

Revitalizing Neurology Practice: Integrating Health Humanities, Neurobiology, and Digital Innovation

Revitalizando a Prática em Neurologia: Integrando as Humanidades em Saúde, Neurobiologia e Inovação Digital

The philosophies of one age have become the absurdities of the next, and the foolishness of yesterday has become the wisdom of tomorrow.

William Osler

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ABSTRACT

Rapid changes in medical education are being fueled by advancements in science, technology, and societal structures. However, the traditional medical curriculum often struggles to keep pace with the evolving demands of medical practice in light of these advancements. Neurology presents distinctive challenges in modern medicine, requiring innovative solutions to improve patient care and support the well-being of healthcare providers. This essay delves into the intricate issues encountered by neurologists, such as the diminishing interpersonal connections in the medical field and the prevalent issue of burnout among professionals, exacerbated by outdated educational programs. This research advocates for a comprehensive approach to enhancing neurology practice through the perspectives of Medical Humanities (MH) and neurobiology, within the evolving realm of Neurohumanities. By integrating state-of-the-art neurobiological findings, MH/Neurohumanities, and a focus on empathy, the article proposes practical strategies to rejuvenate clinical practice and bolster the resilience of neurology practitioners. Furthermore, it underscores the untapped potential of artificial intelligence and machine learning while examining how the digital ecosystem could revolutionize neurology medical education. Grounded in evidence-based research and practical insights, this article offers valuable guidance for navigating the complexities of contemporary neurology practice and cultivating a workforce of healthcare professionals who possess both technological acumen and compassion.

Keywords: Neurology Practice, Medical Humanities, Neurobiology, Healthcare Professionals, Patient Care, Practitioner Burnout, Medical Education

RESUMO

Mudanças rápidas na educação médica estão sendo impulsionadas pelos avanços na ciência, tecnologia e estruturas sociais. No entanto, o currículo médico tradicional frequentemente luta para acompanhar as exigências em constante evolução da prática médica diante desses avanços. A neurologia apresenta desafios distintos na medicina moderna, exigindo soluções inovadoras para melhorar o cuidado ao paciente e apoiar o bem-estar dos profissionais de saúde. Este ensaio explora as questões complexas enfrentadas pelos neurologistas, como a diminuição das conexões interpessoais no campo médico e o problema prevalente do esgotamento entre os profissionais, exacerbado por programas educacionais desatualizados. Esta pesquisa defende uma abordagem abrangente para aprimorar a prática da neurologia por meio das perspectivas das Humanidades Médicas (HM) e da neurobiologia, dentro do campo em evolução das Neuro-Humanidades. Ao integrar descobertas neurobiológicas de ponta, HM/Neuro-Humanidades e um foco na empatia, o artigo propõe estratégias práticas para rejuvenescer a prática clínica e fortalecer a resiliência dos profissionais de neurologia. Além disso, destaca o potencial inexplorado da inteligência artificial e da aprendizagem de máquina ao examinar como o ecossistema digital poderia revolucionar a educação médica em neurologia. Fundamentado em pesquisas baseadas em evidências e insights práticos, este artigo oferece orientações valiosas para navegar pelas complexidades da prática contemporânea da neurologia e cultivar uma força de trabalho de profissionais de saúde que possuam tanto acuidade tecnológica quanto compaixão.

Palavras-chave: Prática de Neurologia, Humanidades Médicas, Neurobiologia, Profissionais de Saúde, Cuidado ao Paciente, Esgotamento do Profissional, Educação Médica

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INTRODUCTION

Neurological disorders stand as the primary contributor to both disability and mortality, necessitating creative, adaptable, and enduring remedies. The promotion of brain health has emerged as a worldwide imperative, highlighted by the endorsement of the World Health Organization's Intersectoral Global Action Plan in 2022¹².

As William Osler's quote presented at the beginning of this paper suggests, human understanding and perception are dynamic, evolving over time. What may appear wise or foolish in one era can evolve into its opposite in the future, emphasizing the importance of adaptability and openness to new ideas as knowledge progresses. These changes have impacted various aspects of education, including learners, teachers, content, methods, assessments, and outcomes. Emerging areas such as health systems science, Medical Humanities (MH), diversity, equity, inclusion, and health disparities have become integral to neurology curricula. Additionally, advancements in technology and a better understanding of learning science have influenced how material is taught and absorbed⁷.

Neurology, as a field, is at the forefront of medical innovation but faces persistent challenges that threaten patient care quality and professional well-being. From the erosion of human connection in healthcare delivery to increasing rates of burnout among neurology professionals, these challenges necessitate a paradigm shift in neurology practice. Lekka et al.⁵ emphasize the significance of language in the hospital environment, suggesting that health professionals' choice of words can either provide comfort or perpetuate dehumanization among patients. They highlight factors such as heavy workloads, bureaucratic hurdles, profit-driven economic agendas, and socioeconomic disparities between doctors and patients as exacerbating dehumanization. Moreover, they point out that medical education emphasizing organ-specific treatment over holistic patient care, excessive reliance on technology, and a lack of empathy can contribute to patient dehumanization in healthcare settings.

The CanMEDS Physician Competency Framework¹¹, formulated in the 1990s, aligns physician abilities with societal demands, delineating eight pivotal roles: medical expert, communicator, collaborator, health advocate, learner, manager, scholar, and person. Its global and domestic adoption has significantly influenced medical education. However, given the dynamic context, successive revisions have been undertaken. Recent developments, including the COVID-19 pandemic, increased awareness of oppression, concerns about climate change, and technological advancements, highlight the need for ongoing updates¹¹.

In response, this article advocates for an integrative approach that bridges the domains of MH and neurobiology, leveraging diverse disciplines' collective

wisdom to address the multifaceted challenges facing neurology. By exploring the intersections between compassion, exposure to the humanities, and neuroscientific advances, this study aims to illuminate pathways toward a more holistic and resilient neurological practice. Additionally, it examines the transformative potential of digital technologies in reshaping neurological education and clinical decision-making, envisioning a future where innovation and humanism converge to enrich patient care and professional well-being.

The intersection of technology, health, and medicine produces impressive advancements in the ever-evolving field of healthcare, despite noteworthy obstacles. The context for examining the difficulties and potential fixes at the nexus of these disciplines is established by this introduction.

NEUROLOGY PRACTICE CHALLENGES AND SOLUTIONS

Clinical practice as a whole and also Neurology practice grapples with a myriad of challenges that create significant barriers to providing optimal patient care and maintaining practitioner satisfaction. Foremost among these challenges is the pervasive issue of dehumanization within medicine⁵, fueled by factors such as time constraints, administrative burdens, and an escalating dependence on technology. Extensive studies have underscored that dehumanization not only undermines patient satisfaction and treatment adherence but also contributes to alarmingly high rates of burnout among neurology professionals. Moreover, the outdated nature of traditional medical education curricula exacerbates these challenges, leaving neurologists ill-prepared to navigate the complexities of modern healthcare delivery.

In light of these formidable challenges, solutions rooted in the principles of MH and neurobiology emerge as compelling pathways forward⁷. By fostering compassion in clinical practice, promoting exposure to humanities during medical training, and integrating neurobiological insights into diagnostic and therapeutic approaches, neurology practitioners can effectively enhance patient outcomes and mitigate the risk of burnout.

Achieving the goals in neurology practice hinges on several crucial considerations regarding the interconnectedness between MH and neurobiology. Firstly, patient-centered care is paramount. This entails crafting personalized treatment plans, honing empathetic communication skills, and fostering collaborative decision-making with patients. Secondly, diagnostic precision is essential. Employing cutting-edge imaging techniques, genetic testing, and biomarker identification ensures precise diagnoses, thus enabling the optimization of treatment strategies. Lastly, treatment innovation is vital. Embracing new therapies, targeted interventions, and personalized medicine approaches allows for tailored treatments tailored to individual patient needs, ultimately

enhancing treatment efficacy and fostering better outcomes.

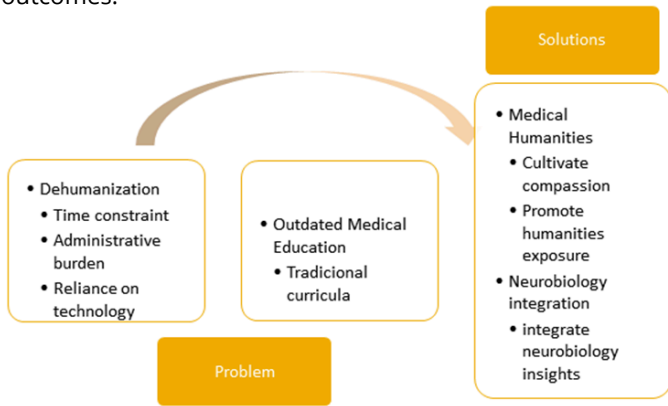


Figure 1. Bridging Health Humanities Principles and Neurobiology for Optimal Patient Care.

INTEGRATION OF HEALTH HUMANITIES AND NEUROBIOLOGY

Eichbaum³ regarding the medical curriculum of the Vandelbit Univrsity has moved away from the traditional conception of the MH as “the arts,” composed of art, music, and literature, toward an approach that integrates the humanities with the basic and clinical sciences, based on metacognition. This metacognition-“thinking about thinking (and emotion)” approach to the - humanities, described in this article by , has three goals: 1) to develop students as flexible thinkers and agile learners and to provide them with essential cognitive and emotional skills for navigating medical complexity and uncertainty; 2) to elicit in students empathy and tolerance by making them aware of the immense diversity in human cognition (and emotion); and 3) to integrate the humanities with the basic and clinical sciences. Consequently, the integration of MH and neurobiology holds immense promise in addressing the multifaceted challenges facing neurology practice. At its core, the metacognitive approach to MH seeks to foster empathy, critical thinking, and self-reflection among students, thereby enhancing their capacity for compassionate and patient-centered care. By incorporating elements of literature, art, ethics, and philosophy into medical curricula, educators can instill in future neurologists a deeper appreciation for the humanistic dimensions of healthcare delivery.

Furthermore, the convergence of neurobiology with disciplines in the humanities yields valuable insights into the intricate functions of the brain and its significant impact on human behavior and cognition. Semir Zeki, the proponent of neuroaesthetics, contends that all knowledge is subjectively filtered through the cognitive processes of the brain¹⁵. He suggests that both scientific and humanistic reasoning rely on similar neural mechanisms, implying that insights from one domain can inform the other. Zeki also asserts that humanities offer valuable perspectives on brain operations, which disciplines like neurobiology and neuroaesthetics can utilize, a trend that is currently

underway. These foundational principles underpin the emerging field of Neurohumanities¹, which integrates neuroscience with a broad array of humanities disciplines as is an opportune moment for a closer partnership between specific domains of neuroscience and their counterparts in the humanities to encompass all facets of human society and culture. This collaborative effort seeks to attain a more comprehensive understanding of human cognition and behavior by synthesizing scientific and humanistic perspectives. Consequently, through the fusion of scientific and humanistic viewpoints, Neurohumanities aims to tackle societal issues, enhance educational and therapeutic interventions, and foster a more inclusive and empathetic society. This interdisciplinary approach underscores the importance of clear communication and collaboration across diverse audiences to enrich our comprehension of the human experience.

Besides, Mangione et al.⁶ testified in a online survey that medical students with higher exposure to the humanities would report higher levels of positive physician qualities (e.g., wisdom, empathy, self-efficacy, emotional appraisal, spatial skills), while reporting lower levels of negative qualities that are detrimental to physician well-being (e.g., intolerance of ambiguity, physical fatigue, emotional exhaustion, and cognitive weariness).

Through interdisciplinary collaboration, neurology practitioners can leverage these insights to develop more nuanced approaches to diagnosis, treatment, and patient communication, ultimately enriching the quality of care and promoting greater empathy and understanding in clinical practice. Addressing challenges in neurology practice requires collaboration among various specialties: Neurology Experts: Bringing clinical expertise, disease-specific knowledge, and treatment protocols to the table; Collaborating Specialties: Engaging with fields like psychiatry, neuropsychology, and physical therapy to offer comprehensive care; Shared Resources: Accessing patient databases, research findings, and treatment guidelines to inform decision-making and improve outcomes.

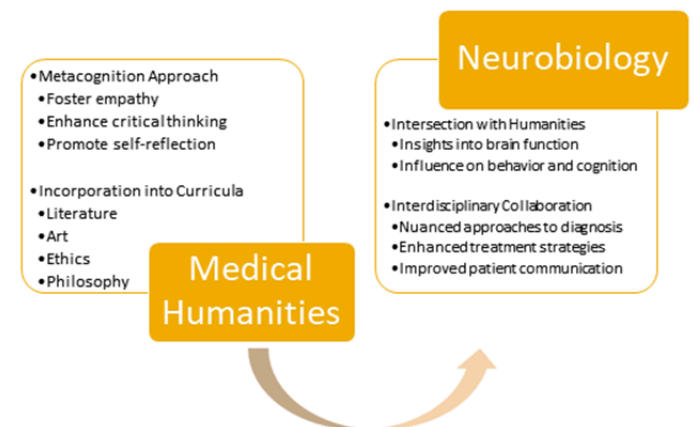


Figure 2. The Neurohumanities Approach to Integrating Health Humanities and Neurobiology in Medical Education and Practice.

THE DIGITAL SCENARIO IN NEUROLOGICAL EDUCATION

The digital landscape in neurological education is evolving rapidly, driven by advancements in artificial intelligence (AI) and machine learning. Salam⁹ highlights the potential applications of AI-based conversational large language models (LLMs), such as ChatGPT, in healthcare education, research, and practice. While acknowledging the promising benefits, concerns regarding ethical, copyright, transparency, and legal issues are also raised, emphasizing the need for proactive examination and addressal of valid concerns.

Zafar et al.¹³ stress the importance of preparing physicians for a hyperconnected digital world, particularly in neurological care delivery. They advocate for aligning education objectives with future digital needs, bridging the gap between technology and neurological education, and highlighting real-world advances to serve next-generation patients and providers.

Moisset and Andrade⁸ discuss potential threats and opportunities regarding Neuro-ChatGPT across care, education, and research in neurology. They speculate on its impact on patient-provider relationships, potential risks of academic dishonesty, and the need for detection mechanisms to discern AI-generated content from human-written text.

Chow et al.² and Shorey et al.¹⁰ express concerns about the use of ChatGPT in healthcare, emphasizing issues related to accuracy, reliability, transparency, ethics, and security. They advocate for careful consideration of risks and benefits, along with the establishment of guidelines and regulations to ensure responsible implementation.

Ganjavi et al.'s bibliometric analysis⁴ reveals variability in guidelines provided by publishers and journals regarding the use of generative artificial intelligence (GAI) in academic publishing. The research investigated how GAI is employed in medical research by analyzing guidelines from the top 100 largest academic publishers and 100 highly regarded scientific journals. Out of the top 100 largest publishers, 24% offered guidance on GAI, with 63% of these being within the top 25. Conversely, 87% of the highly ranked journals provided such guidance. The majority of publications prohibited the inclusion of GAI as authors, with only one journal explicitly stating this prohibition in manuscript creation. Additionally, some publishers and journals specified that their guidelines were focused solely on the writing process: two (8%) publishers and 19 (22%) journals. Guidelines on disclosing GAI use varied, with certain publications requiring specific criteria and methods for disclosure.

Wartman¹³ recommends specific curricular emphases for 21st-century medical education to address challenges posed by the integration of digital technologies, including knowledge capture, collaboration with AI applications, probabilistic reasoning, and ethical standards

in empathy and compassion cultivation.

Overall, the digital transformation in neurological education presents both opportunities and challenges, requiring collaborative efforts to leverage AI-driven tools responsibly and effectively.

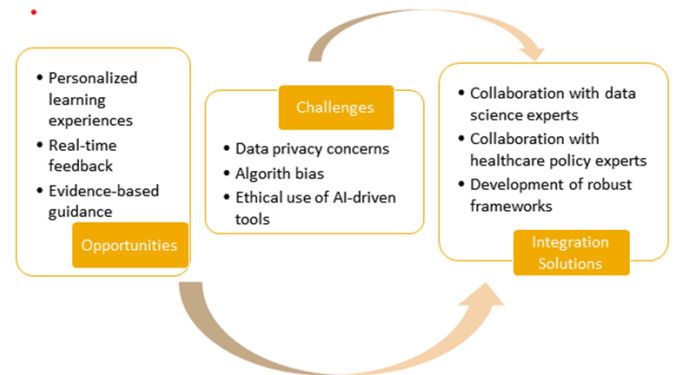


Figure 3. Navigating the Digital Frontier and AI in Neurological Education.

FINAL REMARKS

The Neurology Future Forecasting text by Moeller and Salas⁷ explores the evolution of neurology education in the past decade, driven by technological advancements, demographic shifts, and changing healthcare paradigms. It discusses the incorporation of health systems science (HSS) and health humanities into neurology curricula to prepare graduates for patient-centered care in evolving healthcare systems. To address the limitations of traditional learning methods, there is a focus on developing adaptable learners with coping strategies, communication skills, and a personomics approach to precision medicine. Technology is increasingly used to enhance learning and reduce cognitive load. The future of neurology education will involve educators obtaining formal training and collaborating interprofessionally. This convergence will result in standardized curricula, emphasizing coaching, mentorship, and personal growth. Assessment methods will shift towards holistic evaluations to assess learners comprehensively and standardize educational experiences. There will also be a focus on tracking educational outcomes related to patient care, necessitating investments in data infrastructure and collaborative efforts. Ultimately, the future of neurology education is intertwined with the future of neurologic care, underscoring the importance of relationships between educators, learners, mentors, and patients. Despite upcoming changes, the commitment to patient-centered care remains strong, emphasizing adaptability, innovation, and excellence in education to improve patient outcomes.

CONCLUSION

The integration of MH, neurobiology, and digital technologies represents a powerful and transformative approach to advancing healthcare, including neurology practice, in the modern era. By merging the art and science

of medicine, healthcare providers can deliver more compassionate and patient-centered care that is not only advanced but also deeply empathetic and inclusive. Embracing this integrative approach is essential for addressing challenges, fostering resilience, and cultivating a culture of excellence and compassion in healthcare. Through collaborative efforts and a shared commitment to innovation and humanity, we can build a future where healthcare is not just about treating patients but about truly understanding and caring for them as individuals.

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