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Authors' opinions

Algorithmic accuracy and its impact on healthcare: Rethinking the success of machine learning in healthcare

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Abstract:
Machine learning (ML) has transformed healthcare via improving disease diagnosis, clinical decision making, and personalized care. However, despite significant advances in prediction, high algorithmic accuracy does not always translate into improved patient outcomes or stronger healthcare systems. Challenges such as algorithmic bias, limited transparency, inadequate governance, fragmented implementation, and uneven digital infrastructure continue to limit the safe, effective, and equitable implementation of ML in real-world clinical settings. This commentary argues that the success of ML should be assessed within a broader conceptual framework that extends beyond predictive accuracy and encompasses implementation quality, governance, impact on the healthcare system, equity, and public trust. Responsible implementation, effective governance, clinical integration, and continuous evaluation are essential for translating technological innovations into meaningful improvements in healthcare. Rather than replacing clinical expertise, ML should function as a decision-support tool within transparent, accountable, and patient-centered healthcare systems. Ultimately, the future of ML in healthcare will be determined not only by what algorithms can predict, but also by how effectively they improve patient outcomes, strengthen healthcare systems, and promote equitable access to health care.

Keywords: machine learning, artificial intelligence, healthcare systems, health equity, governance.

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Beyond technical specifications

Machine learning (ML) has become one of the most transformative technologies in contemporary health care, driving advances in disease diagnosis, clinical decision making, risk prediction, and personalized care. Rapid advances in computational methods, coupled with the expanding availability of electronic health records and digital health technologies, have accelerated their integration into diverse healthcare systems, creating unprecedented opportunities to improve the quality, efficiency, and accessibility of health care [1, 2].

Despite these advances, the growing complexity of ML models has revealed a critical limitation: technical advances alone are insufficient to significantly improve health care delivery. Although many algorithms demonstrate outstanding predictive performance during the model development and validation stages, their performance often declines when implemented in routine clinical practice. Differences in patient populations, health care infrastructure, data quality, clinical workflows, regulatory environments, and resource availability can significantly impact actual performance [3, 4]. Consequently, algorithms that achieve high levels of predictive accuracy may fail to improve patient outcomes, support clinical decision making, or deliver sustainable improvements in healthcare system performance.

The gap between algorithm performance and real-world health impact requires a fundamental rethinking of how success in ML in health care is measured. Rather than focusing on forecasting accuracy as the primary criterion, greater emphasis should be placed on the quality of implementation, governance, clinical integration, equity, transparency, and measurable impact on the healthcare system [5-9]. The challenge, therefore, is no longer merely to develop increasingly sophisticated algorithms, but to ensure that these technologies are implemented responsibly, integrated effectively into healthcare systems, and used in ways that build public trust and improve population health.

When high accuracy is not enough

ML has achieved remarkable advances in prediction, leading many to view artificial intelligence (AI) as a transformative force in health care. Numerous studies have demonstrated diagnostic accuracy comparable to, and in some cases, exceeding that of health professionals in controlled research settings [1-4]. While these advances represent significant scientific progress, prediction metrics alone provide only a partial assessment of clinical value. In health care, the success of an innovation should be judged based on its ability to improve patient outcomes, enhance the quality and efficiency of care, strengthen healthcare systems, and deliver sustainable public health benefits.

A fundamental problem is the persistent gap between algorithm development and its successful implementation. Most ML models are developed and validated using carefully curated datasets that may inadequately reflect the complexity, diversity, and dynamic nature of routine clinical practice. When implemented in real-world settings, differences in patient demographics, health care infrastructure, data quality, clinical workflows, organizational capacity, and resource availability can significantly impact model performance [3, 4]. Consequently, algorithms demonstrating exceptional predictive accuracy during development may fail to deliver consistent clinical benefit across diverse health care settings. This implementation gap highlights that technical performance, while important, is insufficient as a primary criterion for evaluating ML in health care.

Human-centered governance as the missing link

As ML increasingly becomes embedded in healthcare systems, the primary challenge is no longer whether algorithms can achieve high predictive accuracy, but whether they can be implemented in a way that improves patient outcomes while maintaining safety, accountability, and public trust. While advances in computing power have expanded the potential applications of ML, technological innovation alone is insufficient to ensure equitable or sustainable health care. Without robust governance, even highly accurate algorithms can produce inconsistent clinical results, exacerbate existing inequalities, or fail to earn the trust of health professionals and their patients [5-9].

Therefore, human-centered governance should be viewed as a strategic basis for responsible innovation in healthcare systems, not just as a regulatory obligation. Governance principles should be integrated throughout the entire lifecycle of ML systems, from development and validation to implementation, continuous evaluation, and post-deployment monitoring. Transparency, accountability, fairness, explainability, and protection of patient rights are essential to ensuring that ML systems remain safe, reliable, and responsive to the needs of diverse health care settings.

Equally important is recognizing that ML is intended to complement, not replace, clinical expertise. Healthcare decisions depend not only on data-driven predictions but also on clinical judgment, patient values, ethical considerations, and contextual understanding, which cannot be fully captured by algorithms. Thus, the greatest value of ML lies in supporting informed clinical decision making while maintaining the central role of health professionals in patient care [6-9].

Governance must also promote equity across various populations and healthcare systems. ML models developed using incomplete, biased, or unrepresentative datasets risk perpetuating existing health disparities, particularly among underserved or historically marginalized populations. Addressing these challenges requires representative data, ongoing monitoring of algorithmic bias, transparent reporting, independent evaluation, and implementation strategies that take into account local health care contexts [5, 6, 9]. Ultimately, the long-term success of ML will depend not only on technological innovation but also on governance frameworks that can translate algorithmic advances into equitable, credible, and sustainable improvements in health care.

From innovation to meaningful health impact

The long-term success of ML in health care should be determined not only by increasingly sophisticated algorithms but also by its ability to improve care delivery, strengthen healthcare systems, and deliver measurable benefits to patients and populations. Achieving this goal requires implementation strategies that consider the realities of health care practice, including workforce capacity, digital infrastructure, regulatory oversight, organizational readiness, and population health needs [4,7,9]. Therefore, technological innovations must be accompanied by ongoing investments in healthcare system readiness to ensure the safe, effective, and sustainable integration of ML into routine clinical practice.

Health professionals remain at the center of translating algorithmic innovations into meaningful health outcomes. Education and training programs must equip physicians with the knowledge and skills to critically interpret algorithmic recommendations, recognize their limitations, and appropriately integrate them into clinical decision making. Equally important is sustained collaboration between clinicians, public health specialists, data scientists, health informaticians, ethicists, and policymakers to ensure that ML systems are designed, implemented, and evaluated in a way that addresses real health priorities, not just technical specifications [4, 7]. Such interdisciplinary collaboration is essential to ensure that technological innovations remain aligned with patient needs and public health goals.

These priorities are particularly important for low- and middle-income countries, where limited digital infrastructure, workforce shortages, fragmented health information systems, limited financial resources, and persistent health inequities can limit ML adoption. Solutions developed in high-resource healthcare systems cannot be assumed to work effectively in resource-constrained settings without careful adaptation to the context. Therefore, context-sensitive governance, equitable investments, local capacity building, and implementation strategies based on regional health priorities are essential to maximizing the benefits of ML while minimizing the risk of widening existing health disparities [9, 10].

The future of ML in healthcare must be determined not only by advances in computing power but also by measurable improvements in the quality of care, equity, patient outcomes, and healthcare system sustainability. Reframing success from algorithmic performance to real-world health impact will provide a more meaningful metric for evaluating innovations and help ensure that ML contributes to safer, more equitable, and more sustainable healthcare systems worldwide.

Conclusion

ML has enormous potential to transform health care, but its long-term success depends on much more than just increasingly sophisticated algorithms. While predictive performance remains an important technical foundation, it alone is not sufficient to achieve meaningful improvements in patient care, population health, or healthcare system efficiency. The primary challenge is no longer developing more accurate models, but rather ensuring the responsible implementation of these technologies, their seamless integration into clinical practice, and governance in a manner

that promotes transparency, accountability, fairness, and public trust.

Therefore, the future of artificial intelligence (AI) in health care requires a broader definition of success that values the quality of implementation, governance, clinical integration, and measurable impact on the healthcare system alongside technical excellence. Progress should be assessed not only by the predictive power of algorithms, but also by whether they improve treatment outcomes, reduce inequities, strengthen healthcare systems, and facilitate more effective decision making in real-world settings.

The greatest achievement of ML in health care will therefore lie not only in creating more intelligent algorithms, but also in building healthcare systems capable of using them responsibly and fairly, for the long-term benefit of patients and society.

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Conflict of Interest

The author declares no conflict of interest.

AI use disclosure

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Ethical approval

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Data availability

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