

EDITORIAL

Advancing Multidisciplinary Health Research: Bridging Clinical Practice, Public Health, and Translational Science

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Citation: Kramat R, Inam M. Advancing Multidisciplinary Health Research: Bridging Clinical Practice, Public Health, and Translational Science. J Med Multidiscip Healthc Res. 2026;1(2):30-32. <https://doi.org/10.68041/jmmhr.v1i2/01>

Acknowledgement: None; **Competing Interests:** The author declared no competing interests; **Grant Support and Funding Source:** None; **Study Ethical Approval:** Not Applicable; **Consent for Participation and Publication:** Not Applicable; **Availability of Data and Materials:** Not Applicable; **Use of Artificial Intelligence:** Figure 1 has been created by using OpenAI ChatGPT (GPT-4o) solely for the purpose of better illustration and scientific understanding. The corresponding author declared that no other artificial intelligence or AI-assisted tools were used anywhere in this manuscript; **Authors' Contribution:** RK, MI: Conception, study design, acquisition, literature search, drafting, writing, critical revision and final approval as per ICMJE.

Received: 04 September, 2026

Revised: 17 September, 2026

Accepted: 20 September, 2026

Published: 30 September, 2026

ABSTRACT

Precision Modern health care is characterized by complex challenges that stretch beyond scientific disciplines. It requires solutions and methods that integrate clinical practice, public health and translational science approaches. The need for multidisciplinary health research is explored in this editorial, and strategies are discussed on how to bridge the gap in translational research between individualized patient care and population health, and between discovery and implementation. It examines the existing challenges such as institutional silos, a lack of data integration, and misaligned incentives, but also identifies opportunities for change and transformation offered by AI, multi-omics integration, and innovative collaborative approaches. In the future, health research will be truly transdisciplinary rather than just interdisciplinary, considering health as an emerging characteristic of the harmonious interaction of biological, behavioral, social, and environmental systems.

Keywords: Delivery of Health Care; Evidence-Based Medicine; Interdisciplinary Research; Public Health; Translational Research, Biomedical

INTRODUCTION

Health research is at a critical point in its evolution. Although we have made unprecedented advances in science and technology, including the sequencing of genomes and artificial intelligence (AI), there has still been surprisingly little progress in measurable health improvement ¹. This translational gap draws attention to a more significant issue, specifically the disjointed integration of health and disease information resulting from disciplinary divisions. Clinical practice, public health, and the translational science have grown mostly as separate endeavors, with distinct methodologies ². However, the health problems of current times, such as ageing populations, the syndemic connection between multiple chronic illnesses, antimicrobial resistance, and health inequities, require a more holistic approach that transcends them all. The World Health Organization (WHO) defines health as total physical, mental, and social well-being rather than only the absence of illness ³. Multidisciplinary cooperation is necessary to realize this aim. This editorial delves into the need for the progression of multidisciplinary health studies and investigates barriers, opportunities, and avenues for an integrated future. **Figure 1** provides a summary of this integrated vision, which goes beyond concurrent disciplinary activities toward a single ecosystem.

The Imperative for Integration: Health issues in today's world are multifaceted and require multidisciplinary approaches. A coordinated approach is needed, incorporating the perspectives of clinicians, public health professionals, behavioral scientists, data analysts, and community stakeholders in the management of diabetes, heart disease, and cancer ⁵. The COVID-19 pandemic clearly proved that, to be effective, it was necessary for advances in virology, clinical trials, vaccine development, public health communication, strengthening of health systems, and implementation of policy all to occur simultaneously ⁶. There was no single discipline that had the necessary expertise; success came from the multidisciplinary approach. Health research must make integration a fundamental operating concept rather than a sporadic goal in an era of complicated health issues.

Bridging Clinical Practice and Public Health: There is a significant dichotomy between clinical medicine (which is about individual care) and public health (which is about population health and prevention) ⁷. Translational research that moves bidirectionally is needed to bridge this interface; translating population-based studies into practice and aggregating clinical data from practice to guide public health strategy. Digital health technologies and electronic health records enable real-time surveillance, population risk stratification, and learning health systems possible ⁸. But this is only achieved by resolving data fragmentation, privacy issues, and the differences in professional community culture. New models are taking shape, such as community health workers, accountable care organizations, and telehealth, but expanding them and their integration into routine operations becomes difficult.

Translational Science: From Bench to Bedside: The aim of translational science is to speed discovery to clinical application, but that route is inefficient. There is a continued struggle between discovery and implementation, reflecting various challenges in science and structure, including inadequate funding, lack of incentives for scientific researchers, and a lack of implementation science integration ⁹. A vision of multidisciplinary cooperation can be the way forward. Multi-omics approaches, combining the whole genome, proteome, metabolome, and epigenome, give the big picture of how things work in disease. Precision medicine programs are increasingly acknowledging that molecular interventions must translate into population-level prevention strategies ¹⁰. Learning health systems, in which systems continuously gather data to drive research, are a promising model, but there is a significant effort needed in training more qualified members of the learning health system's workforce and building data infrastructure.

Artificial Intelligence and Data Integration: From the drug discovery process to the diagnostics of imaging methods or the individual planning of treatments, AI is changing the way we work in health research. Perhaps the most valuable aspect of AI is its ability to give a whole new meaning to data integration, connecting together different data sources and finding new insights ¹¹. Precision medicine at scale can be achieved by multimodal frameworks that integrate imaging, biomarkers, clinical data, and social determinants ¹². But still, there are major challenges to be addressed: data quality and interoperability, algorithm bias, interpretability of models, and clinical workflow integration. First and foremost, there must be ethical implementation. The evaluation process for the AI tools should be done fairly for the different populations and should follow the transparency, accountability, and patient-centered approach. It calls for an interdisciplinary effort in technical skills, ethics, social aspects, and patient populations.

Barriers to Multidisciplinary Collaboration:

Although there has been an upsurge in recognition, there are still many barriers. Collaboration is hampered by systems that promote disciplinary performance, grant review procedures that favor submissions from a single discipline, and institutional organization by discipline ¹³. Cultural barriers are also formidable, including different methods of communication and different ways of working due to differences in language ¹⁴. Researchers may worry that working together will be more expensive than beneficial. The study reveals that despite the gaps in knowledge prevalent, articles addressing these gaps are cited more often and are 61% more likely to be published in high-impact journals. Cross-disciplinary projects are often not being supported through the funding mechanisms ¹⁵. Solving these challenges will need new funding mechanism, training programs fostering cross-disciplinary competencies, and institutions that value joint accomplishment.

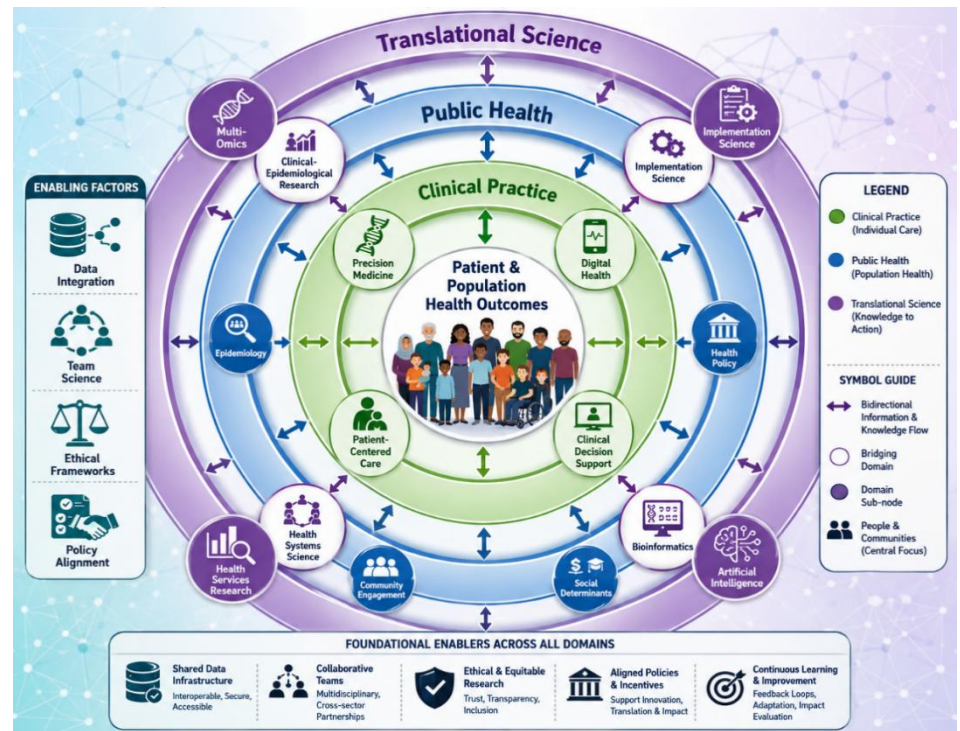


Figure 1: The Multidisciplinary Health Research Ecosystem ⁴

Future Perspectives: The transition from multidisciplinary collaboration to true transdisciplinary integration, utilizing non-academic knowledge like patient expertise, indigenous knowledge, and lived experience, is essential for the future. This thinking is represented in the "One Health" paradigm, which links human, animal, and environmental health. In the same way, whole-person research takes into account physical, psychological, and social factors, and considers health to be an emergent property of a complex line of development. Technological developments will continue to facilitate integration. New connections among previously siloed knowledge domains can be predicted with the help of data synthesis using AI. The digital health platform could combine clinical, behavioral, and environmental data at scale. But it requires more than technology, and it is a matter of cultural change, institutional support, and a partnership that is equitable.

Conclusion: Progress in multidisciplinary health research is not only academically desirable, but essential to achieve positive health impacts. The complex health problems of the current era require an integrated approach to health that is based in clinical care, public health and translational research. AI and data integration could bridge silos between different domains; multi-omics can shed light on the mechanisms of disease across a larger number of cases; and learning health systems can be used for quick translation from discovery to practice. But technologically progress comes with a cultural shift and an understanding of real partnership culture: valuing discipline while transcending disciplinary boundaries. Multidisciplinary integration will not only be a valuable but necessary effort in the context of new challenges being faced by health research in recent years. The ability to collaborate across boundaries to achieve common objectives is critical to both population health and the efficacy of health systems.

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