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Letter to the Editor

Reflections on the role of AI in Alzheimer's disease research: Addressing inclusivity, causality, and ethical considerations

To the Editor,

We read with great interest the editorial "Artificial intelligence and the acceleration of Alzheimer's research—From promise to practice," [1] which provides a timely and comprehensive overview of how artificial intelligence (AI) is reshaping the landscape of Alzheimer's disease (AD) research in biomarker discovery, therapeutic innovation, and clinical trial optimization. The authors effectively articulate both the momentum and responsibility accompanying this paradigm shift. We would like to offer several reflections that may help further contextualize the implications of this important work and suggest pathways for future development.

First, the editorial highlights AI's transformative role in early detection, yet current AI-based biomarker pipelines remain limited by variability in training datasets and the underrepresentation of diverse populations. This concern is consistent with recent reviews demonstrating that speech-based and digital biomarker models often show reduced performance when applied across heterogeneous linguistic or cultural groups [2]. Although multimodal approaches such as speech analytics and digital phenotyping represent promising advances, their generalizability to low-resource settings and multilingual populations is still unclear. Future studies should evaluate cross-cultural reliability and develop adaptive models capable of integrating context-specific digital features to enhance inclusivity and global applicability.

Second, the authors emphasize AI-driven knowledge synthesis for therapeutic discovery, which is particularly compelling given the complexity of AD pathobiology. Recent integrative reviews highlight that AI-enabled discovery pipelines can reveal potential therapeutic targets, yet causal inference and mechanistic validation remain necessary to ensure biological plausibility [3]. We believe that the next frontier lies in causal inference–oriented AI frameworks, which can help distinguish correlative patterns from biologically meaningful mechanisms. As AI models increasingly integrate omics, imaging, and real-world data, transparent mechanistic validation will be essential to ensure that AI-derived targets not only accelerate discovery but also remain clinically credible.

Third, the editorial compellingly discusses AI-enabled improvements in clinical trial efficiency, including stratification, digital twins, and prognostic modeling. Empirical studies using AI-based speech analysis have shown the ability to predict progression to AD years in advance [4], offering substantial promise for more targeted patient selection. While these innovations may reduce sample sizes and trial duration, they also raise questions regarding regulatory oversight and the ethical deployment of synthetic patient trajectories. We suggest that future work include guidelines co-developed with regulatory bodies to ensure that AI-generated predictions are reproducible, interpretable, and suitable for decision-making in high-stakes clinical contexts.

Finally, we strongly agree with the authors that the success of AI in AD research hinges on ethical, equitable, and transparent data-sharing frameworks. Recent scoping reviews emphasize that the growing ecosystem of digital biomarkers—ranging from passive monitoring to speech and behavioral measures—requires standardized, privacy-preserving, and globally inclusive data infrastructures [5]. In addition to the risks of bias noted in the editorial, there is a pressing need to address patient trust, informed consent, and data sovereignty—especially in international collaborations. Building a federated, privacy-preserving infrastructure that enables global data contribution while respecting local governance will be essential for realizing the full promise of AI-driven AD research.

In summary, this editorial provides an exceptional synthesis of the current state and future direction of AI-enabled AD research. As the field moves from promise to practice, integrating methodological rigor, ethical safeguards, and cross-population applicability will be crucial in ensuring that AI innovations translate into meaningful clinical impact. We commend the authors for stimulating such an important and forward-looking discussion and hope that these reflections further contribute to the evolving dialogue around responsible and effective AI integration in AD research.

CRediT authorship contribution statement

Mingyue Chen: Writing – original draft. **Yan Han:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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