one is complicit in a system that often fails to provide equitable care [5].

Addressing the hidden curriculum within medical training is crucial for fostering a socially responsible and ethically engaged workforce that prioritizes patient-centered care and community well-being. By shedding light on implicit values and biases, healthcare professionals can better understand the interconnectedness of humanity and the importance of holistic care. This awareness is essential for ensuring that these values are also integrated into the development and implementation of AI technologies in healthcare. Medical education must emphasize ethical, patient-centric principles in parallel with technological training. Curricula should teach trainees to view patient health as interconnected across physical, emotional, and environmental dimensions, fostering a healthcare system capable of recognizing and addressing systemic bias.

Integrating catalysis into medical education theory

Traditional educational frameworks, such as competency-based medical education and patient-centered care, are necessary but insufficient for preparing physicians to address the root causes of illness. To cultivate physician-catalysts, we must integrate principles from critical pedagogy and transformative learning theories. Drawing from the work of educators like Paulo Freire, medical education should foster 'critical consciousness'—the ability to perceive and challenge social, political, and economic oppression as it manifests in health [6]. The catalyst education approach distinguishes between leadership education, which trains individuals to manage and improve existing systems, and catalyst education, which equips them with the tools to fundamentally transform those systems (Figure 1). Crucially, the structural competency model rejects physician exceptionalism. Physicians are not the sole architects of health system transformation but must function as members of broader coalitions, following the lead of nurses, social workers, and community health workers who have long championed this work. Adopting a framework of 'structural competency' would require training physicians to recognize and respond to health outcomes as the downstream results of upstream policy decisions, institutional structures, and societal values (Figure 2) [7]. Critics may argue this approach risks a 'structural bypass'—focusing on upstream factors while neglecting the acute downstream pathologies patients present with today. However, treating this as a zero-sum game is shortsighted. Evidence suggests that upstream investment eventually reduces the downstream burden on acute care systems [8,9]. The more we address the root causes, the less we will be forced to manage their catastrophic end-stages.

A critical dimension of this educational transformation concerns AI bias. Clinical AI systems trained on non-representative datasets will encode existing health disparities into automated recommendations, potentially widening outcome gaps for communities already underserved by research infrastructure [10]. Physicians must therefore develop 'algorithmic literacy': the ability to critically evaluate AI outputs for representational bias, just as they are trained to assess the external validity of clinical trials. This competency requires understanding how factors such as cohort composition, geographic sampling, and the exclusion of social and environmental variables shape the predictions AI tools generate. Medical curricula must integrate this literacy alongside traditional evidence-based medicine skills, ensuring that the next generation of clinicians can interrogate, contextualize, and when necessary override automated clinical recommendations.

AI as a forcing function for educational reform

The integration of AI into medicine makes this educational evolution an urgent necessity. AI will automate many of the cognitive tasks that currently dominate medical training and practice, from

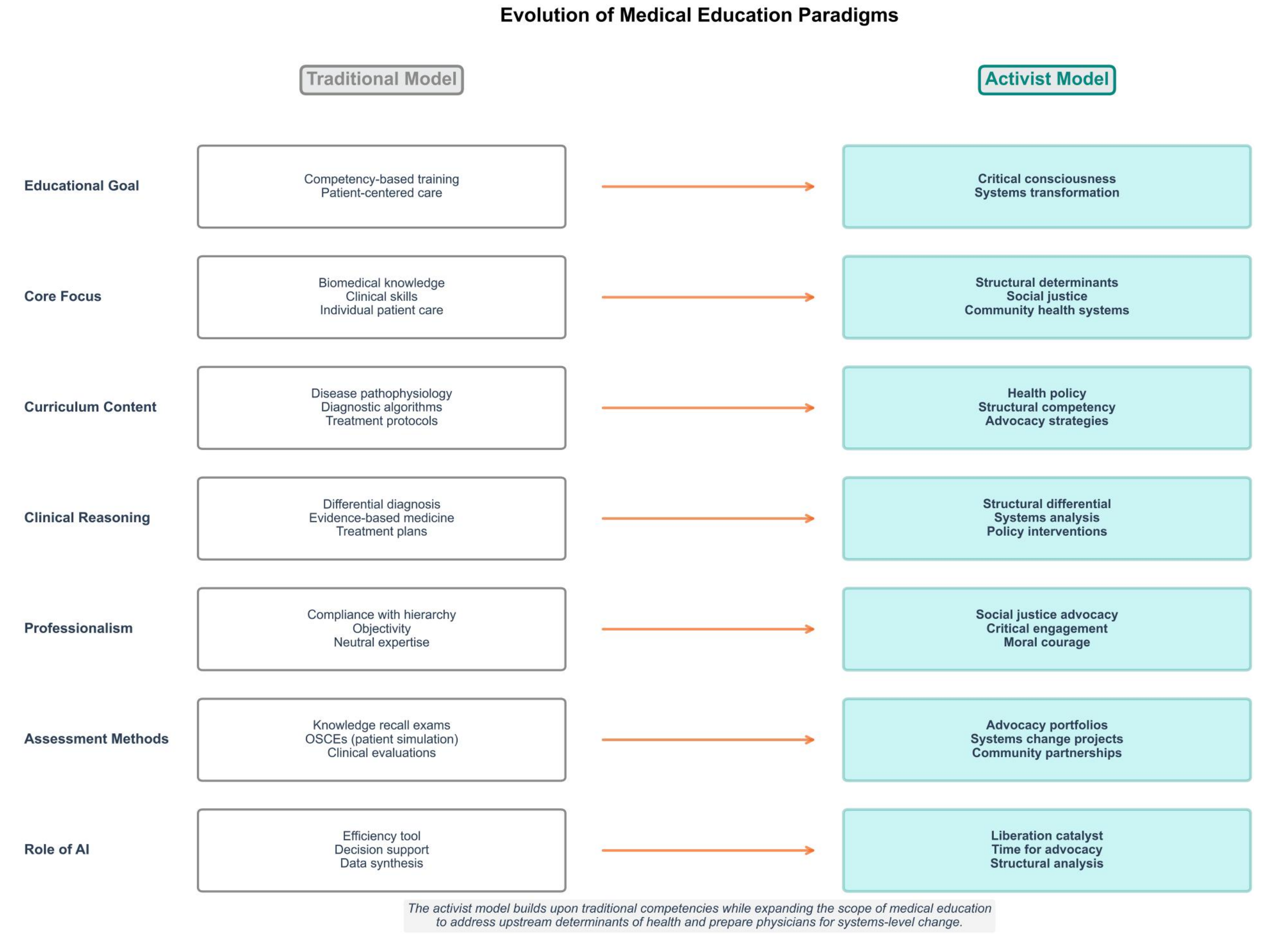

Figure 1. Evolution of medical education paradigms comparison of traditional and activist models of medical education. The traditional model emphasizes competency-based training and patient-centered care with focus on biomedical knowledge, clinical skills, and individual patient management through knowledge recall exams and OSCEs. In contrast, the activist model prioritizes critical consciousness and systems transformation, expanding the scope to address structural determinants of health, social justice, and community health systems. Assessment methods evolve from individual patient simulations to advocacy portfolios and systems change projects, while AI's role shifts from an efficiency tool to a liberation catalyst that enables physicians to focus on advocacy, structural analysis, and systemic interventions. This framework demonstrates how the activist model builds upon traditional competencies while fundamentally expanding the physician's role from clinician to agent of change.

diagnostic imaging interpretation to synthesizing patient data [11]. The risk is that medical schools will simply adopt AI as another tool to enhance efficiency in a transactional model of care, further devaluing the humanistic elements of medicine. The opportunity is to use AI as a deliberate catalyst for role transformation, through a three-part mechanism. First, AI automates the cognitive-diagnostic tasks that currently consume the majority of physician training time, including pattern recognition, data synthesis, and differential generation [12]. Second, this automation creates discretionary capacity in both training schedules and clinical practice. Third, that capacity can be deliberately redirected toward structural competency, advocacy, and systems-level thinking, but only if educational institutions explicitly design curricula to capture it rather than allowing it to be absorbed by increased patient volume [13]. This redirection must also preserve and elevate the humanistic elements that AI cannot replicate, including relational care, cultural safety, and the integration of Traditional Ecological Knowledge into clinical practice. Notably, AI development is proceeding unevenly across medical specialties, risking the amplification of existing disparities in fields where automated tools are less available. Recent randomized trials of ambient AI listening tools have demonstrated their potential to reduce documentation time and administrative burden [14–16]. However, we must temper this optimism with caution [16]. There is a tangible risk that these efficiency gains will be immediately absorbed by increased productivity expectations—more patients per hour—rather than liberated time for advocacy. For AI to serve as a catalyst, we must explicitly guard against it becoming a tool that simply accelerates the hamster wheel. Medical education must be restructured to build these skills, ensuring that AI serves humanistic goals rather than reinforcing a mechanistic view of medicine.

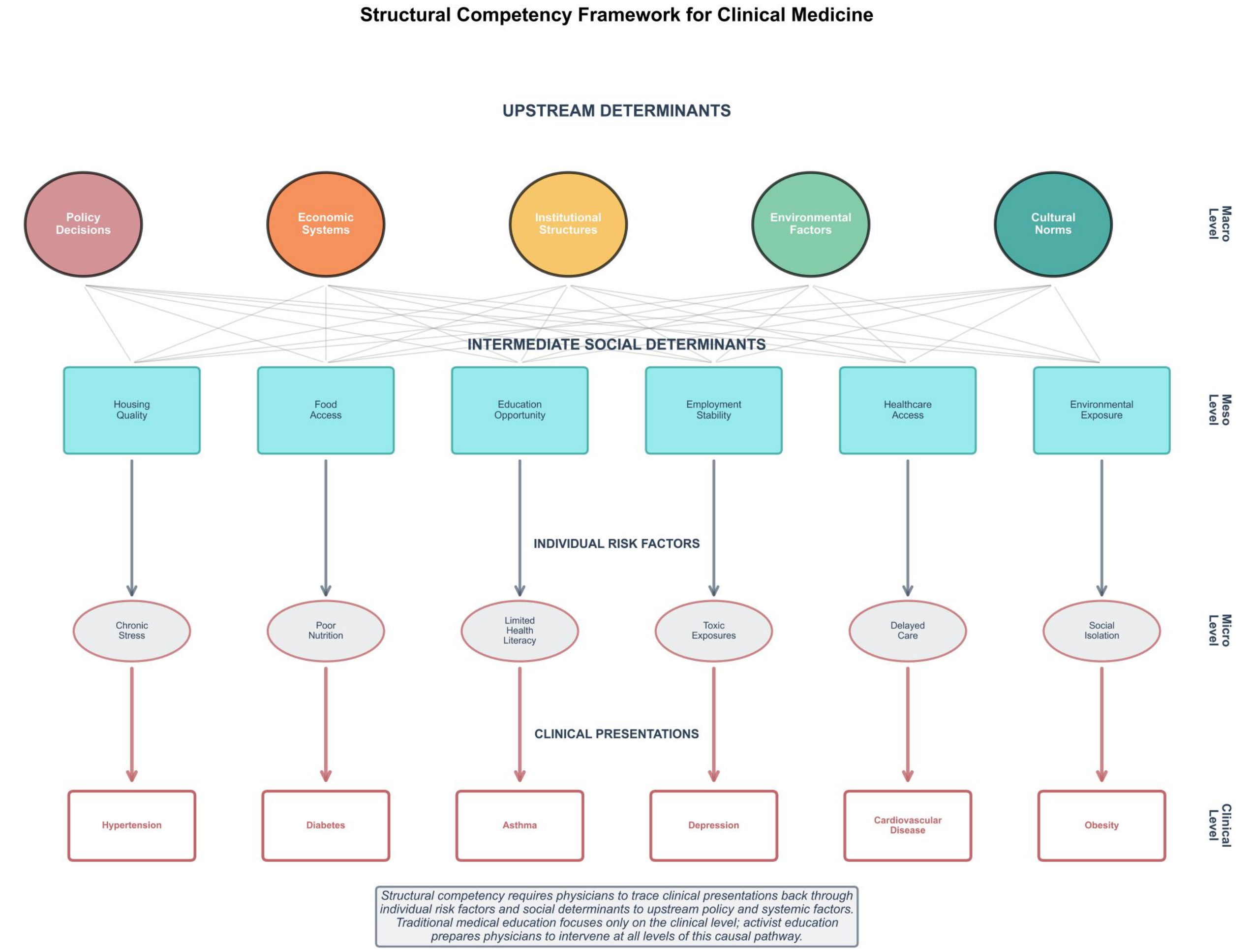

Figure 2. Structural competency framework for clinical medicine causal pathway linking upstream determinants to clinical presentations. This framework illustrates how clinical presentations (hypertension, diabetes, asthma, depression, cardiovascular disease, obesity) result from a cascade of structural factors operating at multiple levels. Upstream determinants at the macro level—including policy decisions, economic systems, institutional structures, environmental factors, and cultural norms—shape intermediate social determinants such as housing quality, food access, education opportunity, employment stability, healthcare access, and environmental exposure. These social determinants in turn influence individual risk factors including chronic stress, poor nutrition, limited health literacy, toxic exposures, delayed care, and social isolation. Structural competency requires physicians to trace clinical presentations back through this causal pathway to identify and address upstream policy and systemic factors, moving beyond traditional medical education's focus solely on the clinical level. This approach distinguishes catalyst education from leadership education by equipping physicians with tools to fundamentally transform systems rather than merely manage them.

A practical framework for catalyst medical education

Operationalizing the structural competency framework described above requires concrete curricular changes organized around four pillars. First, we must abandon outdated concepts of 'professionalism' that are often used to enforce compliance and silence dissent. Drawing on implementation science, we recognize that educational reform is prone to failure without faculty buy-in and structural support [17]. Therefore, these changes must be iterative and supported by robust faculty development. Instead, professionalism should be redefined to include a responsibility to advocate for social justice and health equity [18]. Second, clinical reasoning must be expanded to include systems thinking. Trainees should learn to formulate a 'structural differential diagnosis' for a patient's condition, considering how factors like housing policy, racism, or environmental exposures contribute to their presentation. Third, medical schools and residency programs must create formal, protected spaces for catalysis within the curriculum. This could include requirements for cross-disciplinary coursework in health policy, planetary health, or indigenous health, as well as longitudinal partnerships with community-based organizations [19]. AI diagnostic tools that rely solely on biomarker and biometric data risk treating pathology in isolation from its structural origins. Consider intergenerational trauma among Indigenous communities: epigenetic modifications driven by historical dispossession and cultural disruption elevate risk for metabolic and psychiatric conditions across generations [20]. An AI system trained without these contextual variables will misattribute risk and recommend interventions that ignore root causes. A catalyst curriculum would train physicians to recognize such structural origins and advocate for interventions that address them, integrating Traditional Ecological Knowledge and community-defined health frameworks alongside biomedical evidence. Current AI systems cannot model the experiential dimensions of illness. In palliative care, for example, a patient's spiritual beliefs, sense of time, and grief fundamentally shape treatment preferences in ways that no algorithm trained on biomarker data can capture. This limitation underscores why the catalyst curriculum must preserve protected space for humanistic training even as AI assumes greater diagnostic responsibility.

These reforms need not be implemented simultaneously; rather, they should be phased to align with AI maturity in clinical practice. In the near term, as ambient AI scribes and documentation tools reduce administrative burden, institutions can introduce algorithmic literacy modules and protect the freed time for advocacy training rather than increased patient volume [21]. Over the next three to five years, as AI provides increasingly autonomous diagnostic support across specialties [22], curricula can expand structural differential diagnosis training and cross-disciplinary coursework, leveraging the reduced cognitive workload on pattern-recognition tasks. In the longer term, as AI manages routine clinical pathways from triage to treatment selection, the full catalyst model can be realized, with physicians trained primarily as systems navigators, humanistic care providers, and advocates for health equity. This phased approach ensures that educational reform remains grounded in the actual trajectory of AI capability rather than aspirational speculation.

We acknowledge that these proposals confront significant practical barriers. Medical curricula are already saturated, and adding advocacy and systems-thinking requirements risks overloading trainees unless corresponding content is deprioritized as AI assumes cognitive-diagnostic functions. Faculty development in structural competency and critical pedagogy remains limited at most institutions. Moreover, as one reviewer rightly noted, graduates trained under this model may face fundamental misalignment with health systems not yet designed to support advocacy-oriented practice. Implementing the full catalyst model prematurely, without corresponding changes to the practice environments that receive graduates, risks producing physicians whose training does not match their working conditions. The phased timeline above addresses this concern: near-term changes such as algorithmic literacy and protected advocacy time are compatible with current systems, while more transformative elements are tied to broader system readiness. Pilot programs at individual institutions or small health networks could serve as proof-of-concept sites before wider adoption.

Finally, assessment methods must evolve to evaluate competence in advocacy and systems change, not just the recall of biomedical facts. This could involve portfolio-based assessments of advocacy projects or objective structured clinical examinations (OSCEs) that simulate encounters with policymakers or community groups [23]. We anticipate concern regarding the subjectivity of assessing 'competence in advocacy.' We emphasize that this framework is not a rigid blueprint but a call to start a movement. The goal is to engage a diverse community of educators to rigorously test and refine these metrics, ensuring they evaluate genuine engagement rather than performative compliance.

Conclusion

The automation of cognitive-diagnostic tasks by AI is not a distant prospect but an ongoing transformation. As this shift accelerates, the traditional justification for a medical curriculum organized primarily around biomedical knowledge acquisition will erode. Medical education faces a choice: to allow AI-freed capacity to be absorbed by productivity demands within the current system, or to deliberately redirect that capacity toward preparing physicians as advocates for structural change.

We have proposed a phased approach to this redirection, with near-term reforms in algorithmic literacy and protected advocacy time, medium-term expansion of structural reasoning as AI diagnostic support matures, and long-term realization of the catalyst model as AI assumes routine clinical pathways. We acknowledge the genuine tensions in this vision: saturated curricula, limited faculty expertise, institutional inertia, and the risk of training graduates for systems that do not yet exist. These barriers demand iterative, evidence-based implementation rather than wholesale revolution.

The path forward requires partnership: between medical educators and health system leaders, between physicians and the community health workers and advocates who have long championed structural change, and between the humans who deliver care and the AI tools that increasingly shape it. The goal is not to produce physician-saviors but to cultivate clinicians equipped to work within these coalitions toward a more just and responsive health system.

Author contributions

CRediT: **Milit S. Patel**: Writing – original draft, Writing – review & editing; **Edward Christopher Dee**: Writing – review & editing; **Samarra Toby**: Writing – review & editing; **Mena Ramos**: Writing – review & editing; **Leo**

Anthony Celi: Conceptualization, Writing – review & editing.

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