NexBioHealth

Shaping Futures

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Medical Education: Learning for What's Next

A Physician Shaped by Practice, Service and Mentorship

Paul C. Kang, MD

Medical Education Beyond the Classroom

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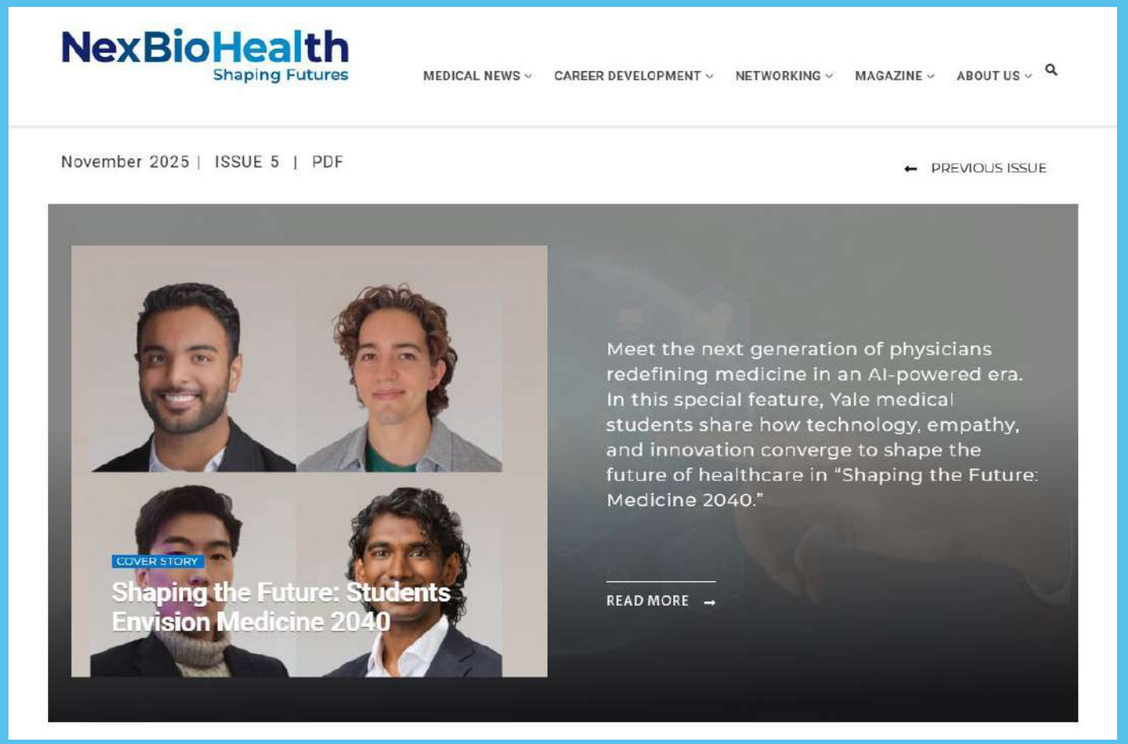
NexBioHealth: What Makes It Unique

NexBioHealth is a global magazine dedicated to empowering and connecting medical students, residents, and budding physicians worldwide. The magazine is a dynamic platform designed to foster global networking, knowledge sharing, research collaboration, and professional growth for young healthcare professionals.



Vision

NexBioHealth aims to foster an international community where future leaders in medicine can learn, collaborate, and grow together. Building on the 10-year legacy of the World Asian Medical Journal (WAMJ), NexBioHealth expands its scope to engage a broader, global audience, creating a platform for medical professionals worldwide.

Key Features

01. Career Development & Mentorship:

This section offers guidance and mentoring to help young medical professionals navigate their career paths. It includes contributions from experienced physicians and focuses on professional growth, education, and research opportunities.

02. Health Equity and Engagement:

Focused on addressing health equity and global health, this section highlights innovations in public health, healthcare delivery, and international healthcare innovations. Through in-depth articles and interviews with global health leaders, we aim to promote discussions around equitable healthcare access and inclusion worldwide.

03. Global Networking for Physicians:

NexBioHealth connects medical students, residents, and physicians worldwide by featuring leading organizations, providing networking opportunities, and facilitating international collaborations.

Conferences: This section highlights important medical conferences and events around the world, providing readers with opportunities for learning and professional development.

04. Medical Report & Healthcare Updates:

A comprehensive section delivering the latest news in medicine and healthcare, covering advancements, policy changes, and industry trends.

05. Student and Resident Engagement:

NexBioHealth is committed to representing the interests of medical students and residents through the formation of the Student Advisory Committee (SAC). These committees help shape the magazine's content, organize events, and promote mentorship opportunities.

NexBioHealth is more than just a publication-it's a vibrant community and resource hub for the next generation of medical professionals. By bringing together students, residents, and physicians from across the globe, NexBioHealth is dedicated to supporting the growth and development of future leaders in the medical field.

Our Editorial Board

NexBioHealth Magazine, ISSN-3055-7595, is published quarterly by NexusHealth Media, Inc., 161 Tweed Blvd., Nyack, NY 10960. Tel: (845) 661-1477, Email: info@NexBioHealth.org, Website: www.nexbiohealth.org. Please send inquiries, subscription requests, and address changes to the above address.

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The NexBioHealth Editorial Board comprises a diverse group of physicians and healthcare professionals from various specialties who are recognized as thought leaders with innovative ideas and notable accomplishments.

This distinguished group is united by a shared mission: to make NexBioHealth a unique platform for addressing the most pressing issues in medicine and healthcare today and into the future. Their goal is to nurture, motivate, and inspire the next generation of healthcare professionals.

Diverse Expertise

Unlike the typical editorial boards of academic journals, the NexBioHealth Editorial Board is intentionally diverse. It includes physicians from major university settings, private practices, and community health centers, not only in the United States but also globally. This diversity ensures that the magazine reflects a wide range of perspectives and experiences, making it relevant and impactful for a global audience.

Interdisciplinary Approach

In addition to physicians, the board includes prominent individuals from the scientific, legal, health industry, and public health fields. This interdisciplinary approach is crucial for interpreting and providing insights into medicine and healthcare from unbiased and diverse viewpoints. By integrating expertise from these various fields, NexBioHealth is positioned to offer comprehensive and balanced coverage of the issues that matter most to healthcare professionals and the communities they serve.

Supporting Young Minds:

To further enrich the content and ensure it resonates with the emerging generation of medical professionals, NexBioHealth has established two additional boards:

Student Advisory Committee (SAC)

- The SAC is designed to represent the interests and perspectives of medical students. Members provide feedback on articles, suggest relevant topics, and help tailor the content to meet their peers' needs. They also liaise between NexBioHealth and medical schools, assisting with student outreach and event coordination. Their involvement ensures that NexBioHealth remains a vital resource for students, providing content that is both educational and inspiring.

Resident Physicians Advisory Committee (RPAC)

- The RPAC represents residents across all specialties, offering valuable insights into the challenges and opportunities faced by physicians in training. The RPAC helps guide the magazine's content by contributing articles, organizing networking opportunities, and supporting mentorship programs. Their participation ensures that the magazine addresses the specific needs of residents, helping them navigate their careers with confidence.

A Growing and Evolving Board:

Our editorial board is in the beginning phase and continues to grow, inviting more great minds to join us in our mission. As we expand, we are committed to bringing together a broader range of expertise and perspectives to enhance the magazine's quality and impact. We seek thought leaders and innovators who share our vision to join us in making NexBioHealth a powerful voice in medicine and healthcare.

A Truly Unique Platform:

NexBioHealth's combination of a diverse, interdisciplinary editorial board and the inclusion of the SAC and RPAC makes it a truly unique platform. It is a magazine that not only raises important issues in medicine and healthcare but also fosters a collaborative environment where young minds are nurtured, motivated, and inspired.
NexBioHealth is committed to being more than just a publication-it is a community and a resource for those who aspire to lead and innovate in the healthcare field. Through the collective efforts of its editorial board, students, and residents, NexBioHealth aims to be the best platform for shaping the future of medicine and healthcare.

A Physician Shaped by Practice, Service, and Mentorship: Paul C. Kang, MD

Medical education is often defined by classrooms, curricula, and credentials-but some of its most enduring lessons are learned elsewhere. In this cover story, Paul C. Kang, MD reflects on how practice, mentorship, global service, and lived experience have shaped his journey as a physician-and how education in medicine truly unfolds beyond institutional walls.

Transforming Medical Education with Artificial Intelligence: An Integrated Perspective

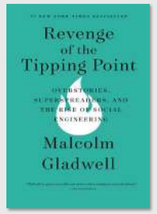
How AI-from digital twins and deep learning to simulation and decision support-is reshaping medical training toward personalized, competency-based education.

Quality vs Quantity of Life in Care

A physician reflects on why clinical decisions must balance longevity with dignity, autonomy, and the lived experience of patients.

Dear Mentor - Evolution of Medical Education

A mentor reflects on how medical training has changed-and how those changes shape the way trainees grow into thoughtful, compassionate physicians.



Medicine at the Tipping Point– And After

A physician's reflection on Malcolm Gladwell's The Revenge of the Tipping Point and what it reveals about prevention, incentives, and why medicine so often intervenes too late.

NEW | AI & HealthTech: Redefining Learning and Care

A special section exploring how AI is reshaping medical education, clinical decision-making, and patient care-from multiple perspectives.

In This Issue

From the Publisher

Chul S. Hyun, MD, PhD, MPH

Div. of Digestive Diseases

Yale School of Medicine

Dear Readers,

Medical Education Beyond the Classroom

Last fall, *NexBioHealth* devoted an issue to medical education for the first time. That issue featured four remarkable medical students on the cover—each already rethinking how medicine is learned, practiced, and shaped by technology, creativity, and purpose. The response was clear: medical education is no longer confined to lecture halls or training milestones. It is evolving in real time, driven by those willing to question, build, and lead.

This February issue continues that conversation.

In many ways, *NexBioHealth* itself is a medical education magazine—though perhaps not in the traditional sense. We are interested not only in how physicians are trained, but in how they become doctors over time: through practice, service, mentorship, failure, reflection, and the courage to choose paths that are not always obvious. Learning in medicine does not end at graduation; it unfolds across a lifetime.

That is why we are honored to feature Paul C. Kang, MD on the cover of this issue. Paul Kang is not a conventional figurehead of medical education, yet he exemplifies one of its most powerful forms. There is a saying, echoed across many traditions, that we teach not only through words, but through action. After years of building a highly successful practice in one of the most competitive medical markets in the country, Paul chose to redirect his energy toward mentorship, academia, and sustained global service through his work with Health In Sight Mission. His career reminds us that some of the most enduring lessons in medicine are taught not from podiums, but through lived example.

This issue also reflects the expanding boundaries of medical education today, including the growing role of artificial intelligence in medicine—how it is influencing clinical judgment, training pathways, and the delivery of care while raising important questions about values, responsibility, and trust. With this issue, we are introducing a new section, AI & HealthTech, to *NexBioHealth*.

To anchor this inaugural section, we spoke with technology journalist and author Sam Greengard, whose outsider perspective offers clarity amid the noise and hype surrounding AI in healthcare. We are also pleased to feature the work of Saahil Chadha and his team, whose innovative applications of AI reflect the kind of thoughtful, practice-grounded work we hope to highlight in this section. In future issues, AI & HealthTech will continue to spotlight emerging voices—students, clinicians, and researchers—applying technology in ways that advance more humane, patient—centered medicine.

Across these pages, you will also find reflections on career development, student growth, mentorship, and the changing culture of medicine-from ivory towers to communities, from hospitals to homes, and from metrics to meaning. Together, these contributions reflect a central belief of *NexBioHealth*: that medicine must remain a learning profession—one that evolves in response to the needs of patients, communities, and society at large.

Thank you for reading *NexBioHealth* and for being part of this evolving conversation. We look forward to exploring what medicine can become—together.

Warm regards,

Chul S. Hyun, MD, PhD, MPH

From the Editor-in-Chief

Joseph P. McMenamin, MD, JD, FCLM

Christian & Barton Group, LLP

Dear Reader,

To galvanize an edition dedicated to medical education, we proudly feature Dr. Paul Kang's "Medical Education Beyond the Classroom." I consider this piece one of the best articles *NexBioHealth* has ever run. Dr. Kang describes his career, inspiring to me even from my law firm perch. Nurtured by the faith and example of a blinded father, Dr. Kang overcame numerous obstacles, acquiring the skills and knowledge to improve eyesight and combat blindness. His career combines private practice, innovating with industry, caring for professional athletes, and medical missionary work in impoverished Honduras. Despite his many duties, including extensive mentoring, he has long pursued his love of the outdoors. I hope you enjoy Dr. Kang's writing as much as I did.

Chul Hyun, MD, PhD, our publisher, is this issue's MVP. Besides his customary letter, Dr. Hyun has written an insightful article on the impact of private equity investment on AMCs, an interview with technology journalist and author Sam Greengard probing AI's risks and benefits, a review of Malcolm Gladwell's *The Revenge of the Tipping Point,* and an analysis of what happens "When AI Redesigns Global Healthcare." Only a polymath could do all this while teaching and providing clinical care.

Both PharmD candidate Raveena Baskaran and Sanghyun Alexander Kim, MD review James Clear's *Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones*. From their descriptions, these volumes seem to be sound choices for our libraries.

Besides its emphasis on education, this issue also launches a new section on healthcare's hottest topic: AI & HealthTech. Doctor Daniel Katz and colleagues have contributed a scholarly piece on using AI in medical education, focusing on digital twins, deep learning–enabled electrocardiography, AI-enhanced simulation, and LLM–based clinical decision support. Med student Saahil Chadha and radiation oncologist Sanjay Aneja, MD comment on Saahil Chadha's *Harnessing AI to Personalize Care for Brain Metastases*.

Telemedicine guru Christian Milaster has authored a provocative piece describing how we go from "Virtual First to Virtual Mostly," prognosticating what care might look for in the near future.

Dr. Mun Hong's reflection on "Quality of Life and Quantity of Life in Patient Care," reminds us all why we decided to care for our fellow humans in the first place. All my ice cream-loving colleagues will understand his patient. Colorectal surgeon Sanghyun (Alex) Kim, MD., has created an introspective article on the characteristics of those choosing medicine, the impact of the profession on those individuals over time, and what we can expect in a world where AI's role is large and growing,

In our mentoring section we offer two remarkably candid and practical pieces, the thoughts of resident Andrew Lee, MD on "How to Earn Honors in Clinical Rotation?," and Dr. Mark Levine's guidance to undergraduates on medical school. Dr. Ansley Baccus shares her thoughts on a neglected topic: Enjoying Medical Education, observing, "It's more important to enjoy learning than the grade."

This issue, then, offers variety, timeliness, learning, and inspiration Happy reading.

Joseph P. McMenamin, MD, JD, FCLM

Connect with Future Medical Leaders Worldwide!

www.NexBioHealth.org

We invite you to become part of a vibrant community of medical professionals, where experienced leaders and emerging physicians from around the world collaborate, share knowledge, and drive the future of healthcare. This global network fosters mentorship, research collaboration, and leadership development across generations, ensuring that the next wave of medical leaders is well-equipped to tackle the challenges of tomorrow.

For more information or questions email: info@nexbiohealth.org

Second Stomach Cancer Task Force Congressional Forum

A bipartisan congressional briefing focused on advancing evidence-based strategies for gastric cancer prevention, early detection, and health equity in high-risk U.S. populations.

Time & Location

March 10, 2026, 12:00–2:00 PM
Washington, DC (to be announced)

Keynote Speakers:
- Congresswoman Judy Chu (CA-28)
- Congressman Suhas Subramanyam (VA-10)

Supporting Organizations:
- Gastric Cancer Prevention & Screening Program, Yale School of Medicine
- Yale Cancer Center
- Hope for Stomach Cancer
- Korean Community Services, Inc.
- NexBioHealth, Inc.

Medical Report

This article first appeared in **Health Affairs Forefront** (July 2025) and is republished here with attribution to the original publication

Author: Chul Hyun

Title: From Ivory Towers to Main Street Originally published in: Health Affairs Forefront, July 2025

URL: https://www.healthaffairs.org/content/forefront/ivory-towers-main-street-advancing-community-health-corporate-era

From Ivory Towers To Main Street

Advancing Community Health In A Corporate Era

As private equity (PE) continues to reshape health care delivery in the United States, academic medical centers (AMCs) face unprecedented ethical and operational challenges in retaining their influence beyond hospital walls. Long regarded as anchors of clinical excellence and public service, AMCs are now contending with corporate-backed outpatient groups for both patients and practitioners. These dynamics threaten not only AMCs' market presence but also their ability to fulfill core public missions of education, equity, and care.

This article explores how AMCs can reclaim leadership in outpatient care by extending their reach into community-based models, prioritizing access and equity, and leveraging partnerships that embed academic excellence in local delivery systems. It also examines how policy oversight—particularly at the state level—can play a vital role in insulating AMCs from the destabilizing effects of PE ownership, including workforce turnover and financial risk transfer. Ultimately, this piece argues that the values underpinning AMC models offer a critical ethical counterweight to profit-driven care. As the corporatization of medicine accelerates, AMCs must evolve not just clinically, but structurally and politically, if they are to remain a vital force for equitable, community-centered health care.

A Path Forward For AMCs

AMCs have long been dedicated to medical education, research, and specialized patient care, yet their engagement in community-based health care has traditionally been limited. As the corporatization of health care reshapes access and delivery, the expansion of PE-backed medical groups has shifted outpatient and specialty services away from academic institutions, challenging AMCs' ability to maintain meaningful connections with the communities they serve.

Historically focused on tertiary and quaternary care, AMCs have often deprioritized primary and preventive services due to financial constraints, institutional rigidity, and reimbursement models favoring high-margin procedures. However, as health care systems evolve, AMCs must extend their reach into community health to sustain their mission and uphold their ethical obligations. Strengthening their role in addressing social determinants of health and expanding access to specialty services across all communities will allow them to bridge long-standing disparities in care. Strategies such as community-based participatory research and community-engaged research provide frameworks for AMCs to collaborate with local populations, ensuring that academic expertise translates into tangible improvements in public health.

Despite the clear need for AMCs to extend their reach, they face significant barriers-particularly due to the growing financialization of outpatient specialty care. In procedural fields such as gastroenterology, ophthalmology, and others, PE-backed groups have aggressively acquired independent physician practices, prioritizing high-volume procedures over broader, continuity-based care models. As a result, access to specialty services is increasingly shaped by financial incentives rather than community health needs. These corporate models, which emphasize efficiency and profitability, threaten to erode AMCs' ability to engage meaningfully with communities and deliver comprehensive care.

Moreover, PE acquisitions have disrupted health care delivery by destabilizing workforce continuity. A study of 200 PE-acquired ophthalmology practices (2014–21) revealed a 46.8 percent increase in total clinicians within three years-but also a 265.0 percent rise in physician turnover, with annual departures 13 percentage points higher than in non-PE-acquired practices. These trends raise concerns about the stability and consistency of care and underscore the importance of the organizations shaping how health services are delivered. The differences between AMCs and PE-backed groups go beyond finances-they affect how care is structured, accessed, and experienced. Understanding who owns and governs these entities is essential to evaluating their impact on communities.

Alternative Models For AMC-Led Community-Based Care

To remain competitive and mission-driven in an increasingly commercialized health care landscape, AMCs must explore alternative care models that extend their reach beyond hospital walls. While many AMCs already operate outpatient procedural centers, these facilities often lack an advantage over PE-backed competitors due to high facility fees and administrative overhead. To differentiate themselves, AMCs must adopt a model that provides greater accessibility, cost-effectiveness, and unique value beyond what PE groups offer. A recent study of the National Breast and Cervical Cancer Early Detection Program highlights how partnerships among academic institutions, hospital systems, and community organizations can significantly improve access to cancer screening and help reduce disparities in high-risk populations. This reinforces the importance of AMC-led care models that extend into communities while maintaining high clinical standards.

One such approach is the academic outpatient procedure center model, which significantly reduces facility fees, making procedural care more financially accessible while maintaining academic quality and patient safety standards-a counterpoint to concerns raised about rising costs and variable quality in PE-owned procedural services. Unlike existing university-operated outpatient facilities, which often mirror hospital-based structures in pricing and administration, these centers aim to streamline operations, reduce non-essential costs, and prioritize accessibility for a broader patient population, including the uninsured as well

as those covered by Medicare and Medicaid. To make these centers viable against well-financed PE-owned outpatient clinics, AMCs must introduce distinct advantages beyond cost reduction. Patients could have access to cutting-edge clinical trials, advanced diagnostics, and novel therapeutics that are unavailable in commercial PE-backed settings, integrating research opportunities directly into clinical care. Unlike traditional university-affiliated outpatient departments, these centers would prioritize procedural efficiency while embedding research and innovation into routine care, allowing patients to benefit from early adoption of emerging technologies and treatments.

AMCs could use these outpatient centers as teaching environments that provide hands-on training for medical trainees while maintaining high-quality patient care. These centers offer a valuable opportunity for trainees to develop real-world clinical skills, cultural competence, and patient engagement beyond hospital settings. Furthermore, ensuring transparency in pricing, patient outcomes, and procedural appropriateness could distinguish AMC-led outpatient procedure centers from PE-backed facilities and reinforce their ethical commitments to accountability and equity.

To counteract the corporate consolidation of outpatient services, AMCs can collaborate with independent physician groups to create integrated care networks. Successful models include Cambridge Health Alliance and the University of California, Los Angeles' (UCLA's) partnerships with community clinics, such as the Venice Family Clinic, which deliver specialty care to underserved populations while providing clinical training for medical students. Additionally, UCLA's community-based participatory research (CBPR) initiatives have addressed local health disparities, underscoring the sustained value of academic-community partnerships. AMCs can further extend their reach by embedding specialty clinics within primary care networks, integrating gastroenterology, oncology, and cardiology into underserved areas. Programs such as Johns Hopkins' collaboration with federally qualified health centers and the University of New Mexico's Project ECHO exemplify how integrating specialty services into primary care enhances access to high-quality, community-based care for vulnerable populations.

Policy Levers To Safeguard Community-Centered Academic Care

While institutional redesign is essential, policy must also function as a lever to reinforce the community-facing mission of AMCs. Regulation is not only about curbing consolidation or limiting market power-it's about safeguarding the ability of academic institutions to provide equitable, community-based care. Without structural protections, AMCs may be increasingly displaced by financial entities whose goals are misaligned with public health. State and federal policy can and should insulate mission-driven systems from these pressures while empowering them to serve where they are needed most.

Several states have begun responding to these trends in meaningful ways. In California, Assembly Bill 3129 now requires the attorney general's consent for private equity health care transactions. Crucially, the law applies not only to direct ownership but also to management services organizations (MSOs)-the vehicle PE firms often use to exert control without being classified as health care providers. This closes a long-standing loophole in acquisition oversight and allows the state to block deals that may reduce access or increase consolidation.

In Massachusetts, the Health Policy Commission (HPC) has implemented a Material Change Notice process, which allows oversight of significant market transactions, including those involving PE firms. The HPC has flagged several PE acquisitions in dermatology and orthopedics for their potential to raise prices and restrict access. The state is now proposing to expand this authority to include non-hospital outpatient acquisitions, in recognition of the growing threat posed by PE roll-up strategies.

Connecticut offers a slightly different approach. The state's Office of Health Strategy monitors practice acquisitions and maintains a registry of physician group ownership, providing early transparency into market shifts. Connecticut also requires Certificate of Need review for certain practice affiliations and has seen its attorney general publicly challenge hospital and PE-linked deals, citing potential harm to access and cost. For example, Attorney General William Tong raised concerns about Yale-New Haven Health's proposed acquisition of Prospect Medical's Connecticut hospitals, highlighting the risk that a private equity firm's debt burden could be transferred to a nonprofit academic institution. While the deal remains pending, the intervention illustrates that even large AMCs are vulnerable to the structural fallout of PE in health care. It underscores the role of state oversight in shielding mission-driven institutions from inheriting unsustainable liabilities-reinforcing that policy must not only protect access and affordability but also insulate academic systems from financial models that prioritize exit over long-term outcomes.

At the federal level, oversight of private equity ownership remains limited and inconsistent. Establishing a national registry of physician practice ownership-including affiliations with PE firms and MSOs-would be a foundational step toward greater transparency. Meanwhile, the Federal Trade Commission and Department of Justice have begun to scrutinize serial acquisitions more closely, particularly those structured to circumvent conventional antitrust review thresholds.

For AMCs to reassert their role in outpatient care, these oversight mechanisms must be strengthened and extended. Transparency, regulatory review, and public accountability are essential if academic medicine is to remain a viable ethical counterweight to the financialization of care.

A Call To Action

The corporatization of medicine has significantly altered health care delivery in the United States, challenging AMCs to redefine their role in an evolving system. If AMCs fail to adapt, they risk losing their influence in outpatient care and becoming increasingly disconnected from the communities they serve. By embracing physician-led community partnerships, innovative outpatient care models, and policy advocacy, AMCs can reclaim their leadership in health care delivery. This is not merely an institutional concern-it is a call to action to preserve the integrity of patient-centered, research-driven medicine. The future of academic medicine must extend beyond hospital walls and into the communities that need it most.

AMCs have the power-and the responsibility-to lead this transformation, but they cannot do so alone. Sustained policy oversight, transparency in ownership, and safeguards against financial exploitation are essential to ensure that academic medicine can compete-and thrive-amid an increasingly corporate and ethically contested landscape.

Medical Education

TRANSFORMING MEDICAL EDUCATION WITH ARTIFICIAL INTELLIGENCE: AN INTEGRATED PERSPECTIVE

By Ashlesha Chaudhary, Carlos Espiche Salazar, Andrew Krumerman and Daniel Katz.

ABSTRACT

Artificial intelligence (AI) is rapidly reshaping medical education by transforming how knowledge is generated, skills are acquired, and clinical competence is assessed. As AI becomes embedded in routine clinical practice, traditional apprenticeship-based training models are increasingly strained by rising patient complexity, expanding medical knowledge, and heightened safety expectations. This review provides an integrated perspective on the educational impact of contemporary AI technologies, including digital twins, deep learning–enabled electrocardiography, AI-enhanced simulation, and large language model–based clinical decision support. These tools enable personalized, competency-based learning at scale, offering high-fidelity, data-driven environments for risk-free experiential training, prognostic reasoning, and procedural skill development.

GRAPHICAL ABSTRACT

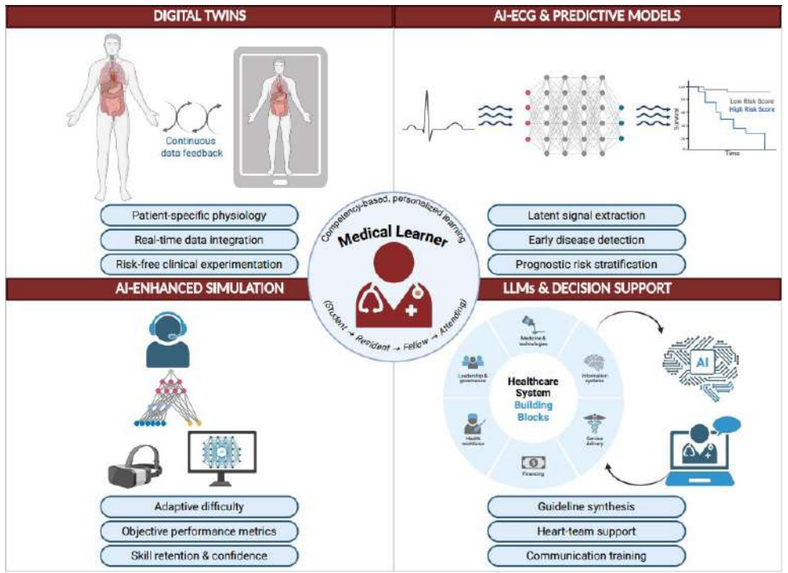


Figure 1 illustrates an integrated framework of AI tools supporting medical education across learning domains.[1]

INTRODUCTION

Medical education is undergoing rapid transformation as artificial intelligence (AI) becomes embedded in clinical practice.[2] Promotion and assessment of knowledge, clinical skills and competence are domains for which AI may enhance medical education. AI can promote personalized learning plans tailored to an individual's needs. Traditional training models, largely dependent on apprenticeship and variable clinical exposure, are increasingly strained by rising patient complexity, expanding medical knowledge, and heightened safety expectations.[3,4] As AI-driven tools reshape diagnosis, risk prediction, simulation, and clinical decision-making, medical education must evolve to prepare physicians to use these technologies critically and responsibly.

Unlike earlier digital innovations, contemporary AI alters how clinical knowledge is generated and applied. Deep neural networks can extract prognostic signals from routine tests, digital twins can model patient-specific physiology, and AI-enhanced simulations can recreate complex or rare clinical scenarios with adaptive realism.[5–7] Extended reality may simulate procedural experience to promote competency and improve safety. These advances blur the boundaries between education, simulation, and care, enabling personalized and competency-based learning at scale. At the same time, AI introduces new challenges, including algorithmic opacity, bias, and the risk of overreliance or deskilling.[8] This review provides an integrated perspective on how AI is transforming medical education.

1. DIGITAL TWINS IN MEDICINE AND MEDICAL EDUCATION

1.1 Definition and Core Components of Digital Twins

Digital twins are high-fidelity virtual models that replicate real-world systems.[9] Unlike static simulations, digital twins maintain a dynamic, bidirectional relationship with the physical system they represent, allowing the model to evolve alongside changes in patient physiology or clinical status.[10,11] For example, engineers and clinicians at Duke University have created vascular digital twins that allow surgeons to simulate procedures in a virtual environment before operating on the actual patient, optimizing surgical plans and potentially reducing complications.[11] In essence, from an educational standpoint, digital twins offer a novel paradigm for experiential learning. By creating patient-specific, data-driven representations of anatomy and physiology, learners can explore "what-if" scenarios, test interventions, and observe downstream consequences in a risk-free environment.

1.2 Applications in Medical Training

Originally developed in engineering, digital twins are increasingly being explored in medical education as tools for immersive and personalized learning.[7,12,13] Current applications primarily involve medical imaging education, critical care training, and accessibility-focused learning. In imaging, digital twins generate interactive 3D anatomical models from MRI or CT data, allowing learners to explore patient-specific anatomy. In clinical training, they simulate complex ICU scenarios and rare conditions with repeatable practice opportunities.

A notable example is the work by Rovati et al. (2024), who developed a patient-specific ICU digital twin incorporating seven organ systems driven by real patient data.[14,15] Delivered via a mobile application, the platform allowed residents and fellows to practice managing sepsis and multi-organ failure, demonstrating high usability and reduced cognitive load during decision-making. Similar digital twin platforms have been piloted for emergency response training, surgical rehearsal, and patient-specific intervention planning.[16] Nonetheless, progress has been rapid in recent years, with growing numbers of pilot programs and institutional deployments.[17–20]Table 1 summarizes some applications of digital twins in medical education.

1.3 Advantages and Challenges

Digital twins offer several potential advantages for education. First, they provide high-fidelity realism, enabling immersive interaction with virtual patients or organs that closely replicate real physiology.[29,30] This supports risk-free, repetitive practice of procedures and clinical decision-making, addressing limitations of traditional training where exposure to complex or rare cases is restricted.[21,31] Studies report improved learner engagement, teaching effectiveness, and satisfaction compared with conventional educational methods.[13,32,33] Because digital twins can be derived from real patient data, learners are exposed to patient-specific anatomical and pathological variability, better preparing them for real-world clinical diversity.[34,35] Digital twins also promote active learning by allowing trainees to manipulate variables such as medications or device settings and immediately

Table 1: Landscape of digital twin applications in medical education.

Citation	Digital twin type	Key Educational Outcome
Mekki YM, 2025[20]	Static ---> intelligent DTs	Provides a conceptual roadmap linking DT maturity to surgical education, but lacks direct educational validation
Sadée C, 2025[11]	Dynamic patient DT	Establishes a consensus definition of medical DTs that can underpin future educational systems
Zhao F, 2025[21]	Imaging-driven patient DTs	Demonstrates technical feasibility of imaging-based DTs with educational relevance inferred rather than tested
Rudsari KH, 2025[22]	Patient, organ, system DTs	Synthesizes DT applications with clear educational potential but minimal empirical evaluation
Zhang K, 2024[23]	DT maturity roadmap	Defines DT maturity stages that are directly translatable to curriculum design
Sel K, 2024[24]	Physiologic DT ecosystem	Clarifies engineering foundations required for future cardiac DT-based education
Xie H, 2025[25]	Biophysical cardiac DT	Positions DTs as powerful tools for EP training without educational outcome data
Trayanova NA & Prakosa A., 2024[26]	Mechanistic heart DTs	Frames DTs as high-fidelity learning environments for advanced electrophysiology training
Rovati L, 2024[13]	Patient-specific rule-based DT	First prospective evidence that patient-specific DTs are usable and acceptable for resident education
Peshkova M, 2023[17]	Data-centric proto-DT	Demonstrates foundational infrastructure needed for future DT-enabled pathology education
Kumar A, 2024[27]	Asset / process DTs	Shows DTs can improve accessibility, but educational impact remains unvalidated
Zackoff MW, 2023[18]	Environment-level DT	Demonstrates large-scale, real-world educational deployment of DTs for clinical onboarding
Zackoff MW, 2024[19]	Environment-level DT	Confirms tolerability and acceptability of DT-based VR at institutional scale
Toofaninejad E, 2024[6]	Conceptual DT framework	Articulates why DTs matter for medical education and identifies key research gaps

observe physiologic consequences, strengthening clinical reasoning and systems-based thinking.[34,36,37]

Despite the promise, digital twin technology in education is still in its infancy and faces meaningful challenges. Development is resource-intensive, requiring advanced imaging, large datasets, computational infrastructure, and multidisciplinary expertise.[13,38] Integration into curricula also poses difficulties, as faculty must acquire new technical skills to design scenarios and interpret outputs.39 Most importantly, evidence of educational effectiveness remains limited, with few large-scale studies demonstrating objective improvements in competency, transfer to clinical performance, or patient outcomes. Model validation, data privacy, and the risk of reinforcing incorrect physiologic assumptions also require careful oversight.[40,41]

2.DEEP LEARNING AND ECG-BASED RISK PREDICTION

2.1 Background

One of the most educationally disruptive advances in clinical AI has been the application of deep learning to electrocardiography (ECG). Algorithms can now identify subtle patterns in ECG signals that are imperceptible to human interpretation, enabling prediction of future cardiovascular disease rather than detection of only current abnormalities. These developments have significant implications for both medical practice and education, especially in cardiology training.

2.2 Implications for Medical Education

Traditional ECG interpretation focuses on detecting current abnormalities such as arrhythmias or ischemia. In contrast, deep learning models can extract latent features from seemingly normal ECGs that predict future disease. Work from the Mayo Clinic demonstrated that a convolutional neural network could identify the electrocardiographic signature of paroxysmal atrial fibrillation even during normal sinus rhythm.[42] Similar models accurately identified reduced left ventricular ejection fraction (≤35%) from ECGs alone, and individuals with positive AI-ECG findings despite normal baseline echocardiograms had a fourfold higher risk of developing cardiomyopathy.[43]

AI-ECG applications continue to expand, enabling prediction of arrhythmias, ventricular dysfunction, coronary disease, stroke risk, and other outcomes from a single ECG. A

Table 2. Summary of key studies evaluating AI-enabled ECG applications.

Citation	Clinical focus	Key Educational Outcome
Lee MS, 2025 [44]	Acute MI	AI-ECG matched or exceeded physician assessment and HEART/GRACE scores
Moon J, 2025[45]	Acute heart failure	ECG-based ML identified acute HF with AUROC ≈ 0.89–0.90
Liu W-T, 2024[46]	Asymptomatic LV dysfunction	AI-ECG screening achieved AUROC up to 0.98 and was cost-saving
Adedinsewo DA, 2024[47]	Peripartum cardiomyopathy	AI-assisted ECG/auscultation outperformed usual care
Liu W-T, 2025[48]	AF detection	AI-ECG alerts improved AF recognition and anticoagulation
Lin CS, 2024[49]	Mortality risk	AI-ECG alerts reduced 90-day mortality
Tsai DJ, 2025[50]	Low LVEF detection	Earlier low-EF detection without increased echocardiography
Ferreira ALC, 2025[51]	HFrEF screening	Pooled AUC ≈ 0.92 supports AI-ECG integration into training
Popat A, 2024[52]	Aortic stenosis	ECG-based AI showed high accuracy (AUC ≈ 0.91)
Mayourian J, 2025[53]	LV dysfunction	AI-ECG detected current and future LVSD and predicted mortality
Surendra K, 2023[54]	HF screening	ECG-only AI matched risk-factor models
Gupta MD, 2025[55]	STEMI risk	ML models outperformed TIMI for mortality prediction
Hao Y, 2025[56]	Sleep apnea	HRV-based ML showed good screening accuracy
Hill NR, 2020[57]	AF screening	Introduced AI-first EHR-based screening strategy
Zaboli A, 2025[58]	ECG + MACE risk	LLM ECG interpretation was inconsistent
Günay S, 2024[59]	ECG interpretation	Physicians outperformed LLMs
Avidan Y, 2025[60]	AF/flutter	LLMs showed unsafe over- and under-diagnosis
Gupta MD, 2020[61]	Stress physiology	AI-ECG captured stress signals; clinical value unproven
Shroyer S, 2025[62]	Occlusive MI	AI reduced missed OMIs and false cath lab activations

notable advance is the AIRE (Artificial Intelligence Risk Estimation) platform, which combines deep learning with survival analysis to generate individualized long-term risk predictions from a single ECG.[44] Collectively, these developments suggest a future in which AI-enhanced ECG outputs generate comprehensive prognostic insights that clinicians must be trained to interpret. As summarized in Table 2, AI-assisted ECG studies increasingly span diagnosis, risk stratification, screening, and workflow integration.

2.3 Advantages and Challenges

For trainees, AI-ECG tools represent both opportunity and challenge. While they enhance diagnostic and prognostic capability, they require AI literacy and introduce risks of overreliance and deskilling.[64] Early AI models were often "black boxes" that gave a risk score without explanation, which made many clinicians understandably hesitant to rely on them,[65,66] prompting a shift toward more explainable and actionable outputs. For example, the AIRE model generates patient-specific survival curves and demonstrates biologically plausible correlations with established clinical markers.44 Medical education must therefore train learners not only to interpret AI-generated risk signals, but to translate them into appropriate clinical actions such as closer surveillance or risk-factor modification.[67] Trainees must also recognize limitations, including false positives, false negatives, and demographic bias, reinforcing the need for critical appraisal and human oversight.

3. AI-ENHANCED SIMULATION AND TRAINING

3.1 Background

Simulation has long been a cornerstone of medical education, from anatomy dissection labs and manikin-based resuscitation drills, to standardized patient encounters. AI is now elevating simulation-based training to new heights, making it more realistic, adaptive, and effective.68 In this section, we examine how AI-driven technologies on simulation are transforming the way medical procedures and clinical scenarios are taught.

3.2 Implications for Medical Education

AI-enhanced simulation enables immersive and adaptive learning environments that closely mirror clinical practice. Virtual reality creates computer-generated operating rooms, emergency departments, and patient encounters, while AI dynamically adjusts scenario progression and provides personalized feedback. A 2025 Scientific Reports study demonstrated that an AI-enabled VR system with haptics and adaptive coaching improved procedural accuracy, efficiency, skill retention, and learner confidence compared with traditional training.[69] These platforms bridge theory and practice by standardizing competency benchmarks while tailoring difficulty to individual performance, and early evidence supports growing adoption across medical schools and residency programs with benefits across surgical and emergency medicine training.[70–76] AI can support procedural training ranging from novices to experienced physicians learning new skills in a safe environment.

AI has also transformed physical simulation using task trainers and manikins. In cardiopulmonary resuscitation (CPR) training, AI-enabled manikins equipped with motion and pressure sensors provide real-time, objective feedback on compression depth, rate, recoil, and ventilation.77,78 Systems such as Resusci Anne QCPR and Brayden CPR manikins alert trainees instantly to errors and reinforce correct technique through auditory and visual cues.[79,80] Studies consistently show improved skill acquisition, retention, and CPR quality with AI-driven feedback compared with instructor-only training.[81–83] By the time learners face a real code blue situation, they are more likely to perform high-quality CPR without needing to consciously recall guidelines, because they have been conditioned to the correct technique by the simulator's feedback.[84] Moreover, AI makes the training personalized: the system can track a trainee's performance over a session and identify recurring weaknesses. Mobile applications that connect via Bluetooth to a CPR manikin can gamify the experience and provide detailed post-training analytics.[85,86] These advances have demonstrated real-world impact and are increasingly incorporated into life-support curricula by organizations such as the American Heart Association and Red Cross.[82,87–90]

AI-enabled simulation also supports complex, dynamic clinical scenarios that adapt to learner decisions, fostering critical thinking, teamwork, and decision-making under pressure and help modify patient responses and clinical trajectories in real time. AI-powered virtual patients further extend training into communication and telehealth skills. For example, Weill Cornell Medicine piloted an AI virtual patient system ("MedSimAI") that allows students to practice history-taking and delivering bad news, while other telehealth simulations using AI-generated patient responses have improved learner confidence and self-assessed competence.[91, 92] Table 3 summarizes applications of AI in simulation and training.

3.3 Advantages and Challenges

Across modalities, AI-enhanced simulation offers personalization, scalability, and enhanced realism with improved accuracy, efficiency, and retention compared with traditional training.[69,103–105] AI simulations also promote standardization, ensuring all learners encounter core scenarios regardless of clinical exposure variability.[106,107] For example, every medical student could manage the exact same virtual pediatric anaphylaxis case or surgical complication, ensuring everyone is tested on key learning objectives.[108] This enables safe rehearsal of rare or high-risk events, reduce ethical concerns associated with patient harm, and allow repeated practice without resource constraints.[109,110] Ethical advantages are also notable: students can make mistakes in a virtual setting without harming patients, and they can repeat procedures until proficient without worrying about resource constraints.[111–115]

Challenges include cost, infrastructure requirements, faculty development, and concerns about reduced real-patient exposure.[116,117] AI is intended to augment, not replace, instructors for clinical mentorship, bedside teaching, and reflective debriefing. Additional concerns include simulation fatigue, reduced real-patient exposure, and technical issues such as VR discomfort or software instability.[118,119]

Table 3: Applications of AI in simulation and training.

Citation	AI Approach	Key Educational Outcome
Raquepo TM, 2025[92]	Computer vision, NN, AR/VR	Improved objective skill assessment and reduced training time
Farooq F, 2025[93]	VR/AR, CADe, ML	Enhanced procedural training and diagnostic accuracy
Bhakar R, 2025[94]	VR/AR, analytics	Feasible adoption; limited outcome-level evidence
Ng ZX, 2025[95]	DL auto-contouring, CDS	Improved feedback and complex case exposure
Pan W, 2025[96]	AI imaging, simulation	Reduced diagnostic variability among trainees
Escobar-Castillejos D, 2025[97]	ML, DL, CNNs	Automated assessment and adaptive learning
Li Z, 2025[98]	VR + ML	Personalized feedback improved performance
Borg A, 2025[99]	LLM-enhanced virtual patients	Greater realism and coaching quality vs traditional platforms
Truong H, 2022[100]	VR + AI	Faster competency achievement
Fazlollahi AM, 2023[101]	AI-guided feedback	Improved safety metrics; noted unintended effects

4. APPLICATIONS OF AI FOR MEDICAL MANAGEMENT AND EDUCATION

Cardiovascular diseases involve complex interactions among therapeutic strategies, clinical decision-making, and drug treatments. AI, especially AI and ML, is increasingly used to improve risk assessment for acute and chronic conditions, enhancing personalized care.[120] As these tools become part of routine care, medical education must prepare trainees to understand, interpret, and appropriately apply AI-assisted outputs. For example, AI-based ASCVD risk calculators embedded in electronic health records outperform traditional scores in predicting individual cardiovascular risk.[121]

4.1 Diagnostic and Clinical Support

Diagnostic and clinical support by AI involves aiding clinicians in acquiring patient history, analyzing clinical features like face and voice, and integrating laboratory results, biomarkers, and imaging.[120] The use of natural language processing (NLP) and large language models (LLMs) can improve diagnostic recognition, guideline adherence, and patient education. From an educational perspective, these systems introduce new learning goals centered on clinical validation, oversight, and integration of AI recommendations into decision-making.[121,122]

Cardiac imaging has broadly benefited from advances in AI. AI-derived coronary CT measures, such as the fat attenuation index (FAI), provide prognostic information beyond traditional imaging, including in patients with minimal visible atherosclerosis. Emerging techniques such as radiomics and radiotranscriptomics allow earlier and more detailed characterization of plaque biology. These advances shift imaging education toward integrative interpretation that links anatomy, biology, and clinical risk.[120,123]

The NLPs use information such as history, results examinations, and management for diagnostic and prognostic purposes to answer complex diagnostic questions or help diagnose complex, clinically defined diseases. Wu et al., in a retrospective cohort study, used NLPs to analyze EHRs, including clinical, demographic, echocardiographic, and outcome data on heart failure, and compared AI-driven Heart Failure with Preserved Ejection Fraction (HFpEF) diagnoses using the ESC criteria and the simple criteria vs the confirmed HFpEF diagnosis, demonstrating that over 91% of the patients with HF and a LVEF >50% on echocardiogram did not have a formal diagnosis of HFpEF and had worse outcomes.120,124 Artificial intelligence-

Risks and Safeguards in AI-Enabled Medical Education

Key Risks	Safeguards
1 Algorithmic bias	1 AI literacy training
2 Overreliance and deskilling	2 Human-in-the-loop oversight
3 Opacity and lack of explainability	3 Model validation and auditing
4 Data privacy concerns	4 Curricular governance frameworks

clinical decision support systems (AI-CDSS) could assist clinicians in the HF diagnosis. Choi et al. tested their AI-CDSS algorithm in a prospective pilot study using a database of patients not diagnosed with HF and databases of patients diagnosed with cardiovascular HF and non-HF physicians, having a 98% concordance rate with the HF-specialist and 76% with the non-HF physicians; this could provide an excellent tool for regions or institutions without HF diagnostic tools or specialists.[120,125]

LLMs are also being explored as tools for clinician training and simulated patient interactions. Evaluation of Google's Articulate Medical Intelligence Explorer (AMIE) across international case scenarios showed strong performance in structured clinical conversations.[126] However, more research is needed, and barriers must be overcome before this can be translated into real-world patient interactions. Ongoing work on multimodal LLMs, particularly in medical imaging, may further expand their educational role.[127]

4.2 Heart Team Decision-Making

Clinical guidelines advocate multidisciplinary heart team (MDHT) discussions in complex scenarios, such as coronary revascularization. Sudri et al. compared the use of ChatGPT-3.5 and ChatGPT-4 with the MDHT in clinical decisions, achieving concordance accuracies of 0.82 with ChatGPT-4 and 0.67 with ChatGPT-3.5, respectively.128 From an educational standpoint, AI may serve as a supplementary tool for case preparation, discussion rehearsal, and reflective learning rather than as a decision-maker. Prompt-based reasoning strategies, such as Tree-of-Thoughts methods, further improve alignment with expert consensus in complex cases like aortic stenosis.[129] AI could help interventional cardiologists plan their interventions, base contrast data on each case, and make decisions in complex cases.

5. USE OF DEEP NEURAL NETWORKS

Deep neural networks (DNNs) are a sophisticated deep learning method that uses multi-layered neural networks to learn from large datasets, much as the human brain does.[130] DNN allows the machine to make accurate predictions and decisions and to help train cardiovascular trainees to approach the decision making capability of seasoned specialists.

5.1 Electrocardiogram (ECG) Analysis using Deep Neural Network

Deep learning networks have been used to analyze ECGs in order to improve accuracy and scalability, with encouraging results. DNN achieves an area under the receiver operating characteristic (ROC) curve of 0.97 compared with a consensus committee of board-certified practicing cardiologists.[131] Furthermore, the use of Convolutional Neural Networks (CNNs) to analyze ECGs could identify left ventricular dysfunction (LVEF <35%), achieving an AUC of 0.93, and those who were falsely positive in the AI screening had a hazard ratio of 4.1.[43] This growing capability of interpretation based on AI gives room to improve the methods used to teach ECG interpretation and the limitations associated with the standard interpretation. Programs such as Waven Maven could include AI processing or the creation of real-world ECG-challenging cases for learners to facilitate improved performance.[132] Table 4 summarizes applications of deep neural networks in cardiovascular medicine.

5.2 Medical Cardiac Imaging and Deep Neural Network

CNNs can be used to analyze and generate data from complex structures, facilitating the work of cardiac imaging researchers and advancing scholarship in this area.[132] AI enables innovative approaches to analyzing big data and obtaining information, such as the Agatston score, from ECG-gated CT scans of coronary arteries for preventive studies,[140] or for characterizing post-MI scars in cardiac MRIs.[132] The use of machine learning algorithms, including DNNs, has enabled integration of cardiac imaging with vascular biology by associating radiomic features with other biological features secondary to cytokine-related arterial inflammation, creating an algorithm called C19-RS.[123] From an educational perspective, these tools encourage trainees to move beyond image recognition toward integrated understanding of imaging, pathophysiology, and clinical risk.

Table 4. Selected Applications of Deep Neural Networks in Cardiovascular Medicine

Citation	Data Modality	Key Educational Outcome
Hannun AY, 2019[132]	Ambulatory ECG	DNN achieved cardiologist-level accuracy for rhythm detection
van de Leur RR, 2020[133]	12-lead ECG	DNN accurately classified ECGs into acute and non-acute categories
Fiorina L, 2022[134]	Holter ECG	DNN-based Holter analysis was faster and non-inferior to conventional interpretation
Gumpfer N, 2020[135]	ECG + clinical data	Deep learning detected myocardial scar with moderate diagnostic accuracy
Ríos-Muñoz GR, 2022[136]	Intracardiac electrograms	CNN-based models identified rotational activity linked to AF mechanisms
Stephens AF, 2023[137]	ELSO registry data	DNN-based ECMO PAL score outperformed conventional prognostic scores
Weimann K & Conrad TOF, 2024[138]	Multi-site ECG databases	Federated DNNs preserved privacy while maintaining diagnostic performance

6. AI TO PROMOTE A SPECIFIC LEARNER'S KNOWLEDGE

The applications and integration of AI into clinical practice should be reflected in the healthcare personnel curriculum, including that of cardiology fellows and medical students.

6.1 Curriculum Development

The concepts of CNNs within DNNs and as an efficient approach to deep learning need to be integrated into cardiovascular education, with a focus on developing computational simulations.[141] AI should be taught as a tool that complements clinical judgment, not as a replacement for it. However, many current curricula lag behind rapid technological advances.[142] Modern competence-based curricula should include structured integration of AI-related competencies, particularly in cardiology fellowship programs.

Cardiac imaging is at the forefront of AI development, with growing applications and emerging challenges. Curriculum development in this area is crucial for getting the most out of this growing field and for taking advantage of the several knowledge gaps and development opportunities from medical school to cardiovascular diseases training programs.[143] Training statements from the American Heart Association and the American College of Cardiology recognize AI as a core competency across imaging modalities. At the same time, AI outputs remain imperfect, and trainees must be taught to independently review images, validate measurements, and recognize potential errors.[144]

AI is now routinely used in cardiology, including wearable devices that accurately detect common arrhythmias such as atrial fibrillation, with a recent meta-analysis reporting a pooled AUC of 0.97 (95% CI: 0.96–0.99).[145] These tools are well suited for screening and population-level prevention but are not diagnostic on their own. Clinical experience has shown that AI performance varies by task and patient population, showing the need for clinician oversight.[146,147] Medical education must therefore train clinicians to actively interrogate AI outputs rather than accept them at face value. Trainees should learn to identify false-positive and false-negative results and to review interpretability outputs, such as saliency maps, to assess whether model attention aligns with physiologically meaningful ECG features before acting on AI-generated predictions.

6.2 Simulations and Skilled Assessment in Cardiovascular Diseases

Surgery and other procedural fields have adopted AI systems that use natural language processing and deep neural networks to track case exposure and acquired competencies during training. These tools can expand and refine competency classification, achieve accuracies up to 97%, and even suggest appropriate logging of complex cases based on procedural language.[148] Similar systems would be highly applicable to interventional cardiology, electrophysiology, and structural heart training, where increasing procedural volume and complexity make manual tracking challenging. As cardiovascular therapies continue to evolve rapidly, AI may also support lifelong learning by facilitating ongoing competency assessment and credentialing.

In parallel, advances in portable, high-resolution recording devices now allow NLP-based tools to categorize and log procedures in near real time according to type and complexity.[149] This approach can provide timely, objective feedback to trainees, support completion of comprehensive training requirements, and enable program leadership to better individualize learning objectives and procedural opportunities.

CONCLUSIONS

Artificial intelligence has transformed traditional cardiovascular diagnostic tools into predictive systems capable of learning from clinical data. This shift requires a corresponding evolution in cardiovascular medical education toward personalized, precision-based, and high-fidelity training. Deep and convolutional neural networks have revitalized the electrocardiogram, expanding its role from pattern recognition to risk prediction and longitudinal assessment. In parallel, large language models and natural language processing now support multidisciplinary heart teams through clinical decision-support tools that also serve as educational platforms. Medical education has likewise advanced through the use of digital twins and AI-enhanced simulation, which improve procedural accuracy, learner confidence, and skill retention. To ensure safe and effective integration into practice, medical curricula must prioritize AI literacy and competency-based training. Preparing future clinicians to critically interpret and apply AI-supported insights will help bridge education with clinical care and support lifelong learning in an increasingly data-driven healthcare environment.

REFERENCES

Complete references for this article are available upon request.

Key Terms

Machine Learning (ML)
A type of AI in which computers learn from data rather than following fixed rules.

Deep Learning
A form of machine learning that uses multiple layers of computation to detect complex patterns in images, signals, or text.

Deep Neural Network (DNN)
A deep learning model made of many connected layers that learns from large datasets to make predictions.

Convolutional Neural Network (CNN)
A specialized deep learning model designed to recognize patterns in images or signals, such as ECG waveforms or medical scans.

Digital Twin
A patient-specific virtual model of the body or an organ system that can be used to simulate how disease or treatments might affect that individual.

High-Fidelity Simulation
A realistic simulation that closely mimics real clinical conditions, including physiology and patient responses.

Risk Prediction (vs Diagnosis)
Diagnosis identifies what is happening now; risk prediction estimates the chance of developing a disease or outcome in the future.

Clinical Decision Support (AI-CDSS)
Software that uses AI to provide risk estimates or recommendations to help clinicians make decisions.

Large Language Model (LLM)
An AI system trained on large amounts of text that can understand and generate human-like language.

Natural Language Processing (NLP)
AI methods that extract meaning from written or spoken language, such as clinical notes.

Black Box Model
An AI system that gives a result (like a risk score) without clearly showing how it reached that conclusion.

Explainable AI (XAI)
AI methods that reveal why a model made a certain prediction, increasing transparency and trust.

Algorithmic Bias
When an AI system performs differently across groups because of differences in data or design.

Overreliance (Automation Bias)
The tendency to trust AI outputs too much, even when they may be wrong.

Deskilling
Loss of human expertise when clinicians rely too heavily on automated systems.

Extended Reality (XR)
Immersive technologies, including virtual and augmented reality, used for training and simulation.

Haptics
Technology that provides touch or force feedback, such as feeling resistance during a simulated procedure.

Latent Features
Hidden patterns in data that AI can detect even when they are not visible to humans

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Medical Education

Healthcare Comes Home:
With Virtual First to Virtual Mostly

By Christian Milaster

In the early days of medicine, healthcare came to the patient. The village healer walked to your hut. The medicine woman brought her tinctures to your cot. Even in early 1900s America, physicians such as William Worrell Mayo - father of the Mayo brothers - made house calls with horse and buggy, carrying his black doctor's bag to kitchen tables that doubled as surgical gurneys.

Then we centralized everything. We built hospitals, clinics, and - yes - waiting rooms. We made patients travel hours for 10, 15-minute appointments. We created a system where sick people drive themselves to sterile buildings to sit with other sick people, filling out the same forms they completed six months ago, waiting to see a provider who will order tests that could have been ordered over the phone.

By 2040, we've come full circle. Healthcare is back where it started: at home, on your terms, in your space. But this time, it's powered by technology that would have seemed like magic to Dr. Mayo.

Welcome to a world where every healthcare episode starts virtually and most care stays virtual.

This Could Be 2030

Here's what's remarkable: the infrastructure already exists.

Medical diagnostic devices designed for home use are available now. Think of them as medical tricorders - all-in-one tools that measure temperature, heart rate, and oxygen saturation, and perform otoscopic exams. Insurance companies could ship one to every household for less than a few percent of the cost of a single emergency room visit. They're rugged, foolproof, and designed to be operated by patients, not clinicians.

Mobile phlebotomy services already operate in major cities. A van arrives at your home. You step inside for a blood draw. The samples go to the lab. You never leave your property. The economics work perfectly - especially when you optimize routes such as Uber or Amazon deliveries. One phlebotomist visiting 15 patients in four hours costs less than maintaining a centralized draw station where 30 patients drive themselves, find parking, and wait in a queue.

Mobile imaging exists too. During COVID, some clinics offered radiological or ultrasound exams in your driveway. A specialized van parks outside. You step in, get scanned, step out. The images upload to the cloud. Your physician reviews them remotely. No hospital visit required. For imaging that requires larger equipment, a mobile van, e.g., for a CT scan, can park in a rural town's city center a few times a month.

Virtual triage for urgent care and emergency departments is not only possible - it's overdue. Unless you've put a screwdriver through your hand and it's actively bleeding, your urgent care visit should start at home with a video assessment. A triage nurse determines whether you need in-person care or can be treated remotely. Emergency departments could operate call centers managing video triage across all 50 states. No staffing shortages. No regional bottlenecks. Just immediate access to assessment, 24/7.

Even if you do need in-person care, you might still be seen virtually. Imagine arriving at an ED where a pan-tilt-zoom camera on a robotic arm conducts your initial assessment while a physician examines you from a central monitoring station. During mass casualty events, natural disasters or flu season surges, this isn't just efficient - it's essential.

This isn't healthcare in 2040. This is healthcare we could implement by 2030 if we wanted to.

The Physical Exam Is Theater

Now, I'm not a clinician, but after talking to hundreds of clinicians over the years, everybody more or less agrees that an actual physical exam that requires a touching of the patient is largely a relic of the past and only makes a difference in very few circumstances.

Many physicians have privately acknowledged that the physical exam rarely changes their diagnosis. Rather, the exam is used to confirm what they already know. Plus, they're waiting for lab results. They're waiting for imaging. The physical exam is oftentimes performed because it's expected, because it's tradition, because it's what happens in a doctor's office. It's the medical equivalent of cutting the ends off the ham.

You know that story, right? A daughter asks her mother why she cuts the ends off the ham before putting it in the oven. The mother says, "I don't know - my mother always did it that way." So they call the grandmother, who explains: "We had a tiny oven in our old apartment. The ham never fit, so I had to cut the ends off."

It is actually amazing what a "virtual physical exam" can do in lieu of touching the patient. With the right mindset, the right prompts, and fairly decent lighting and camera, many aspects can be assessed over video with similar efficacy.

With that, the physical exam is the ham ends of medicine. We do it because we've always done it. We pull out the reflex hammer and tap your knee. We listen to your heart and lungs with a stethoscope. We palpate your abdomen. These rituals provide comfort and familiarity, but they rarely provide the information that determines or changes the course of treatment.

What we actually need - the labs, the imaging, the patient history - can be gathered virtually. Range of motion can be assessed over video. "Does it hurt when you press here?" works just as well when the patient presses her own abdomen while you watch. Skin conditions are visible on high-resolution cameras. Gait abnormalities show up clearly on video.

For the few cases where hands-on examination matters, we have options. Local drop-in clinics with exam tools and telepresenters who facilitate the virtual physician's assessment. Medical assistants who perform the physical components under remote guidance. Or, increasingly, patients who use home diagnostic devices to gather the needed data themselves.

The sacred cow of the physical exam needs to be questioned. Not eliminated - but questioned, put in its rightful place. Which elements actually inform clinical decisions? Which are security blankets we cling to out of habit (and to protect against malpractice claims or Board of Medicine investigations)?

The Paradox of Young Physicians

Here's something unexpected: younger physicians often struggle more with telehealth than their older colleagues.

You'd think the generation raised on FaceTime and Zoom would excel at virtual care. But the opposite is often true. The reason is simple: they lack the pattern recognition that comes from thousands of in-person encounters. Experienced clinicians have seen so many presentations of strep throat, so many cases of congestive heart failure, that they can often diagnose from across the room. Their mental library of clinical patterns is vast.

Young physicians haven't built that library yet. They're still learning to recognize the subtle signs, the small deviations from normal. Taking away the in-person encounter feels like removing a crucial learning tool.

But here's where AI becomes transformative.

Imagine an AI advisor that listens to every telehealth encounter. It has access to the patient's complete history. It knows - "remembers" - the father had early-onset heart disease. It notices the patient mentioned fatigue during intake three months ago. While the physician conducts the video visit, the AI suggests: "Have you considered ordering a lipid panel? Family history indicates elevated risk." Or: "The patient's current symptoms align with hypothyroidism. Previous TSH was borderline. Recommend retest."

The AI isn't replacing clinical judgment - it's augmenting pattern recognition. It's giving young physicians access to the kind of deep, contextualized prompting that would normally come from a senior attending standing behind them during rounds.

This solves the training paradox. Young physicians can practice virtually while still developing the diagnostic intuition they need. The AI serves as a preceptor, mentor, and safety net.

What's Really Blocking Us

Here's the truth: technology isn't the barrier. Patient reluctance isn't the barrier. Clinical efficacy isn't the barrier.

The barriers are reimbursement, clinician mindset, and leadership apathy.

What if we would consider paying more for a virtual visit because of the lower cost to society (lost work hours) and to the environment (transportation)? What if an admittedly arbitrary expectation is that every primary care clinician is conducting 20% of his visits virtually?

I have a dream that one day we will reach 100% telehealth. I don't mean that 100% of (outpatient) care is delivered virtually. What I do mean is that if (1) it is clinically appropriate, (2) the patient wants it, and (3) the patient has the technical capabilities, we should be doing telehealth 100% of the time.

But we don't offer it, because to the clinics and clinicians it makes no difference whether you come in or are virtual. Since they are familiar with in-person, let's just stick with that.

We don't offer it, because nobody ever sat down with the clinicians and systematically identified which symptoms or conditions or types of visits are indeed suitable for telehealth.

We don't offer it, because we think that patients don't want it (which is mostly more about the physicians' than the patients' preference) and we don't offer them Telehealth TechChecks before the visit, so they are prepared.

Fee-for-service creates unnecessary visits. Consider urinary tract infections. If you have a history of UTIs and you feel one coming on with classic symptoms, why do you need an office visit? In a value-based system, your provider would simply send the prescription. But in fee-for-service, that visit generates revenue. The system is designed to require in-person encounters even when they add no clinical value.

Or consider follow-up visits to discuss lab results. Why am I driving two hours round-trip to have a physician tell me my cholesterol is high and here's a prescription? That's a phone call. It's a secure message. It's anything but a reason to burn half a day traveling.

Every system is perfectly designed to get the results it gets. Our system produces fragmentation, inefficiency, and unnecessary in-person visits because that's what it's designed to produce.

Equity Is Solvable

Before anyone claims virtual care will deepen health disparities, let's address the obvious solutions.

Broadband access: Between terrestrial infrastructure and satellite coverage (Starlink and competitors), we can achieve 100% broadband availability in the U.S. This is a political choice, not a technical limitation. For those still limited, cellular is a viable option - even if it means handing out 5G Smartphones for $80 each to those who cannot make it to the clinic.

Devices: Insurance companies could provide every patient with a rugged, 10-inch healthcare tablet. These are single-purpose devices - they work for virtual visits and health management only. Production cost is $30-60 at scale. When one breaks, it's replaced. The cost is trivial compared to the savings from preventing a single ED visit.

Language barriers: Real-time translation is here. You speak Spanish, I respond in German, and we both hear each other in our native languages with natural tone and inflection. Within five years, this won't even be remarkable - it'll just be how multilingual communication works.

Digital literacy: The smartphone adoption rate among all demographics - including elderly and low-income populations - proves that when technology solves real problems, people learn to use it. The 75-year-old who "can't do computers" somehow figured out how to FaceTime with grandchildren during COVID. Technology adoption follows utility.

The equity concerns are real, but they're not insurmountable. They require intentional design and investment. They don't require waiting for some future breakthrough.

Healthcare Comes Home

By 2040, here's what a typical healthcare experience looks like:

You wake up feeling ill. You open the health app on your insurance-provided tablet. The AI triage asks questions, reviews your history, and schedules a video visit within the hour. You connect with a physician who guides you through a self-exam using your home diagnostic device. Based on the findings, she orders labs. Within two hours, a mobile phlebotomist arrives. By that afternoon, results are back. The physician sends a prescription to your local pharmacy - or more likely, a drone delivers it to your doorstep.

You never left home. You never sat in a waiting room. You never exposed yourself to other sick patients or wasted half a day traveling.

For primary care, this is already the norm - somewhere. Annual wellness visits, chronic disease management, medication adjustments, minor acute conditions - all handled virtually. The occasional in-person visit for procedures that genuinely require hands-on care happens at convenient local clinics, not distant medical centers.

Specialty care operates the same way. Your cardiologist reviews your at-home EKG. Your dermatologist examines the rash via high-resolution photos. Your surgeon conducts pre-operative assessments over video and schedules post-operative wound checks at a local clinic with a telepresenter.

Behavioral health led the way here. Teletherapy normalized virtual mental health care years before the rest of medicine caught up. It demonstrated that therapeutic relationships form just as effectively over video as in person - sometimes more effectively, because patients feel safer in their own environments.

The shift from "virtual first" (every episode starts remotely) to "virtual mostly" (most care stays remote) isn't radical. It's the natural evolution of bringing healthcare back to where it started: close to the patient, integrated into daily life, accessible without heroic effort.

What Happens Next

The technology exists. The clinical models work. The patient acceptance is there - COVID proved people will embrace virtual care when given the option.

What's missing is systems change.

Young physicians entering practice today will spend their careers navigating this transition.

They'll practice in a world where some health systems cling to the old model - waiting rooms, in-person defaults, fee-for-service incentives - while others sprint toward virtual-first care. You'll need to be fluent in both.

But they also have the power to accelerate the shift. Pushing for reimbursement models that reward outcomes over encounters. Demanding training in virtual care that's as rigorous as traditional clinical rotations. Questioning every assumption about what "must" happen in person. Building their practices around patient convenience instead of institutional inertia.

The village healer walked to your home because that's where you were. Dr. Mayo drove his buggy to your kitchen table because that made sense. Then we built hospitals and forgot why we did things that way in the first place.

Now we remember. Healthcare is coming home. Not because it's nostalgic or romantic, but because it's better. More efficient. More accessible. More humane.

The waiting room is dying. By 2040, it might finally be dead.

The question isn't whether virtual care will dominate healthcare delivery. The question is whether you'll help build that future or spend your career defending a system designed for a world that no longer exists.

Christian Milaster, MS
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Christian Milaster is a telehealth strategist and digital health consultant focused on the intersection of technology and healthcare delivery. He writes the "Telehealth Tuesday" series and serves as a futurist who lives for and contributes to the creation of a better tomorrow. You can find him (virtually) on LinkedIn or via christian@ingeniumadvisors.net.

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Medical Education Beyond the Classroom

A Physician Shaped by Practice, Service, and Mentorship, Paul C. Kang, MD

When we think of *medical education*, the default image is often institutional: deans, presidents, endowed professors, lecture halls, accreditation standards, and curricula carefully mapped across years of training. These figures and structures matter deeply. They shape the scaffolding of medicine and ensure rigor, continuity, and standards across generations of physicians.

But education in medicine does not end at the classroom door—and in many ways, it does not truly begin there either.

At NexBioHealth, we believe that the most formative medical education often happens outside formal titles and beyond institutional boundaries. It happens in clinics built from scratch, in communities with limited resources, in moments of moral decision-making, and in the lived tension between innovation, responsibility, faith, and service. It happens when physicians translate what they have learned into systems that endure—and when they teach not by instruction alone, but by example.

That is why, for this issue dedicated to *Medical Education*, we are featuring Paul C. Kang, MD.

Dr. Kang is not a university president or a career dean. Yet his life's work represents a powerful and underrecognized form of medical education: education embodied. Through decades of private practice leadership, global mission work, mentorship, and now academic service, he has demonstrated how physicians learn—and teach—what cannot be codified in syllabi: judgment, humility, resilience, stewardship, and purpose. His work reminds us that medicine is not only a body of knowledge to be mastered, but a responsibility to be carried.

In communities from Washington, DC to Roatán, Honduras, Dr. Kang has shown how technical excellence, systems thinking, and moral clarity can coexist—and how the lessons learned at the bedside, in the operating room, and in resource-limited settings shape physicians long after formal training ends. In doing so, he exemplifies a broader vision of medical education: one rooted in lived experience, mentorship across generations, and the courage to apply knowledge where it matters most.

This issue invites readers to *expand* their understanding of what it means to educate physicians—and to recognize that some of the most enduring teachers in medicine are those who lead not from podiums, but from practice, service, and example.

I. Origins & Family

Your journey into medicine is deeply shaped by your father, who lost his vision at a young age yet went on to achieve remarkable things. What was it like growing up under his influence, and what lessons from his life still guide you today?

Growing up with a blind father, I always felt a quiet desire to understand his condition—and, if possible, help fix it. That instinct eventually drew me toward ophthalmology. But my father, Young Woo Kang, influenced me in ways that go far beyond my specialty choice. He shaped how I think about ability, resilience, and what it really means to care for others.

My father was born in South Korea in 1944 and lost his vision at sixteen after a soccer accident. With limited access to medical care, his blindness became permanent. He later became an orphan and grew up in poverty. At the time, discrimination against people with disabilities in Korea—especially the blind—was widespread. Many believed that encountering a blind person brought bad luck. Education was off-limits, and job opportunities were essentially restricted to fortune telling or massage.

Despite all of this, my father refused to accept those limitations. He became the first blind Korean to attend college and eventually earned a doctorate degree. He went on to teach as a college professor, serve under several U.S. presidents on the National Council on Disability, and help establish Goodwill Industries in Korea. His story has been told in books and films, but

for me, it was simply the example I grew up with every day.

One formative memory comes from when I was in fourth grade, traveling alone with my father from Chicago to Louisville. We navigated buses, hotels, and meals together as a team. Even at a young age, I appreciated the responsibility and skill required to be a guide for my father—calling out curbs at street crossings, describing the layout of a room, or letting him know where food and drinks were on the table. It taught me to communicate clearly, notice details others overlook, and anticipate needs. Looking back, those moments quietly trained skills I rely on as a physician today.

At the same time, my father was one of the most capable people I knew. He taught me how to "see" without eyes—how to look beyond physical limitations and recognize human worth. Through him, I learned that insight often comes from unexpected places and that resilience can redefine what is possible. He taught me lessons of life that I could have only learned through his perspective.

My father was also a deeply devout Christian, and his faith shaped how he understood both suffering and purpose. He believed that setbacks—his blindness included—were often part of a much larger story. He once told me that knowing what he believed to be the ultimate outcome of his life, he would not trade his blindness for the ability to see. That perspective stayed with me.

Growing up with him gave me a lens I carry into every part of my life. It influences how I counsel patients facing uncertainty or loss, how I approach my career with humility and gratitude, and how I try to be present for my family. Watching my father live with faith, meaning, and joy—despite circumstances most people would see only as limitation—taught me that healing isn't always about restoring what was lost, but about helping people find purpose, hope, and dignity where they are.

When I felt uncertain about my future, my father would remind me, "I am a blind man in a foreign country. If I can accomplish this much, imagine what you can do." That message still stays with me. It set a high bar for my own expectations, a responsibility to help those who face barriers, and a steady determination to meet challenges with purpose and compassion.

II. Becoming a Physician

When you first entered medicine, what did you imagine your career would look like? How did your understanding of what it means to be a physician evolve once you were in practice?

When I first entered medicine, I imagined a career focused on technical excellence—mastering procedures, using the latest technology, and delivering the best possible visual outcomes for my patients. As an ophthalmologist, I was quickly drawn to cornea, cataract, and refractive surgery. I loved that this subspecialty allowed me to not just slow vision loss, but often to restore or enhance vision. The pace of innovation—lasers, intraocular lenses, and constantly evolving surgical techniques—was energizing.

My early career goal was straightforward: provide outstanding care by using the most advanced tools and strategies available. I believed the best environment for that was private practice. While academic medicine plays an important role, it felt weighed down by bureaucracy and politics. In a fast-moving field like ophthalmology, layers of committees, meetings, and approval processes often seemed more like obstacles than safeguards.

Private practice gave me autonomy. I could make decisions quickly, become an early adopter of new technology, and build systems that supported high-quality care. I valued the ability to assemble the right team—colleagues, technicians, and staff who shared a commitment to excellence—and to implement best practices efficiently.

What I didn't fully anticipate was how much being a physician extended beyond medicine itself. I quickly learned that success required fluency in areas rarely taught during training: business operations, accounting, human resources, compliance, billing, and coding. At times, the learning curve felt overwhelming, but it was also deeply rewarding. I came to realize that running a well-managed practice isn't separate from patient care—it's essential to it. Those skills allowed me to integrate new technologies, expand to satellite offices and surgery centers, and build a practice trusted by both patients and the broader community.

I also discovered that my career could extend beyond traditional patient care. Over time, I became the team ophthalmologist for several professional sports teams in the Washington, DC area and participated in multiple clinical trials evaluating new treatment options. These experiences broadened my perspective and reinforced the importance of collaboration, innovation, and adaptability in medicine.

Perhaps the biggest evolution in my understanding of what it means to be a physician is realizing that learning never ends—but neither can work consume everything else. Early on, success meant volume, growth, and technical mastery. Today, I define it more holistically: delivering excellent care while building a sustainable career that leaves room for family, reflection, and personal well-being. Every physician must think like a clinician-scientist—constantly questioning, refining, and improving how we care for patients—while also recognizing the importance of balance. Striving for mastery with humility, staying curious as medicine evolves, and protecting longevity in the profession have become just as important as innovation itself. That pursuit, I've learned, is never-ending—and that's what makes the profession so compelling.

III. Redefining Success in Medicine

You built a highly successful private practice before shifting more of your time toward academia, mentorship, and service. Tell us about your practice. What prompted that transition, and how has your definition of "success" in medicine changed over time?

When I look back on my career, I see it unfolding in distinct seasons, each shaping how I define success in medicine. Early on, success meant building something excellent—technically, clinically, and operationally. For seventeen years, I practiced at the Eye Doctors of Washington in Washington, DC, with a simple but ambitious goal: to integrate the best technology and strategies to deliver the best possible outcomes for our patients. We built the practice around innovation, becoming the first in the region to offer all-laser LASIK, laser cataract surgery, and premium intraocular lenses—not for novelty's sake, but because these advances allowed us to restore vision in ways that were previously impossible. As the practice grew, so did its scope and reputation. We expanded services and locations, earned national recognition, served as team physicians for professional sports teams, and I became deeply involved in leadership, professional societies, and clinical trials. There was an undeniable exhilaration in building something so successful.

With that growth, however, came complexity.

Managing a large practice became increasingly demanding, and as senior partners approached retirement, succession planning became essential. When the practice attracted interest from private equity, we made the decision to sell—creating a natural inflection point that offered continuity for the group and freedom from day-to-day management. At the same time, I carried a persistent desire to serve patients like my father—those without access to advanced care. I realized, ironically, that the technologies I valued most would have been completely inaccessible to someone like him growing up blind in Korea. That tension came into sharp focus when I discovered Health In Sight Mission in Roatan, Honduras. The contrast between the resources of my practice in Washington, DC and the realities of care in Roatan—limited infrastructure, power outages, and improvised solutions—was impossible to ignore. Standing in that clinic, I felt called to apply what I had learned about building practices, integrating technology, and partnering with industry to create sustainable eye care where it was most needed.

The COVID-19 pandemic deepened that reflection. During that time, my longtime surgical coordinator and close colleague passed away, and I was struck by how differently well-resourced communities would weather the crisis compared to places like Roatan. It became clear to me that Washington, DC would be fine without me—but Roatan needed sustained service. After selling my practice, my family and I moved to Connecticut, taking a leap of faith without a clear plan. Months later, an opportunity at Yale unexpectedly emerged, offering the chance to teach, care for patients, and continue my commitment to mission work. Today, my definition of success has evolved. It is no longer measured by growth, volume, or innovation alone, but by impact—training the next generation, expanding access to care, building sustainable systems, and doing work aligned with my values while leaving room for family and balance.

IV. Mission Work & Global Perspective

Health In Sight Mission has become central to your work. What drew you to this mission, and what has practicing medicine in resource-limited settings taught you that clinical training alone could not?

Health In Sight Mission has become central to my work because it brings together accessibility, sustainability, and purpose in a way I had never experienced before. Roatan, an island off the coast of Honduras best known for cruise ships and scuba diving, exists alongside profound poverty and historically limited access to healthcare—particularly comprehensive eye care. Health In Sight Mission is a faith-based nonprofit founded more than twenty years ago with a commitment to Christian service and partnership with the local community. I was initially drawn to the mission because it was accessible—a relatively short trip from the U.S.—and because it allowed physicians to serve alongside their families in a safe, structured environment. What I didn't anticipate was how deeply it would reshape my understanding of medicine and give new meaning to the skills I had developed over years in private practice.

Practicing in a resource-limited setting quickly taught me that delivering care successfully requires far more than clinical skill alone. Sustainability matters. We are intentional about ensuring that our work strengthens, rather than displaces, local providers, partnering closely with Honduran ophthalmologists and community leaders to ensure continuity of care. Over time, trust became as important as technology. Drawing on lessons from private practice and long-standing industry relationships, we brought modern diagnostic equipment to the island and built a clinic with appropriate infrastructure, allowing local staff to perform testing even when visiting teams are not present. In this setting, innovation became a tool for equity—not just advancement.

This work has also transformed how physicians engage in mission medicine. Many feel called to serve but hesitate because of concerns about safety, effectiveness, or sustainability. By creating systems that support thoughtful, long-term care, we've been able to expand participation across multiple subspecialties and institutions while working toward a long-term goal of eliminating preventable blindness on the island. Practicing in Roatan has taught me humility, creativity, and systems thinking—lessons no formal training alone could impart. In many ways, it mirrors what I learned growing up with my father: that faith is not only about acceptance, but about having the courage to challenge barriers that stand in the way of dignity, compassion, and justice—for patients, communities, and those who serve them.

How has global service changed the way you view patients, privilege, and responsibility in your everyday medical practice back in the U.S.?

Global service has profoundly changed the way I view patients, privilege, and responsibility in my everyday medical practice in the United States. Over time, medicine can easily become routine. The demands of efficiency, protocols, documentation, and metrics are necessary for modern healthcare to function, but they can quietly pull us away from the original reason most of us chose this profession: to care for people.

In Roatan, the pace is different. Many of those external pressures fall away, and the focus returns to the patient in front of you. With far fewer resources, we still find ways to care deeply and meaningfully. Practicing with less has reminded me of what matters most. Mission work strips medicine down to its core and re-centers the human connection that first drew me to this work.

That perspective follows me home. In the U.S., clinical care can become highly algorithmic—patients seen quickly, outcomes expected to be perfect, and little margin for imperfection. We often carry the emotional weight of complications silently, while failing to pause and celebrate good outcomes. Over time, the beauty and humanity of medicine can be replaced by pressure and fatigue.

Serving in resource-limited settings has reminded me that medicine is not only about outcomes, but about presence. Even when we cannot fix everything, patients express profound gratitude simply for being seen, heard, and cared for. That gratitude has reshaped how I approach my patients at home, encouraging me to slow down, listen more carefully, and recognize the privilege of being trusted with someone's care.

Global service has also deepened my awareness of privilege. Many people in Roatan face daily challenges related to poverty and access to care, yet demonstrate extraordinary resilience, joy, and community. Ultimately, this work has reframed my sense of responsibility—not just as technical excellence, but as stewardship of resources, trust, and compassion. Carrying these lessons back into my everyday practice has helped me practice medicine with greater humility, gratitude, and intention, and to see each patient encounter not as a task to complete, but as a privilege to honor.

V. Mentorship & Learning Beyond the Classroom

You mentor many young physicians outside traditional academic structures. Why is mentorship so important to you at this stage of your life?

Mentorship has become increasingly important to me at this stage of my life because I've come to believe that careers unfold in seasons. I once heard Denzel Washington describe that arc simply: first you learn, then you earn, and eventually, you return. That idea resonates deeply with me.

I've been fortunate to have a wide range of professional experiences, but I didn't come from a family of physicians. Much of what I learned came through trial and error—through successes, setbacks, and moments of real uncertainty. My career was not a straight upward trajectory. Every opportunity carried risk, responsibility, and the pressure of knowing that patients and their families were depending on me. Looking back, there are many moments when having a trusted mentor—someone to offer perspective or reassurance—would have made a meaningful difference.

In a relatively short period of time, I went from finishing fellowship to becoming a partner in private practice, a community leader, and an innovator in my field. At the same time, I was trying to be a supportive husband to my OB/GYN wife and a present father to our three children. I wish I had better understood earlier how to balance ambition with sustainability, and professional success with family life.

Medical training is highly structured and takes place in the insulated environment of academic institutions. While that structure is essential, it leaves little room to address the realities physicians face once training ends—career choices, leadership challenges, financial decisions, work–life balance, and the emotional weight of responsibility. That gap is where mentorship becomes critical.

Because my career has spanned private practice, academia, medical mission work, and collaboration with industry, I'm able to offer a broader perspective on what a career in medicine can look like. I find great joy in helping residents and young physicians explore possibilities they may not have considered, connecting them with opportunities, and opening doors—then watching them run through those doors on their own. At this stage of my life, mentorship feels less like guidance and more like stewardship. I'm excited to see what this next generation will build, and I'm grateful to play even a small role in helping them find their path.

Some of the most important lessons in medicine are never taught in classrooms. In your experience, where do physicians truly learn how to become doctors—and where does formal medical education fall short?

Some of the most important lessons in medicine are never taught in classrooms. In my experience, physicians truly learn how to become doctors through direct patient care. After all, it's called medical practice for a reason. Responsibility, judgment, and the weight of decision-making cannot be fully simulated—they are learned over time, through experience, accountability, and reflection at the bedside.

Formal medical education provides an essential foundation, but it is just that—a framework. I often tell trainees that there are many successful ways to practice medicine beyond the environment in which they were trained. It's easy to assume that one's academic institution represents the "right" or definitive way to practice, but medicine extends far beyond any single system or philosophy. Standards of care vary across cultures, countries, and belief systems. Eastern and Western medicine, cultural expectations, and even homeopathic or complementary approaches all influence how patients understand health and healing.

Medical education tends to focus heavily on diagnosis and treatment algorithms, which are important, but patient care is never purely algorithmic. True care requires attention to the whole person—physical, mental, emotional, spiritual, and social well-being. Physicians must learn not to become shortsighted or overly dependent on protocols alone, but instead to draw on experience, remain open-minded, and continually reassess what is best for the individual patient in front of them.

I often use the analogy of learning a sport, like basketball. You can be taught the rules of the game and the fundamental skills needed to play, but true mastery only comes from playing over time—learning from mistakes, adapting to different opponents, and developing instincts. The best players don't just follow the fundamentals; they innovate, create new strategies, and redefine how the game is played. Medicine is no different.

Ultimately, becoming a doctor is a lifelong process of learning—one that requires humility, curiosity, and a willingness to grow beyond formal training. The classroom teaches the basics, but experience teaches wisdom. The best physicians remain students throughout their careers, always ready to listen, learn, and evolve in service of their patients.

VI. Reflection, NexBioHealth & Looking Forward

NexBioHealth focuses on medicine beyond metrics and productivity. What resonates with you about this mission, and why do you think platforms like this matter for the culture of medicine today?

What resonates most with me about NexBioHealth is its recognition that medicine cannot be reduced to metrics, productivity, or checklists. While those measures have a place, they fail to capture the complexity of what it truly means to be a physician. Young doctors and trainees intuitively understand this. They know early on that medicine extends far beyond formal education, protocols, and performance benchmarks—but they often lack access to the lived experience and guidance needed to navigate that reality.

Early in training, decisions are largely prescribed: where to rotate, what to study, how to progress. But once physicians move beyond that structure, the questions become far more complex. What does a sustainable career look like? How do you balance ambition with family, service, and personal well-being? How do you choose among private practice, academia, industry, or nontraditional paths? These are not questions answered by exams or productivity dashboards—they are answered through conversation, mentorship, and shared experience.

We live in a time when people seek information before making even the smallest decisions. We read countless reviews before choosing a restaurant for dinner or a hotel for a vacation. Yet physicians are often expected to make life-defining career choices with remarkably little insight into what different paths actually look like day to day. Platforms like NexBioHealth help close that gap by creating access—to perspective, to mentorship, and to honest dialogue about the realities of medicine.

Equally important is the sense of community such platforms foster. Medicine can be isolating, especially as pressures around efficiency, documentation, and performance continue to grow. NexBioHealth reminds us that we are not navigating these challenges alone. We are part of a shared profession—facing similar struggles, asking similar questions, and striving for meaning in the same demanding environment. Creating spaces where physicians can learn from one another, support one another, and reflect together is essential for the health of the profession itself.

Looking back, what experiences—inside or outside medicine—shaped you most as a person and physician?

Looking back, there is no question that growing up with my blind father had the most profound impact on me—both as a person and as a physician. I've spoken about how his life shaped my professional path and my commitment to mission work, but his influence reaches far beyond those choices. Many of the values that guide how I live and practice medicine today were formed long before I ever put on a white coat.

Despite my later academic achievements, I was not a strong student in my early years. Studying never came easily to me, and I struggled in ways I didn't yet understand. Only as an adult did I learn that much of this difficulty was due to undiagnosed dyslexia. At the time, however, I simply felt behind.

One memory from second grade stands out vividly. During a parent open house, my mother searched for my desk and eventually found it placed directly next to the teacher's—isolated from the rest of the class. At first, she assumed it was an honor. She soon learned the real reason: I was seated there to keep me from talking and distracting others. While my parents were disappointed in my academic performance, they never withdrew their encouragement. In fact, they rewarded effort and behavior just as much as grades—perhaps understanding that perseverance mattered more than early success.

Standardized testing only reinforced my struggles. Year after year, I failed to score well enough to be placed in honors classes. While I occasionally wondered if I was "smart enough," the disappointment weighed more heavily on my parents—especially my father. Having fought his own way through systemic barriers to education, he refused to accept the conclusion that I was simply "above average." He challenged the school, pointed to my developmental milestones, and ultimately convinced them to administer an IQ test. To nearly everyone's surprise—except his—I tested in the exceptional range. With that evidence, the school reversed course and placed me in honors classes.

In retrospect, that moment was pivotal. It was a clear example of how belief, advocacy, and family support can accomplish what talent alone sometimes cannot. My father had fought for his own education as a blind man in a society that dismissed him; now he was teaching me how to challenge systems, persist through doubt, and trust that setbacks do not define potential.

As I grew older, I learned how to adapt. Even without knowing I had dyslexia, I understood that traditional reading was difficult for me. My father helped me obtain audio versions of textbooks from libraries for the blind, which transformed how I studied. He also instilled in me a simple but powerful mantra: you never know unless you try. That belief freed me to explore widely—from sports and theater to playing guitar, writing songs, academic pursuits, and even starting a company while in college.

Perhaps the most enduring lessons came not from classrooms, but from time spent with my father outdoors. He loved walking and hiking, and on family trips to national parks, my brother and I would often hike challenging trails with him. The terrain could be steep and rocky, sometimes requiring us to crawl on hands and knees. Other hikers would stare, clearly wondering why a blind man was attempting such paths. But my father always pressed forward with calm confidence.

One hike ended at a suspension bridge—an obstacle that stopped me cold. I've never been comfortable with heights, and I froze. Yet in that moment, it was my blind father who urged me forward. I was supposed to be guiding him, but instead he was guiding me. In many ways, that scene captures the story of my life.

From him, I learned resilience, courage, and faith—not the absence of fear, but the willingness to move forward despite it. Those lessons continue to shape how I approach medicine, adversity, and responsibility. They remind me that true vision has little to do with what the eyes can see, and everything to do with trust, perseverance, and the people who believe in us when we struggle to believe in ourselves..

Finally, if you could speak directly to a medical student or resident who feels disillusioned or burned out, what would you want them to hear?

For the trainee who feels disillusioned or burned out, know this: what you're experiencing is not a failure—it's part of the journey, and you are not alone. So much of becoming a physician involves coming to terms with impossible expectations. You are asked to master an enormous and ever-changing body of knowledge, to grow confident in your skills while remaining humble enough to learn from mistakes, and to pursue perfect outcomes while knowing that complications and uncertainty are inevitable. Medicine is a noble calling, but even if you gave every waking hour, you would still fall short of every demand placed upon you. That tension is not a personal weakness—it is the reality of the profession.

Being a doctor means learning to live within that paradox. Learning to be comfortable being uncomfortable is essential. It requires accepting uncertainty, imperfection, and limits, and recognizing that your own well-being matters. The standard pre-flight message reminds us that in an emergency, oxygen masks drop from the ceiling—and you must secure your own mask before helping others. The same is true in medicine. Without taking care of yourself, you cannot provide the best care for those who depend on you.

Another critical lesson to learn early is that being a doctor is what you do, not who you are. Your profession cannot be allowed to define your entire identity. You must make room for the other roles and relationships that shape you as a person. You are also a son or daughter, a spouse or partner, a friend, a parent, a person of faith, and a member of a community. Neglecting those parts of yourself does not make you a better physician—it eventually makes the work unsustainable.

This work is hard, but it matters—and you are not alone in it. Seek out mentors who will speak honestly, encourage you, and help you see beyond the next hurdle. Develop healthy habits early. Don't fall into the illusion that balance will come later—after residency, after fellowship, or after the next promotion. There will always be another milestone to chase. If you postpone caring for yourself until "later," later rarely comes.

Finally, I would encourage you to see medicine not as something to be conquered, but as a journey—one to be navigated with curiosity, humility, and gratitude. When medicine is kept in its proper place, it can be deeply fulfilling rather than consuming. You don't need to have it all figured out right now. You simply need to keep moving forward with intention, perspective, and grace—for your patients, and for yourself.

Connect with Dr. Kang
Learn more about his work and mission:
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Dr. Mun K. Hong's Reflection

Quality Of Life And Quantity Of Life In Patient Care

By Mun K. Hong

Quality of life should be valued as highly as longevity when advising patients and their families. Clinical decisions are not made in a vacuum; they shape how patients live, not merely how long they survive. One experience from my years in practice reinforced this principle in a way that guidelines alone never could.

While practicing in Manhattan, I cared for an 85-year-old Korean-American man who had been hospitalized in Flushing with a non–ST-elevation myocardial infarction (NSTEMI). He requested transfer to my hospital so that I could oversee his care. When I met him and his family, we discussed treatment options candidly. Given his age, the family wished to proceed with cardiac catheterization and possible stenting but declined coronary artery bypass surgery. Angiography revealed a severe proximal left anterior descending artery lesion, which I successfully treated with a stent. The result was immediate and gratifying: he told me he felt markedly better, and in retrospect admitted that he had been ignoring chest discomfort for quite some time.

During these conversations, his wife and daughter expressed concern about his fondness for foods they considered unhealthy—particularly cheese and ice cream. They asked me to instruct him never to eat them again. While I understood their concern, I hesitated. Instead, I suggested moderation and a general reduction in animal fats rather than absolute prohibition. After this discussion, the patient smiled brightly for the first time since I had met him, appearing relaxed and relieved. I scheduled a follow-up visit in my Flushing office.

At that follow-up appointment, however, I was startled by the change in him. He appeared older, withdrawn, and markedly different from the man I had seen in the hospital. Concerned about possible stent-related complications or post–myocardial infarction depression, I questioned him about his symptoms. He denied any chest pain and reported feeling well physically. When he asked to speak with me alone—despite his wife and daughter accompanying him—I grew even more concerned. After asking his family to step out, he quietly confided that his life had become miserable. Either his wife or daughter accompanied him to the kitchen at all times, ensuring he did not eat ice cream. What he described as his "only pleasure" had been taken away.

I was relieved that his distress was not medical in origin, yet troubled by how profoundly his quality of life had been affected. I reassured him and invited his family back into the room. I explained that while a prudent diet is important, so too is the ability to enjoy life. Given his age and the joy he clearly derived from ice cream, I recommended moderation rather than complete elimination. This suggestion was met with visible discomfort, particularly from his daughter, who warned that my advice could hasten her father's demise. At the time, guidelines emphasized strict dietary fat restriction for patients with coronary artery disease, and moderation was not yet widely endorsed.

I acknowledged their concern and I also admitted that, ideally, he should avoid high-cholesterol foods. However, I explained that I strive to recommend lifestyle changes I would make for my own family. Seeing him as a peer of my own father, I would want not only years added to his life, but life added to his years. Gradually, their stance softened. They agreed to allow him his favorite treat in moderation and to work with him rather than against him.

As they left the office together—smiling as a family—I felt a deep sense of fulfillment. Shortly thereafter, I moved to another state for a new position and never learned how his story continued. Still, I hope that after our last meeting, he enjoyed both meaningful longevity and the simple pleasures that made his life worth living.

This experience continues to guide my practice. Medicine must aim not only to prolong life, but to preserve dignity, autonomy, and joy. True healing lies in balancing evidence-based care with compassion.

Mun K. Hong, MD, MHCM, FACC

Dr. Mun K. Hong, born in Seoul, Korea, immigrated to America at age 15. He earned his BA-MD from Johns Hopkins University School of Medicine in 1986 and completed residencies and fellowships in internal medicine and cardiology at Johns Hopkins, Georgetown, and the Washington Hospital Center. Dr. Hong has held leadership roles, including Director of Cardiovascular Intervention at Weill Cornell and Chairman of Cardiology at Medstar Southern Maryland Hospital. He currently practices at Bassett Hospital Center as Inaugural Chief of Cardiovascular Services. A dedicated mentor, he sponsored over 10 interventional cardiologists from Korea, helping them achieve significant academic success. During the pandemic, he earned an MHCM from Harvard. Dr. Hong enjoys family time with his wife of 37 years and their three children in New York City.

Dr. Sanghyun Alexander Kim's Perspective

Judgment, Responsibility, and the Physician in the Age of AI

By Sanghyun Alexander Kim

Artificial intelligence is often discussed as a technological turning point in medicine. Dr. Sanghyun Alexander Kim approaches this moment from a longer view—one shaped by years of surgical practice, training across generations of physicians, and reflection on how doctors are formed by responsibility, uncertainty, and culture.

This essay moves from the personalities drawn to medicine, to how physicians change through training and specialty choice, to the quiet expectations placed on doctors to endure without complaint. AI enters the story not as a threat, but as a clarifying force—revealing what medicine has always demanded and what cannot be delegated: judgment, accountability, and moral ownership of decisions.

We publish this perspective in the ***Career Development section because it speaks to professional identity at a moment of transition. As medicine evolves, Dr. Kim reminds us that the most important work of becoming a physician happens not through technology, but through experience—and the willingness to carry responsibility forward.***

— The Editors, NexBioHealth

After many years of practicing medicine, most of them spent as a surgeon, I have learned that physicians are not defined primarily by how much they know, but by who they are. I have spent countless hours in operating rooms, clinics, conference rooms, and hospital hallways. I have trained residents and fellows, worked alongside internists, family physicians, anesthesiologists, and nurses, and watched generations of doctors grow into their roles.

What follows is not a scientific analysis or a personality inventory. It is a personal reflection on the kinds of people who choose medicine, the personalities that gravitate toward different specialties, and how those identities must now evolve as artificial intelligence reshapes the profession.

Who Applies to Medical School

One of the most common questions I am asked by parents, students, and colleagues is deceptively simple. What kind of person becomes a doctor?

The easy answer is intelligence and discipline. The truer answer is more complex.

Medical school applicants tend to share a recognizable personality profile. They are achievement oriented, highly responsible, and often deeply self critical. They are rarely satisfied with good enough. Many have spent most of their lives striving toward grades, test scores, accolades, and external validation.

Among Korean and other East Asian students in particular, this drive is often amplified by cultural expectations. These individuals learn early how to carry not only their own ambitions, but also the hopes of their families. They become skilled at tolerating pressure, delaying gratification, and performing under sustained stress.

At this stage, empathy is frequently discussed but not always fully developed. What stands out more clearly is focus. The ability to endure long hours, deferred rewards, and constant evaluation is often what distinguishes those who make it into medicine.

How People Change When They Become Physicians

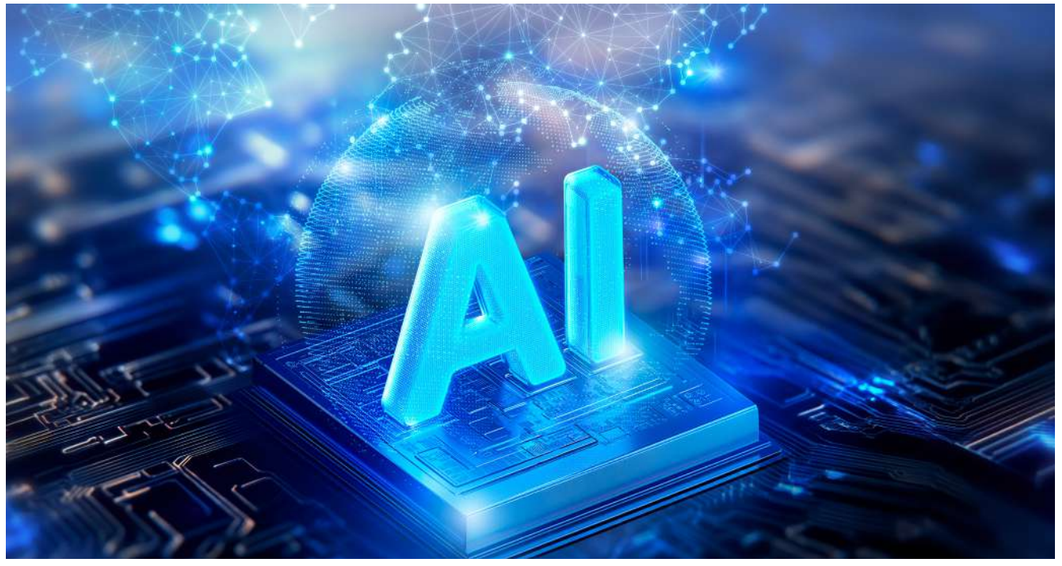
Applying to medical school and becoming a physician are fundamentally different experiences.

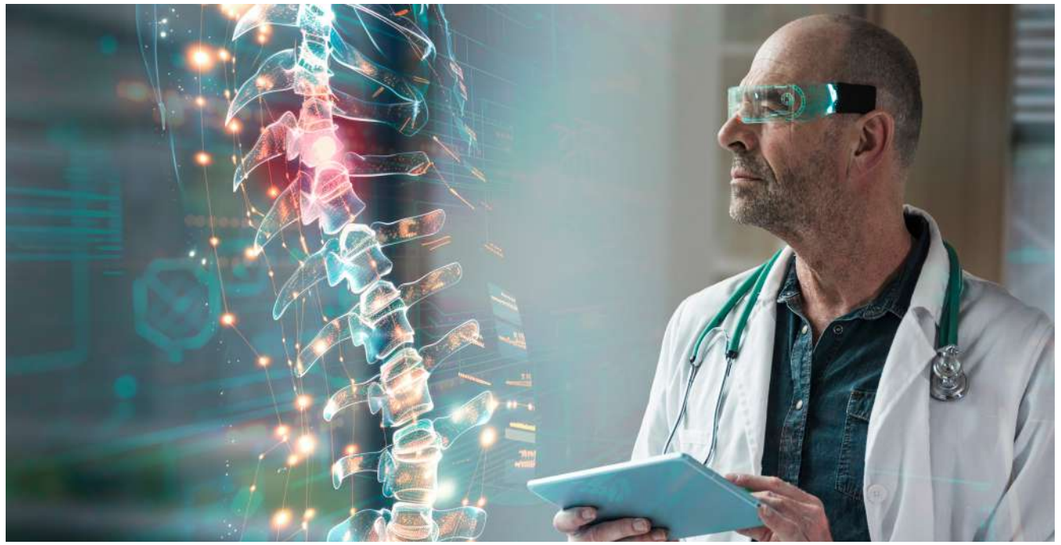
Once young doctors begin caring for real patients, they quickly realize that medicine rarely offers certainty. Symptoms are ambiguous. Data is incomplete. Outcomes are unpredictable. Decisions must still be made, often with lasting consequences.

Over time, physicians develop a tolerance for uncertainty that few other professions require. They learn how to act without complete information and how to live with the results of those decisions.

As a surgeon, this reality is especially vivid. In the operating room, there is no pause and no consensus vote. At critical moments, responsibility rests on one person. That weight reshapes how one thinks and feels. It teaches emotional control, intellectual humility, and acceptance that perfection is unattainable even when lives are at stake.

Empathy also matures. Early in training, empathy is often emotional and immediate. With experience, it becomes steadier and more deliberate. Clinical empathy is less about sharing distress and more about presence, clarity, and accountability.





Why Personality Shapes Specialty Choice

After observing hundreds of physicians choose their specialties, it has become clear to me that this decision is rarely about prestige or income. It is about psychological fit.

Surgeons tend to be decisive and action oriented. Many of us find meaning in fixing problems directly and seeing tangible results. We are often less expressive emotionally, yet deeply invested in ownership and responsibility. Surgical outcomes remain with us long after the case is finished.

Internists and primary care physicians often display a different kind of strength. They are relationship centered, patient, and comfortable with long term uncertainty. Their work unfolds over months and years rather than hours. It demands sustained attention, communication, and trust.

Neither disposition is superior. Each thrives in a different tempo of medicine. Difficulty arises when physicians practice in environments that conflict with their natural tendencies.

Cultural Expectations Placed on Physicians

In many cultures, particularly Korean culture, physicians have long been expected to be endlessly resilient. Strength is admired. Vulnerability is rarely encouraged.

Many doctors of my generation were trained to believe that exhaustion and sacrifice were simply part of the profession. While this mindset produced dedicated physicians, it also led to quiet burnout.

Younger physicians are now more open about boundaries, mental health, and balance. This shift is not a weakness. It is a necessary correction.

The Arrival of Artificial Intelligence

Artificial intelligence is now rapidly entering every domain of medicine. It assists with imaging interpretation, diagnostic reasoning, workflow optimization, and surgical planning. In some areas, it will soon surpass human speed and accuracy.

It is reasonable to ask whether physicians and surgeons will be replaced.

I believe this question misunderstands the essence of medicine.

Artificial intelligence excels at pattern recognition and data synthesis. What it lacks is moral responsibility, contextual judgment, and human presence. When information is incomplete and values conflict, a physician must still decide and accept responsibility for the outcome.

How the Physician Must Evolve

The future physician will not be defined by memorized knowledge or technical execution alone. The role will increasingly be one of integration.

Internists will translate algorithmic insights into care that reflects a patient's life circumstances and values. Surgeons will combine advanced technology with judgment, adaptability, and ethical responsibility.

In the coming decades, physicians will be valued less for what they can calculate and more for what they can interpret and decide.

Final Thoughts

After more than two decades in medicine, one truth stands out clearly. Physicians are shaped over time.

They are formed by responsibility, uncertainty, failure, and reflection.

As artificial intelligence transforms the technical landscape of healthcare, the core of medicine will remain human. The physician who thrives will not compete with machines, but will rise above them by offering judgment, compassion, and accountability.

Physicians are not defined solely by intelligence or training.

They are shaped by self awareness, adaptability, and a willingness to grow with their era.

Sanghyun Alexander Kim, MD

Dr. Sanghyun Alexander Kim is a colorectal surgeon at Mount Sinai who immigrated to the United States from Korea at age 17 and completed his education, medical training, residency, and fellowship entirely in New York. He joined the Mount Sinai surgical faculty in 2005 and currently serves as Program Director of the Robotic Colorectal Surgery Fellowship, where he trains surgeons in advanced minimally invasive techniques.

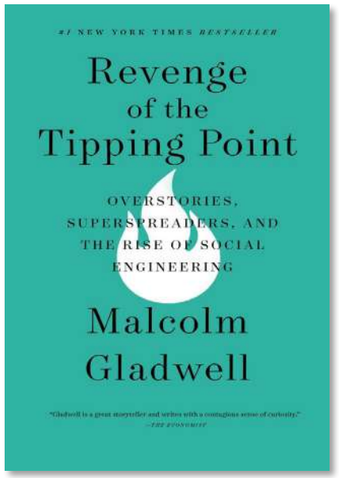
Dr. Kim's clinical practice focuses on colon and rectal cancer, inflammatory bowel disease, fecal incontinence, robotic colon and rectal surgery, and painless hemorrhoid treatment. He also has a large clinical practice performing high-resolution anoscopy, a specialized camera-based examination used to detect precancerous lesions and early anal cancer. In addition to caring for patients, Dr. Kim actively teaches medical students, residents, and surgeons, with a strong commitment to early cancer detection and serving diverse and underserved communities throughout New York and New Jersey.

Medicine at the Tipping Point—and After

Revenge of the Tipping Point

by Malcolm Gladwell

By Chul S. Hyun, MD, PhD, MPH



I first read **The Tipping Point** nearly twenty-five years ago, early in my career as a physician, during my years in private practice. At that stage, I was trying to understand not just medicine itself, but medicine's place within society—how individual behavior, professional culture, and broader social forces shape health and disease. Like many readers, I was drawn to **Malcolm Gladwell's** ability to translate complex social dynamics into stories that felt grounded in everyday life.

Over the years, I read several of his books as they appeared—*Blink, Outliers, What the Dog Saw*, among others. What stayed with me was less any particular conclusion than the way they sharpened how I noticed patterns—subtle dynamics operating beneath everyday behavior, institutions, and decision-making. Gladwell's strength has never been prediction so much as perception: an ability to surface hidden structures that quietly shape how systems function.

Reading *The Revenge of the Tipping Point* now, a quarter century later, feels less like revisiting an old idea and more like encountering its aftermath. This is not a book about how change begins. It is a book about what happens after systems have already changed—after they have tipped, settled into place, and begun to defend their new normal.

What struck me immediately is how medical many of Gladwell's examples are. Pharmaceutical marketing, prescribing norms, and the opioid crisis—particularly around oxycodone—feature prominently. These stories are not included for shock value. Rather, they illustrate how systems built to respond downstream can amplify harm even when upstream risks are recognized. In many cases, the dangers were known. The challenge was not ignorance, but constraint: financial incentives, institutional momentum, and professional norms made upstream correction difficult, even when warning signs were clear.

As a physician with a longstanding interest in prevention, this framing resonated deeply. For years, I have wondered why modern medicine—despite remarkable advances in diagnostics, genomics, biomarkers, and targeted therapies—continues to invest so heavily in late-stage intervention, while devoting comparatively little effort to preventing disease in the first place. We celebrate increasingly sophisticated tools for treating illness once it declares itself yet remain hesitant to reorganize care around avoiding that illness altogether.

This imbalance is difficult to justify. Primary prevention is often simpler. Secondary prevention is often more cost-effective. Tertiary prevention—care delivered after disease is advanced—is extraordinarily expensive, not only financially, but socially and humanly. And yet our healthcare system remains overwhelmingly downstream in its orientation, often mobilizing its greatest resources after harm has already become visible.

In the book's later chapters, particularly Chapter 9, "The Overstory," Gladwell introduces a concept that helps clarify why this pattern persists. He describes how systems become organized around dominant explanatory narratives—overstories—that shape which problems are recognized, which data are prioritized, and which solutions are considered legitimate. Once an overstory takes hold, new evidence may accumulate without immediately translating into meaningful change.

Consider cancer care. Evidence has long shown that early detection saves lives and reduces costs, and effective prevention and screening strategies exist for many cancers. Yet healthcare systems continue to invest far more heavily in treatment infrastructure than in upstream detection or prevention. The prevailing narrative—that cancer is something we primarily find and treat once it appears—continues to exert a strong influence. New evidence is often acknowledged, but it rarely reshapes how care is fundamentally organized.

While reasonable people may differ on how far this analogy extends, Gladwell's comparison to social epidemics is a useful one. In medicine, dominant norms—about what counts as legitimate care, where resources belong, and when intervention should occur—can stabilize over time and become self-reinforcing. Within such a framework, prevention, particularly primary prevention, sits uneasily: it is harder to see when it works, slower to reward, and disruptive to systems oriented around intervention after harm has already occurred.

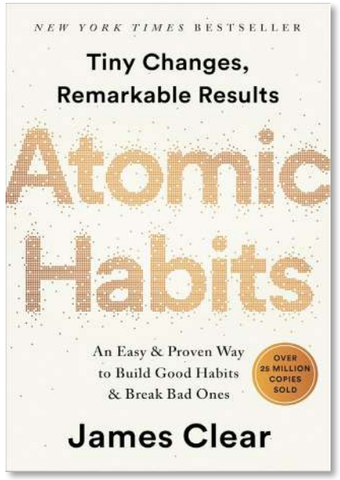
This framing helped me articulate something I had long sensed but struggled to name. The marginalization of preventive medicine is not simply a failure of evidence, imagination, or technology. It is, at least in part, the predictable outcome of systems that have already tipped toward downstream care—and that may now resist upstream reform, even when the rationale for prevention is strong.

Reading *The Revenge of the Tipping Point* as a physician is both unsettling and clarifying. Gladwell does not write for doctors, yet many of his observations land squarely within medicine. His stories remind us that some of our most persistent challenges are not technical problems awaiting better tools. They are structural problems—shaped by incentives, norms, and institutional narratives that are rarely examined.

Until we are willing to walk upstream—not only intellectually, but institutionally—the most elegant downstream solutions will continue to arrive too late.

Atomic Habits

An Easy & Proven Way to Build Good Habits & Break Bad Ones



Author: James Clear

In his book Atomic Habits, James Clear emphasizes the power of habits by compounding small changes that lead to remarkable long-term outcomes. With years of research in habit formation and seminar leadership around the U.S., Clear explains the four Laws of Behavior Change and how to use them to the reader's advantage. The four laws that he focuses on are (1) Make it obvious, (2) Make it attractive, (3) Make it easy, and (4) Make it satisfying. Clear employs numerous examples from across the world, in various disciplines, and his personal experience to explain the principles of habit formation.

The main premise of this book is that behavior change is driven by systems, rather than willpower. This is what makes this book so impactful. Rather than designating energy towards making changes that are unrealistic for a given person and their circumstances, Clear urges the reader to redirect the energy towards redesigning the environment and working with personality traits. He truly changes the perspective on habit formation and destruction by helping the reader become the person they want to be in a realistic fashion.

I see Atomic Habits to be a powerful tool for healthcare professionals in the treatment plan for many disease states in regards to lifestyle changes. As a future pharmacist, I hope to employ the concepts in this book to counsel my patients in smoking cessation, dietary recommendations, physical activity, medication adherence, and much more. I highly recommend this book for future healthcare professionals for not only for its impact on patients, but also for the benefit it can provide for students in school to manage a challenging curriculum while balancing personal life. Overall, it is entertaining and easy to read as the chapters build upon each other for sustainable habits.

Reviewed by Raveena Baskaran, PharmD Candidate

Raveena Baskaran is a second-year pharmacy student attending the Harrison College of Pharmacy at Auburn University. She is passionate about pharmacists' role in patient education and medication management. She is currently an Albert Schweitzer Fellow working with a partner to provide Internet Safety for children in grades 4-7. Baskaran hopes to become a clinical pharmacist working alongside physicians.

Physician's Perspective

Why I Often Recommend Atomic Habits to My Students

By Sanghyun Alexander Kim, MD

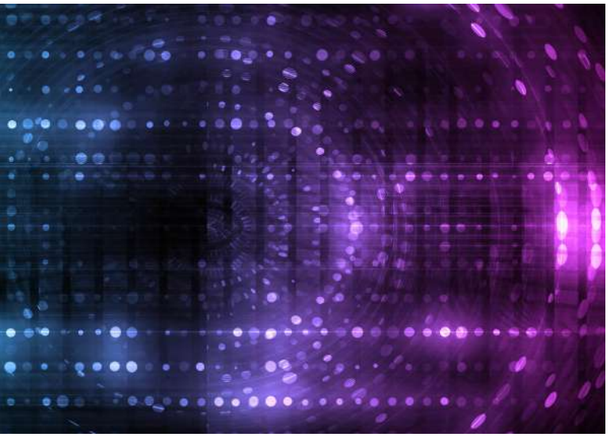
From the perspective of a senior physician who has spent decades in clinical practice, education, and leadership, Atomic Habits stands out as one of the most practical and applicable works on behavior change. What distinguishes this book is not lofty theory, but a clear, adaptable framework that can be readily integrated into daily professional and personal life. The principles translates well to healthcare settings, including efforts to improve personal wellbeing, enhanced productivity in demanding clinical environments, strengthening professional relationships, and developing effective leadership habits.

In medicine, surgery and pharmacy alike, sustained excellence rarely comes from dramatic, overnight change. Rather, it is the result of small, consistent behaviors practiced over time. For students and healthcare professionals who struggle with consistency, burnout, or motivation, Atomic Habits offers a grounded and realistic perspective: meaningful transformation is built through small, repeatable wins. This incremental approach mirrors how competence, judgment, and professionalism are truly cultivated in healthcare-one disciplined habit at a time.

AI & HealthTech: What Is It, and Why Now?

Medicine is entering a moment that feels quietly seismic. Artificial intelligence, advanced computing, and digital platforms are no longer peripheral to healthcare; they are moving into exam rooms, operating rooms, training programs, and health systems. Algorithms now read images, predict risk, flag deterioration, and shape decisions. Virtual tools simulate procedures and patients. Data flows across clinics, devices, and populations in ways that were difficult to imagine even a decade ago. Yet for many clinicians, this transformation is unfolding faster than it can be fully understood.

At NexBioHealth, we have always tried to bridge that gap—between what is technically possible and what is clinically meaningful. In recent issues, we explored how AI is reshaping medical education through the perspectives of students and trainees encountering these tools firsthand.



In this issue, **Dr. Daniel Katz and colleagues**, writing in our Medical Report section, extend that conversation by examining how AI-driven systems—from digital twins to intelligent simulation and decision support—are changing how physicians learn, train, and practice.

We open the **AI & HealthTech** section itself with a different, essential perspective. The inaugural feature of this section is an interview with **Sam Greengard**, a longtime technology journalist whose work has shaped how readers understand digital systems as they move from promise to practice. Greengard is not a clinician—and that is precisely the point. He has spent decades observing how technologies enter complex institutions, often revealing patterns that insiders are too close to see. His interview anchors this new section because it reminds us that technology does not arrive in healthcare as a neutral force; it reflects incentives, priorities, and values already embedded in the systems it enters.

Alongside this opening interview, we also feature work by **Saahil Chadha**, whose article in this section examines emerging AI-driven innovations and their potential applications in medicine. Drawing on current research, his contribution explores where technical promise meets clinical reality—an essential perspective for trainees and practitioners navigating this rapidly evolving space. Together, these voices—external, systems-level insight alongside emerging clinical and research perspectives-define what **AI & HealthTech** aims to be.

This section is not about hype, futurism, or product promotion. It is about understanding. We aim to give physicians, trainees, and healthcare leaders a clear, grounded way to engage with technologies that are already reshaping their work—what they do well, where they fall short, and what questions they demand we ask. Some voices will come from medicine; others will come from the broader worlds of technology, data, and systems design—because healthcare does not evolve in isolation.

Our goal is simple: to make AI and HealthTech legible, relevant, and human for the people who care for patients. We hope this section becomes a place where curiosity replaces anxiety-and where clinicians can begin to see not only what these technologies are, but how they may shape the future of care, education, and professional life.

Editors, NexBioHealth

Sam Greengard's Interview

AI in Healthcare, Seen from the Outside

A technology journalist on incentives, equity, and why AI reflects the systems we build

By Chul S. Hyun, MD, PhD, MPH

Editor's Note

This interview opens the inaugural **AI & HealthTech** section of NexBioHealth. We begin with Sam Greengard not to forecast the future of medicine, but to step back from it. His perspective-shaped by decades of observing how digital systems enter complex institutions-offers a way to examine artificial intelligence in healthcare without hype or inevitability.

What follows is a conversation about how AI actually takes hold, what it amplifies, and why its impact depends less on algorithms than on the values embedded in the systems that deploy them.

Artificial intelligence is rapidly becoming part of healthcare's infrastructure—shaping documentation, diagnostics, billing, and decision-making. Yet much of the conversation around AI remains internal, driven by clinicians, administrators, vendors, and technologists speaking largely to one another.

What is often missing is distance: an external vantage point that recognizes patterns across technologies, institutions, and time. As AI moves from promise to practice in medicine, that perspective becomes essential—not to slow progress, but to understand its direction.

AI doesn't fix broken systems-it accelerates them.

Q1. What feels fundamentally different about AI compared with earlier waves of technology?

A key difference between traditional digital technology and artificial intelligence is that AI is more than a new way to layer on efficiencies. If we look back through digital history—typewriters, personal computers, the internet, mobile phones—these inventions introduced shortcuts that allowed people to accomplish tasks faster and often better. However, they didn't replace human thinking.

AI "thinks" like a human brain, and generative AI sounds like a real person. Increasingly, AI eliminates the need for a human to handle a task. The repercussions are enormous. Right now, most AI systems automate low-value tasks, but as the technology advances, it will increasingly complement and even replace humans. Although doctors and nurses aren't going to become obsolete anytime soon, it's critical to acknowledge that AI will drive fundamental and systemic changes in healthcare.

Q2. Many physicians feel AI is being "done to them" rather than built with them. How does AI actually enter real-world systems?

AI remains in the early stages, and it is largely untested in many fields, including medicine. Right now, there's a tendency for healthcare systems to push new AI solutions out to medical professionals—and for busy professionals to reflexively resist changes.

Physicians must be honest and open-minded. It's easy to reject change simply because a new app or workflow is different. At the same time, it's important to avoid thinking that AI is a fix-all. The technology shouldn't replace human decision-making or put more distance between doctors and patients; it should serve as an assistant that can spot issues, provide second opinions, and streamline rote tasks.

Clinicians should take a proactive approach—providing honest feedback about what works and what doesn't, and getting involved in committees and task forces so that clinical expertise guides AI alongside executives and CIOs.

AI shouldn't replace judgment-it should support it.

Q3. What is one misconception about AI you most wish professionals would move past?

AI is extremely powerful, and it could profoundly change medicine in the years ahead. But it can't fix broken processes and systems. Right now, healthcare in the U.S. demands fundamental reform.

As AI evolves and AI agents appear—systems that can automate complex tasks independent of humans—there's a greater risk that things could go off the rails. With people's lives at stake, it's essential to reject the idea that AI is a utopian technology that will fix everything. If AI isn't used wisely, it could reduce the quality of care and magnify existing inequities—benefiting the affluent at the expense of the poor.

This is where physicians must be vocal. They have an important role in shaping how AI is actually used.

Q4. Is the future of AI in healthcare more likely to be slow transformation or sudden disruption?

There has been a lot of hype, and there will be disappointments. But clinicians who do not adapt to AI will face enormous challenges. A common pattern with powerful technologies is uneven early adoption, followed by a tipping point once systems mature and reach scale.

You don't need to become a technical guru, but you do need a basic level of understanding and proficiency. Staying informed is no longer optional.

REFLECTION & CLOSE

Q5. Was there a reporting moment that sharpened your concern about AI and equity?

I don't think there was a single "aha" moment. But one recurring theme in my reporting is that digital technologies often benefit certain groups—usually the privileged and affluent—while falling short for everyone else.

As a society, we can't let profits and cost savings serve as the North Star for AI design and use. They should be only part of the equation. We must factor in ethics and outcomes. Do we want to make the world better—or simply make a few people running AI companies richer?

Profit should never be the North Star for AI in medicine.

Closing Reflection

Greengard's perspective is notable not because it rejects AI, but because it resists inevitability. Across his answers runs a consistent theme: technology reflects incentives. AI does not arrive as a neutral force—it inherits the values, priorities, and blind spots of the systems that deploy it.

For clinicians navigating AI's growing presence, the takeaway is not that they must become futurists or technologists. It is that their role as stewards of care gives them a responsibility to question how AI is introduced, what problems it is meant to solve, and whose interests it ultimately serves. In healthcare, the future of AI will be shaped not only by algorithms, but by the human choices surrounding them.

Reading Technology Through Its Consequences

The Internet of Things (MIT Press)
An exploration of how connected systems quietly reshape industries—an idea that resonates as AI becomes invisible infrastructure in healthcare.

Virtual Reality (MIT Press)
A study of how immersive technologies alter perception and behavior, reinforcing a central theme in Greengard's work: technology's impact is defined less by novelty than by human adaptation.

Harnessing AI to Personalize Care for Brain Metastases

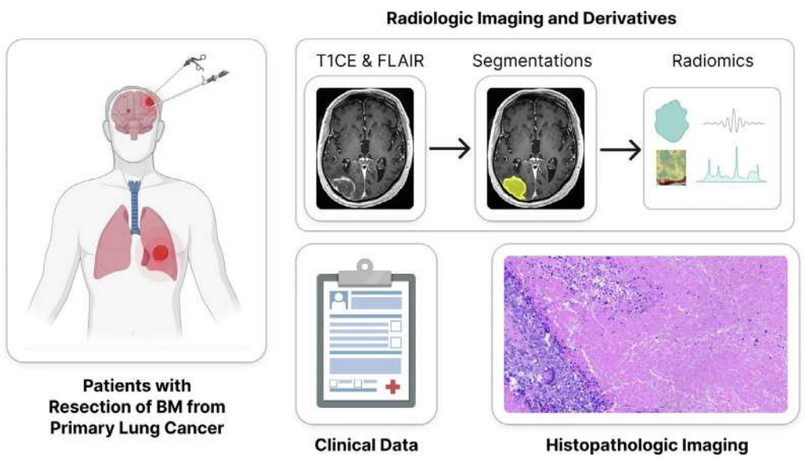
By Saahil Chadha

ChatGPT was released during my first semester of medical school, and it immediately transformed the way that I learned. Suddenly, I was able to use AI to break down complex physiology, generate clinical vignettes, and walk through diagnostic reasoning step by step. As I progressed, I soon realized the same technologies helping me to study for exams were quickly being applied to patient care, helping with clinical decisions and treatment planning.

Rather than simply using these tools, I became increasingly curious about how they worked and what their limitations might be in clinical settings. With an interest in oncology, I was especially drawn to questions about whether AI could meaningfully help address some of the uncertainty that surrounds cancer care. This interest led me to pursue a dedicated research year at Yale, working with Dr. Sanjay Aneja. Our lab leverages deep learning to develop image-based biomarkers for cancer patients, and my work in particular focuses on improving prognostication for lung cancer patients with brain metastases.

The Problem

For patients with lung cancer, the development of brain metastases is often a clinical and emotional turning point. Occurring in up to forty percent of this population, such intracranial tumors can cause neurologic symptoms, cognitive decline, and highly variable survival.1 Some patients live for years with aggressive therapy, while others decline rapidly despite similar treatment, making high-stakes decisions, such as surgery, radiation, or systemic therapy, especially difficult. Indeed, brain metastases vary widely in size, location, growth pattern, vascularity, and histology, even among patients with the same primary tumor subtype. Traditional prognostic tools, based on clinical factors, capture population-level trends, but they are less informed by the underlying biology driving outcomes in individual patients. Rich quantitative information embedded in radiologic scans, tissue slides, and longitudinal clinical data remains underutilized, which led us to ask: what if AI could integrate these diverse datasets to produce patient-specific predictions that meaningfully inform clinical decision-making?



AI and Multimodal Modeling

A Published Dataset

To explore the potential of AI in brain metastases, our team partnered with Dr. Don Nguyen and Dr. Darin Dolezal in the Department of Pathology at Yale to assemble a dataset designed to capture the complexity of lung cancer brain metastases. A key strength of our dataset is its multimodal design, which integrates multiple types of information from the same patients, including imaging, pathology, and clinical data. Each of these modalities provides a different window into the biology of the tumor, and integrating them allows a more complete, patient-specific view than any single type of data could provide. The fully annotated dataset is publicly available through The Cancer Imaging Archive at the National Institutes of Health, offering a resource for reproducibility and collaboration.2

The dataset links three core components:

Pre-operative brain MRI, including multiple imaging sequences.

Matched whole-slide histopathology images from brain metastasis tissue.

Detailed clinical data, including patient demographics, tumor characteristics, key molecular markers, and established prognostic scores.

By aligning these modalities at the patient level, we sought to create a more faithful representation of the disease. For radiologic imaging, brain metastases were segmented to delineate tumor boundaries, and radiomic features were extracted to quantify tumor shape, intensity, and texture, properties that may reflect growth patterns, vascularity, and surrounding edema. Digitized whole-slide histopathology images were also included, providing the foundation for AI tools that could analyze subtle histologic patterns beyond traditional descriptors such as grade or morphology.

Making the dataset publicly available supports external validation, methodological comparison, and broader participation, particularly for trainees and early-career researchers who may lack the resources to assemble large multimodal datasets independently. In a rapidly evolving field like AI in oncology, shared benchmarks are essential for meaningful progress, and the integration of imaging, pathology, and clinical data makes this dataset uniquely positioned to advance patient-specific modeling.

Ongoing Work in Survival Prediction

Building on this foundation, our lab is also actively exploring deep learning models for survival prediction. Traditional survival models, such as Cox proportional hazards models, are interpretable and familiar to clinicians, but they have limitations. They assume simple relationships between variables and struggle with high-dimensional inputs, like the data that we extract from images. Complex interactions such as how tumor shape modifies the prognostic significance of clinical variables are difficult to capture.

Preliminary results from our ongoing work suggest that combining quantitative radiologic imaging features with clinical data may improve prognostic accuracy compared with clinical information alone. In parallel, Dr. Greg Breuer is leading efforts to apply AI to digitized pathology slides, allowing the models to detect subtle patterns in cells and surrounding tissue that are invisible to the naked eye. Bringing pathology and clinical data together in this way may reveal new insights, particularly for predicting patient outcomes.

Together, these approaches represent a shift in how prognostic information can be captured, moving from simple summary descriptors toward richer, biologically informed representations that better reflect the complexity of individual tumors. While this work is ongoing, early results are encouraging and highlight the potential of multimodal AI to provide patient-specific insights without requiring new tests or experimental assays.

Toward Point-of-Care Decision Support

The goal is to embed these models within clinical workflows. In practice, this could mean systems that automatically

Saahil, Dr. PI and team members

extract radiologic imaging features, pathology embeddings, and clinical variables from the electronic health record to provide tailored decision support. Such tools could help clinicians weigh treatment options, identify patients for clinical trials, and have more informed prognostic conversations while preserving clinician judgment. Crucially, these tools are designed to support rather than replace physicians, offering additional insights to help improve patient care.

Building Scalable and Ethical AI

As AI becomes increasingly integrated into healthcare, technical innovation must go hand in hand with ethical and practical safeguards. Issues such as scalability, data privacy, and bias are central to responsible deployment, also impacting public perception and acceptance.3 Ongoing work at the Aneja Lab includes developing computationally efficient neuro-oncologic image segmentation models, exploring federated learning approaches to enable multi-institutional collaboration without centralized data sharing, and systematically evaluating model performance across patient subgroups to promote equity.4

The promise of AI in oncology lies not just in creating better models, but in building systems that are trustworthy, transparent, and aligned with clinical realities, helping make patient care more precise, personalized, and data-driven.

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Saahil Chadha

MD Candidate, Class of 2027, Yale School of Medicine

Saahil Chadha is a fourth-year medical student at Yale School of Medicine. Originally from Excelsior, Minnesota, he studied computer science at University of California, Berkeley, before working as a software engineer at Amazon. He later brought this technical foundation into medicine, where his interests lie at the intersection of artificial intelligence, cancer imaging, and clinical care.

At Yale, Saahil conducts research in the Aneja Lab, where he develops AI models to analyze radiologic and pathologic data with the goal of creating imaging-based biomarkers that can personalize treatment and improve outcomes for cancer patients. His current work focuses on how multiple data sources can be integrated to improve prognostication, with particular attention to patients with brain metastases.

Looking ahead, Saahil plans to pursue residency in internal medicine while continuing his research on AI applications in medicine. Beyond research and clinical training, he is interested in medical education and community-building. He also plays viola in the Yale Medical Symphony Orchestra.

Sanjay Aneja, MD

Sanjay Aneja, MD is an Assistant Professor within the Department of Therapeutic Radiology at Yale School of Medicine. Dr. Aneja is a physician scientist whose research group is focused on the application of machine learning techniques on clinical oncology. He received his medical degree from Yale School of Medicine and served as class president. During medical school he completed a research fellowship at the Department of Health and Human Services in large scale data analysis. He later completed his medicine internship at Memorial Sloan Kettering Cancer Center followed by his residency in radiation oncology at Yale-New Haven Hospital. During his residency he completed his post-doc in machine learning at the Center for Outcomes Research and Evaluation (CORE) receiving research grant from IBM Computing. He is currently a recipient of an NIH Career Development award, an NSF research grant, and an American Cancer Society research award.

When AI Redesigns Global Healthcare

How trust, systems, and accountability—not technology alone—are reshaping care across borders

Editor's Note

Artificial intelligence in healthcare is often discussed in terms of tools, algorithms, and efficiency gains. This article anchors NexBioHealth's AI & Health Tech section by shifting the focus outward—from technology itself to the systems it reshapes. Rather than asking what AI can do, it explores how AI is redefining global healthcare connectivity, professional trust, and accountability across borders.

For decades, global healthcare has been framed around patient movement—individuals crossing borders in search of better care. Hospitals built international wings, countries marketed themselves as destinations, and success was measured by volume. That model is now being outgrown. What is emerging is not a digital upgrade of medical tourism, but a redefinition of global healthcare itself—one shaped by systems, professional trust, and long-term accountability, with artificial intelligence acting as a catalyst rather than the centerpiece.

From Patient Travel to System Design

Traditional medical tourism is episodic by design: patients travel, receive care, and return home, often without clear follow-up or shared responsibility. The burden of continuity frequently falls back on local clinicians who had little involvement in the original care. Outcomes are difficult to track, accountability is diffuse, and learning rarely travels with the patient.

Artificial intelligence begins to alter this dynamic by introducing repeatability into healthcare systems. Protocols become portable. Quality benchmarks become more visible. Expertise becomes accessible beyond geography. This does not replace physicians; it amplifies clinical judgment by embedding it within transparent, structured pathways rather than isolated encounters.

As a result, global healthcare systems can begin to ask different questions: Which patients truly need to travel? When can care remain local with remote support? How should outcomes be monitored after patients return home? Who remains responsible across borders? These are not technical problems. They are system-design challenges—and they define the next phase of global healthcare.

When Trust Becomes Infrastructure

Healthcare has always depended on trust, but trust historically scaled slowly through individual relationships. In practice, physicians rarely trust hospitals first; they trust other physicians—through shared training, research collaboration, and repeated clinical interaction. Artificial intelligence does not create trust, but it allows parts of trust to be operationalized through shared data, aligned protocols, and sustained communication.

When professional accountability is built into systems, patient movement becomes safer and more selective. Trust moves first between clinicians; patients follow within defined pathways rather than marketing funnels. AI makes it possible to support this model at scale—by enabling coordination, visibility, and feedback that extend beyond a single episode of care.

This shift is increasingly visible across the global healthcare industry. International forums are beginning to look beyond attracting foreign patients and toward how artificial intelligence can support cross-border collaboration, physician training, quality oversight, and continuity of care. One example is Medical Korea 2026, a major global healthcare conference scheduled for March 19–22, 2026, in Seoul, where AI-powered healthcare is being introduced as a forward-looking theme within a broader global health agenda. The importance lies less in the event itself than in what it signals: AI is increasingly being recognized not as an add-on, but as a structural enabler of new global care models. As healthcare becomes more interconnected, success will no longer be defined by facilities alone, but by ecosystems. Durable systems will combine digital platforms, physician-to-physician networks, AI-supported quality frameworks, and mechanisms for shared learning and accountability. In this model, global healthcare is not primarily about moving patients efficiently—it is about moving trust responsibly. When trust, knowledge, and responsibility travel farther than any individual journey, global healthcare becomes not only more connected, but more precise, equitable, and sustainable.

Chul S. Hyun, MD, PhD, MPH
Publisher, *NexBioHealth*

How to Earn Honors in Clinical Rotation?

Dear Mentor,

I am currently a second-year student, and I just started my clerkships! I am super excited about the hands-on learning, but I am worried about standing out and making a good impression on my preceptors. Do you have any advice on what makes an exceptional 'honor' medical student on rotations?

Thanks!

Emily Wang
MS2 Hackensack Meridian School of Medicine

Dear Emily,

This is a question as old as medical education itself, and still very relevant. The first thing I'll say (perhaps controversially) is that clinical evaluations are subjective and often imperfect. They can feel validating when you're labeled "excellent," and disproportionately discouraging when you're not. That said, they do carry real consequences for your future, so it's reasonable to want to understand how to excel. What follows is one resident's perspective, offered with the goal of helping you put your best foot forward and maximize your chances of earning honors.

Before clinical rotations even begin, know your school's grading structure. At my medical school, clinical evaluations could make up anywhere from 20–70% of a rotation grade, with additional requirements such as OSCEs or shelf exam cutoffs needed to qualify for honors. Those latter components are far more objective (and controllable) so they deserve deliberate preparation. For example, I made it a habit to complete all relevant UWorld questions during each rotation and then redo my incorrects. That strategy consistently helped me score above the 80th percentile on shelf exams and removed a major source of stress from the equation.

Because evaluations are inherently subjective, your assigned preceptors can heavily influence your final grade. Some evaluators are generous with 5/5's while others are notoriously stringent. When possible, be thoughtful about rotation sites and preceptors. Word of mouth from upperclassmen is often surprisingly accurate and worth listening to!

When it comes to the rotation itself, I won't offer the usual "just be yourself" or "be normal." The reality is that the wards come with unspoken expectations, whether or not anyone actually states them. Instead, here are some general principles to keep in mind.

Be on time and be prepared. Showing up reliably and knowing your patients earns trust quickly. While you're still a learner, preparation allows you to take on real responsibility. For example, I am happy to let a student suture (even with awkward knots and all) if that student has clearly read and practiced the basics.

Have a good attitude. Ask genuine, thoughtful questions. Try not to ask things that can be answered with a quick search unless they're contextual ("Why do you do it this way?" is very different from "What is X?"). Remember that we choose our specialty because we care deeply about it, so showing sincere interest and respect goes a long way.

Understand hospital social norms. Be kind and respectful to everyone-nurses, techs, attendings alike. Avoid taboo or overly personal topics (drinking, drugs, gossip), even if the vibe feels casual. Be hygienic, wear appropriate and clean attire, and don't distract busy residents or attendings when they're managing urgent clinical tasks.

Know when to leave and when to stay. If you're told to go home, take that permission graciously. Sometimes having a student around can genuinely slow things down. That said, if you want to stay and help, make your offer concrete. Everyone knows that "Can I help with anything else?" often means "Can I leave?"-which is fine. But if you actually want to contribute, offer something actionable: "I can call that consult," "I'm happy to write the note," or "I can walk the patient to imaging."

Remember that being an "honors" student is less about perfection and more about being reliable, prepared, curious, respectful, and easy to work with. If residents feel that you make their day even slightly easier, and attendings feel they can trust you with patients, you're already doing everything you can. I wish you the best of luck during your clinical rotations!

Andrew Lee, MD. PGY2

Dr. Andrew Lee is currently a second year otolaryngology-head & neck surgery resident at Loma Linda University in southern California. He studied chemistry at Seattle Pacific University and completed his medical school training at Dartmouth Medical School. His academic interests include head-and-neck oncology as well as thyroid endocrine surgery.

The Evolution of Medical Education

Dear Mentor,

Stephen Park

Dr. Levine,

Hello! My name is Stephen Park, and I am currently a first year undergraduate student at Washington University in St. Louis (WashU) seeking guidance as I learn more about medical school. I often hear that medical education is a constantly evolving field. I was wondering in what ways the education transforms, and also how those changes influence the way trainees come to view medicine itself. From your experience, how have you seen medical education transform, and what impact do you think these changes have on the way trainees grow into their roles as future physicians?

Thank you for your time and guidance.

Dear Stephen,

Medical education truly transforms a learner-from an undergraduate with broad, general knowledge into a medical trainee developing the focused expertise required for a specific specialty. Beyond the foundational "book knowledge," medical training teaches students how to think: how to reason clinically, how to incorporate social determinants of health into care, and how to communicate clearly and compassionately with patients. Through this process, new students and physicians begin to understand the weight of the responsibility they carry-quite literally holding people's lives in their hands. Immersion in the healthcare system also exposes them to the benefits, challenges, and inequities within American medical care.

Over the 20+ years I have been practicing, I have watched medical education and clinical practice evolve significantly. Innovations such as electronic medical records, computerized lab and radiology reporting, and rapid advances in research and technology have reshaped the landscape. There has also been an important reckoning with mistakes and injustices committed in the past by physicians and the healthcare system. While these technological efficiencies have improved access to information and streamlined workflows, they have also unintentionally removed some of the personalization from medicine, contributing to a model that can feel more like a business than a deeply human profession.

Despite these challenges, today's students have unprecedented access to information and are more engaged with ongoing research than ever before. This allows them to make well-informed, evidence-based decisions for their patients. There is also greater awareness of trainee well-being and mental health, which fosters healthier, more resilient physicians and helps reduce burnout and attrition. Additionally, there is a stronger sense of camaraderie among physicians-a shift that ultimately supports better care for patients.

Overall, the evolution of medical education shapes trainees not just as clinicians, but as thoughtful, informed, and compassionate future physicians.

Mark D. Levine, MD, FAEMS

Mark D. Levine, MD, FAEMS, is a Professor of Emergency Medicine at Washington University School of Medicine and an attending physician at Barnes-Jewish Hospital and Barnes-Jewish West County Hospital. A board-certified specialist in both Emergency Medicine and Emergency Medical Services, Dr. Levine has more than two decades of experience as a clinician, educator, and EMS medical director. He has served in key leadership roles with the St. Louis Fire Department, where he has contributed to protocol development, disaster planning, and operational medical support.

An award-winning educator, Dr. Levine directs multiple medical student rotations, leads simulation-based curricula, and has mentored dozens of trainees across all levels. He is the lead editor of The Washington Manual of Emergency Medicine and a frequent national speaker on EMS operations, airway management, and prehospital care. Dr. Levine also serves on numerous national committees focused on EMS standards, operations, and medical education.

Q&A with Dr. Ansley Baccus: Enjoying Medical Education

By Kendrick Yu

Kendrick Yu, MS3 at the University of Birmingham Heersink School of Medicine, interviews Dr. Ansley Baccus, a family medicine physician and family medicine clerkship director, on the inner workings of medical education and how students can position themselves for growth. Dr. Baccus shares her inspirations and goals as a practicing physician and clinic director, along with valuable advice and insights for current medical students.

Editor's Note: Questions and answers are not direct quotations. Paraphrasing and edits were made to accommodate for the article's flow and style. The interview was held via Zoom.

Kendrick: Could you introduce yourself?

Dr. Baccus: My name is Ansley Baccus. I am from North Alabama, did my undergraduate and medical school at the University of Alabama at Birmingham (UAB; 2015), and I did my family medicine residency in Tuscaloosa, Alabama (2018). I started out in private practice but quickly found a passion for academics in 2022, so I returned to the Tuscaloosa residency program to work with medical students and residents. Within 2 years, I took over for the family medicine clerkship.

Kendrick: Although you started off in private practice, was education ever planned to be a part of your future?

Dr. Baccus: It [education] was always part of what I did in undergrad as a chemistry major. I was a chemistry teaching assistant, tutored, and I come from a long line of family members that are teachers. My dad was a teacher and now a principal, and my sister is currently a science teacher... But when I first got out of medical school and residency, I felt like I needed to get away and stretch my legs.

My husband, an internal medicine physician, partnered with his residency program immediately, and he would do rounds in the hospital and took medical residents to my clinic. I would help them with things like women's health procedures, and I also partnered with the local nursing school and had nurse practitioners rotating through the clinic. I quickly realized that teaching them was the fun part of my job and made it my full-time job.

Kendrick: When it comes to being the head of the family medicine clerkship, are there specific principles or priorities you have when approaching medical school education?

Dr. Baccus:The basis of family medicine is long term relationships with the patients and getting involved with the community. You treat the patient, not the disease. Instilling this idea in students is the cornerstone of family medicine. But overall, I want to ensure my students are enjoying themselves in academics and striving to be lifelong learners because that is necessary in this field.

Kendrick: How do you think a positive learning experience changes a student's perspective on medicine as a whole?

Dr. Baccus: I remember being a student, getting bogged down and worrying, "Am I getting the right answer? Am I doing the right thing? Am I checking the right boxes so my preceptor can give me honors?" Because I was worrying, I missed the fun of learning new things and valuing the process of learning. It is also important to never forget you are taking care of real people. You are an integral part of their care even if you are "just a medical student." The decisions you help make as part of the healthcare team affect their lives. Sometimes this is lost in the noise of the medical grading system, and you shouldn't learn for the multiple-choice question. You should learn for your life and future patient care. I think these concepts are hard to grasp when bogged down by studying.

Kendrick: What mindset do you see in students that are successful in medicine?

Dr. Baccus: I think being open-minded and adaptable. You never know what situation you will be in or what type of patient will walk through the door. If you're so focused on the right thing, you may miss the minutia and the small things. Taking the pressure off yourself and being more open-minded is a good quality to have... in family medicine and different communities, you meet with all types of people. You must be open to types of lifestyles, ages, religions, and backgrounds. Some speak different languages so, being comfortable with interpreters. You have to be nonjudgmental and be open to the things that you don't understand. You might have to get the patient to explain to you because you want to treat the patient in THEIR environment.

Kendrick: Not everyone is good at doing these things when they first enter the clinic. What are some goals that students can set for themselves to grow?

Dr. Baccus: First, self-reflection and understanding where your areas of weakness are. This is hard, but finding an area, such as taking patient history, taking notes while the patient is talking, performing parts of the physical exam, and being open with your preceptor on what you want to improve on. Finite and small goals. Maybe the whole patient history is too broad to work on but maybe it's asking pertinent questions for hypertension or getting better at social history. Getting a preceptor to note what you are trying to improve on will help them help you a little bit better.

Kendrick: Do you feel like there was something that you wish your medical education had that you are trying to implement in your current teaching?

DB: I think... feeling like you're an integral part of the team instead of being on the lowest level of the totem pole and developing a relationship with the preceptors that I did not get. I want to show students that we [physicians] are humans and are not infallible. We make mistakes. I try to get closer to students through events and student-led activities to make them feel comfortable. I learned that being comfortable leads to a better learning environment compared to something that is extremely stressful. I want students to look forward to the clinic because you have a relationship with the person that's teaching you.

Kendrick: What should a medical student's MAIN goal in their clinical rotations be?

Dr. Baccus: It's more important to enjoy learning than the grade. It is getting more difficult to do this with STEP 1 turning into pass/fail. Everyone is trying to find ways to distinguish themselves in their residency applications. The worry shifted from STEP 1 grades to STEP 2 scores, honoring the clerkship, and research and publications. In worrying about the future, students don't take part in and appreciate the present, so we lose the value of the learning experience. I would like to really encourage students to let go of the worry. When you learn and enjoy what you are doing, and you are doing it for the right reasons, you will ultimately stand out compared to if you were gunning for a specific grade.

Kendrick: As an educator, what motivates you to continue teaching?

Dr. Baccus: It's the small things like seeing a student finally grasp a topic or nail a presentation. Every little thing the student does well, and you can see their face light up. Those are the small wins that I celebrate. Each time I see that, it reinforces that I am doing what I should be doing. This culminates in match day when I see the students I developed a relationship with and thinking about the small role I may have played in their development. It's all paid off when I see them walk across that stage. I enjoyed your match days more than mine. Seeing the scared first year to the competent fourth year and seeing how you are excited about medicine.

Kendrick: Anything else you would like to tell the students?

Dr. Baccus: Ultimately, it's worth it and you will get there. It's hard to see that in the beginning. I didn't have a good medical experience. I was not a great student, and it was hard for me. I made it through, and I believe anyone else can for the right reasons. So, going in with an open mind and doing it for the right reasons, you'll ultimately get there. But don't forget to take care of yourself in the process. You need to eat. You need to sleep. You need to have relationships and get out of the house. So, take care of yourself. You can't take care of others if you can't take care of yourself.

Also, your colleagues are your family. Lift them up because you never know what they are struggling with, and your small act of kindness may be the thing that gets them through difficult times. Support your fellow students and celebrate each other's accomplishments!

Ansley Omega Hairrell Baccus, MD
Family, Internal, and Rural Medicine Clinic Director

Dr. Baccus is a native Alabamian and family medicine physician, graduating from UABHSOM in 2015 and Tuscaloosa family medicine residency program in 2018. She has been in medical practice for 6 years, academia for 3 years and the family medicine clerkship director for 2 years with a professional interest in education and lifestyle medicine. She is happily married to fellow internal medicine physician, Dr. Jon Tyler Baccus and they have 2 children: Elijah, 7 years, and Delilah, 2 months.

UPCOMING CONFERENCE ALERT

WHX Dubai (formerly Arab Health)
Dates: February 9–12, 2026
Location: Dubai, UAE

Focus: One of the world's largest medical exhibitions, showcasing global healthcare innovations and industry networking.

https://www.worldhealthexpo.com/events/healthcare/dubai/en/home.html

Primary Care Conference Hawaii 2026
Dates: February 22–26, 2026
Location: Honolulu, HI

Focus: CComprehensive updates in primary care, family medicine, and internal medicine for practicing clinicians.

https://primarycarehawaii.com/

Global Engagement & Empowerment Forum (GEEF) 2026
Dates: March 12–13, 2026
Location: Yonsei University, Seoul, South Korea

Focus: International forum on sustainable development, global engagement, and empowerment; brings together global leaders, experts, and stakeholders to collaborate on advancing the UN Sustainable Development Goals.

https://www.geef-sd.org

Medical Korea 2026 (KIMES- Korea International Medical & Hosp)
Dates: March 19–22, 2026
Location: Seoul, South Korea

Focus: Korea's largest healthcare expo, featuring innovations in medical equipment, digital health, and hospital systems.

https://kimes.kr/en

International Congress on Integrative Medicine and Health 2026
Dates: April 21–23, 2026
Location: Salt Lake City, UT

Focus: Whole health approaches, integrative therapies, and community-based models of care.

https://imconsortium.org/page/2026-international-congress

American Hospital Association (AHA) Annual Meeting 2026
Dates: April 19–21, 2026
Location: Washington, D.C.

Focus: Leadership, advocacy, healthcare policy, and strategic initiatives in hospital systems.

https://annualmeeting.aha.org/

Innovations in Medical Education (IME) Conference 2026
Dates: February 11–12, 2026
Location: Los Angeles, CA & Online

Focus: Exploring cutting-edge methods and innovations in medical education for students and faculty.

https://sites.usc.edu/ime-conference/

Stomach Cancer Patient Empowerment Summit & Gastric Cancer Advocacy Day
Dates: March 7–10, 2026
Location: Washington, D.C.

Focus: A national, biannual summit designed to empower stomach cancer patients, caregivers, and survivors through education, community support, and expert-led sessions. The event includes interactive panels, networking with medical professionals, and concludes with an advocacy day on Capitol Hill to raise awareness and promote policy change for gastric cancer research and care.

https://stocan.org/stomach-cancer-patient-empowerment-summit/

HIMSS Global Health Conference & Exhibition
Dates: March 9–12, 2026
Location: Las Vegas, NV

Focus: Health IT, digital transformation, AI, cybersecurity, and leadership.

https://www.himssconference.com

Society of Critical Care Medicine – Critical Care Congress 2026
Dates: March 22–24, 2026
Location: Chicago, IL

Focus: Advances in intensive care, sepsis management, team-based practice, and education.

https://sccm.org/annual-congress/critical-care-conference

Business Group on Health 2026 Annual Conference
Dates: April 22–24, 2026
Location: New Orleans, LA

Focus: Employer-based healthcare innovation, benefits design, wellness, and policy.

https://www.businessgrouphealth.org/annual-conference

Digestive Disease Week® (DDW) 2026
Dates: May 2–5, 2026
Location: Chicago, Illinois (McCormick Place) and online

Focus: One of the largest and most prestigious conferences in gastroenterology, hepatology, endoscopy, and GI surgery — featuring scientific sessions, poster presentations, educational courses, and industry exhibits for clinicians and researchers.

https://ddw.org

UPCOMING ISSUE

The New Global Health

How ideas, people, and innovation are transforming medicine across borders

For decades, global health was shaped by large institutions, national programs, and one-way models of aid. But today, medicine moves very differently. Breakthroughs now travel through international research partnerships, diaspora communities, digital platforms, and cross-border innovation networks. A technology developed in Seoul, a discovery from New Haven, or a clinical insight from Boston can now influence care far beyond where it began. Global health has become a dynamic, interconnected system - no longer confined by geography or bureaucracy.

In this special May issue, *NexBioHealth* explores **The New Global Health** through the lens of modern academic and clinical ecosystems, including collaborations spanning **Yale, Yonsei, Harvard, and partners around the world.** We highlight how science, equity, and technology are converging to create new pathways for impact - from precision medicine and AI to community-based prevention and global mentorship. This is global health as it is truly practiced today: **collaborative, borderless, and driven by people, ideas, and shared purpose.**

The *NexBioHealth* Editorial Team

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Korea Health Industry Development Institute

KHIDI
Promoting Healthcare Industry

KHIDI is a government-affiliated organization dedicated to fostering innovation and driving global competitiveness in Korea's biohealth industry.

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- Promoting Korean healthcare services
- Hosting global events (MEDICAL KOREA, BIO KOREA)

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