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Perspective Article

Using Clinical Decision Intelligence Applications to Improve Pathways For Earlier Detection Of Underrecognized Cognitive Disorders

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Abstract

Cost estimates for care for those with dementia and other cognitive impairments are rising globally, estimated to reach US $1 trillion by 2025. Lack of specialized personnel, infrastructure, diagnostic capabilities, and healthcare access impedes the timely identification of patients progressing to dementia, particularly in underserved populations. International healthcare infrastructure may be unable to handle existing cases in addition to a sudden increase due to undiagnosed cognitive impairment and dementia. Healthcare bioinformatics offers a potential route for quicker access to healthcare services; however, a better preparedness plan must be implemented now if expected demands are to be met. The most critical consideration for implementing artificial intelligence/machine learning (AI/ML) -driven clinical decision intelligence applications (CDIA) is ensuring patients and practitioners take action on the information provided.

Key words: Dementia, Alzheimer, healthcare systems, artificial intelligence, machine learning, clinical decision applications, healthcare system preparedness, technology adoption.

Introduction

Cost estimates for care for those with dementia and other cognitive impairments are rising with approximations approaching US $1 trillion globally by 2025 (1). This is the devastating economic strain of Alzheimer's disease and related dementias (AD/ADRD). The lack of specialized personnel, infrastructure, diagnostic capabilities, and health care access impedes timely identification of patients progressing to dementia, particularly in underserved populations (2). In the wake of dementia lies an array of harrowing emotional, medical, and financial implications that call for urgent improvement..

Despite the potential for several new intervention options for AD/ADRD, the international health care infrastructure systems may not be able to handle the existing cases, not to mention additional sudden increases among those with underrecognized cognitive impairment and dementia (3). To make matters worse, the magnitude of ramifications for memory, movement, and mood disorders due to COVID-19 infections and isolation policies starting in Wuhan in late 2019 and globally in early 2020, along with other rising comorbidities such as diabetes mellitus, remain unknown. Delivering timely, dependable, and quality clinical care for those at higher risk or with cognitive difficulties must overcome many challenges (2). Although healthcare bioinformatics offers a potential route to quicken access to health services, a better preparedness plan that focuses on deployment and pragmatic implementation must be implemented now if we are to have a chance to meet these vast demands already coming our way.

Background

Using electronic health record (EHR) data and artificial intelligence/machine learning algorithms, or clinical decision intelligence applications, to detect people at risk for unrecognized cognitive impairment and early-stage dementia is a promising development in the healthcare field (4). With the help of clinical decision intelligence applications, medical professionals may be able to identify more readily patients at risk for developing dementia and provide them with the care they need. Among the advantages, clinical decision intelligence applications for cognitive impairments and dementia will provide more efficient use of clinical resources, less bias in detection, and more significant opportunities for promoting health equity.

In an ideal setting, clinical decision intelligence applications (CDIA) offer promise to analyze patient data from various sources, such as diagnosis codes, pharmacy records, primary care notes, and specialty care visits. By combining this data with machine learning techniques, these algorithms can potentially identify patterns and prediction horizons (5) for an increased risk of dementia (6-11). These prediction horizons can range from 1 year to 3 years before a dementia diagnosis. This could empower medical professionals to intervene earlier and provide more effective treatment plans for at-risk people.

In addition to helping medical professionals detect those at risk for unrecognized cognitive impairment and dementia earlier, CDIA could also improve

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patient outcomes. By providing aid for more accurate diagnoses and better treatment plans, these algorithms can help reduce the number of hospitalizations due to complications related to dementia. Furthermore, they can help reduce costs associated with long-term care by providing early interventions that may slow or even prevent the progression of the disease. In this way, it will help an individual maintain personal autonomy and independence.

Despite their potential benefits, some challenges are still associated with developing, validating, deploying, and implementing CDIA for detecting unrecognized cognitive impairment and dementia. For example, ensuring that these algorithms are reliable and accurate is essential to lessen misdiagnoses or false positives. Additionally, these systems must be secure to protect patient privacy. Finally, any algorithm developed must be clinically validated before being deployed in clinical settings.

Three key challenge areas for CDIA

The human healthcare system is increasingly exploring artificial intelligence (AI) /machine learning (ML) solutions to solve problems and improve outcomes. These AI/ML solutions have the potential to revolutionize clinical care, saving time, money, and lives. Three key challenge areas must be addressed before AI/ML-derived CDIA can enter clinical care: accuracy of derived clinical knowledge, cost-effectiveness, and trust. With these three factors in place, the potential for AI/ML-derived CDIA to revolutionize healthcare may be possible.

Accuracy of derived clinical knowledge

The potential for AI/ML-derived CDIA in healthcare is numerous and vast. From diagnosis to treatment plans, the ability of AI/ML-derived CDIA to provide reliable predictions offers great promise for this field. However, despite the accuracy of their results, practical implementation and utilization of these tools remain a significant barrier due to medical professionals' slow adoption and/or trust in the technology.

Within older adult populations, creating an externally generalizable detection algorithm capable of accurately and cost-effectively identifying those suffering from cognitive impairments is an immense challenge. To ensure success, demonstration projects must be designed to produce sufficient evidence to address all stakeholders' requirements. Also, awareness and education initiatives must contextualize their capabilities and features to ensure that AI/ML-driven CDIA can be broadly used in healthcare. Currently, it is too often seen as a novelty, only being implemented in specific circumstances or research projects rather than becoming part of standard procedure. Without such education and understanding, clinicians, patients, and healthcare systems will hesitate to trust and use AI/ML-driven CDIA on a wide scale.

Necessary considerations for health care adoption of clinical decision intelligence applications

As healthcare solutions powered by artificial intelligence (AI) and machine learning (ML) continue to grow in popularity, healthcare industry stakeholders will need to focus on how best they can empower medical professionals to utilize the technology effectively. Providing an effective, equitable, and reliable clinical workflow requires considering various factors that demonstrate the reliability and validity of AI/ML-driven CDIA. Additionally, ensuring access to care for patients across all socio-economic groups is essential for meaningful solutions to have the most impact on the entire population.

Effective implementation of technology into existing medical workflow processes is a critical challenge. Plans must consider how best to optimize/manage patient flow, accounting for capacity constraints. To ensure a successful transition, healthcare staff must understand the capabilities and features within such technologies; this can be accomplished through thorough educational programs across healthcare institutions that extend beyond manual interpretation or existing software solutions.

The development of meaningful solutions also depends on ensuring everyone has access to such services regardless of their geographical location or socio-economic status. Therefore, when developing AI/ML-driven CDIA and other algorithms for healthcare purposes, it is essential to consider its practical application across different populations and demographic groups in addition to performance accuracy. By considering health disparities that limit historically underserved patient populations from accessing traditional care solutions, AI/ML-powered options developed, validated, deployed, and validated in diverse geographic areas and populations could make a real difference by providing better and broader accessible alternatives without sacrificing quality or reliability.

Finally, creating impactful solutions requires going beyond just treating illnesses. There is a responsibility to empower and support the person. Solutions should approach health care delivery as a holistic concept that addresses individual needs both arising from a diagnosis or condition as well as health and well-being in general. To better drive the adoption of new AI/ML-derived clinical tools, it is essential to keep both patient and physician stakeholders in mind—we must recognize that there are aspects too complex for software alone that require careful synthesis between the interface of human experience and machine interpretation.

Trust and confidence

Building and maintaining trust and ease of use for healthcare professionals in AI/ML-driven CDIA is paramount. To do so successfully requires excellent accuracy and reliable interaction with traditional practices without distorting decision-making due to unconscious biases or false positives. Patient safety must also remain a top priority; security protocols protecting sensitive information will be critical in gaining clinician confidence in their practice.

AI/ML-driven CDIA must be manageable for medical practitioners without inundating users with inopportune alerts or notifications. In addition, risk and liability considerations should be considered for each level of implementation so that healthcare providers understand what types of unexpected results may arise from such technology. Finally, user consent must also be deemed when gathering data from involved parties—ensuring that proper authorization that respects individual privacy concerns has been addressed before collecting any information from patients or practitioners.

Equitable and accessible care

Ensuring equitable and accessible AI/ML-driven CDIA is paramount to making a meaningful medical impact. Access should not be restricted by geographical location or socio-economic status—especially in areas and populations where traditional care has been limited. Providing universal access requires addressing gaps in care that can arise from language barriers or cultural misunderstandings.

Efforts must focus on essential patient safety and satisfaction to ensure equitable outcomes for all involved. AI/ML-driven CDIA should be trained on robust datasets that reflect different groups of individuals whom healthcare decisions may disproportionately impact. This includes incorporating data from diverse ethnicities and genders as well as accounting for essential aspects like health literacy and educational backgrounds—all of which can play into how effective health plans are for patients.

Finally, research and development efforts must comprehensively account for underlying differences to inform diagnosis, treatment plans, and monitoring regimens with accuracy and reliability. Incorporating all relevant factors, including environmental components, risk/benefit profiles, lifestyle considerations, affordability constraints, and other socioeconomic considerations, provides an initial basis for creating an equitable system that includes patients' and practitioners' interests and needs.

Meaningful solutions to problems that matter

When considering meaningful healthcare solutions enabled by AI/ML, ease of use for both patients and physicians must be a priority. For instance, actionable clinical insights resulting from data analysis should be presented intuitively at a time best suited to address it that can easily be interpreted without requiring significant technical understanding. Moreover, users should have options for developing clear pathways of care based on the analysis results—so they can quickly and confidently act when needed.

Another consideration is regarding barriers that might arise due to differences between patient populations or access to specific treatments or medications. Identifying these potential obstacles before implementation allows organizations to develop proactive solutions that ensure equitable access for all patients—regardless of their circumstances.

A further consideration is imperative to understand which elements are perceived as significant or trivial by those engaging with healthcare technology solutions through user-centered design. Essential features perceived as substantial by those engaging with healthcare technology solutions include ease of use/interpretation, actionable clinical insights, the timing of use, and options for developing clear clinical pathways for care. These factors directly impact how quickly and accurately healthcare decisions can be made—so these are essential considerations when implementing any machine learning-enabled solution. Elements perceived as more trivial may include aesthetics, such as the user interface color scheme or font size, as well as specific features which do not necessarily support core functionalities but are nonetheless desirable from an end-user perspective. While these features may not impact the primary goal of a healthcare system—providing reliable and effective care—they still should be considered when attempting to create an all-encompassing solution for clinical utility that will be adopted by both patients and practitioners alike.

Finally, the most critical consideration for implementing AI/ML-driven CDIA is empowering and motivating patients and practitioners to act on the information AI/ML-driven CDIA provides. Ensuring confidence, ease of use, equity, relevance, and timeliness of AI/ML-driven CDIA are all necessary steps in activating patients and providers to take advantage of this call to action for better health. By considering perspectives from both patient and practitioner groups, organizations can better design solutions that accurately reflect the needs and preferences of their actual users—making them more likely to be adopted in real-world scenarios.

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Conflict of interest: Ara S. Khachaturian, Ph.D. is an Officer and director of the Campaign to Prevent Alzheimer's Disease (PAD 20/20) and; Officer, director and employee of Khachaturian and Associates; Founding executive-editor of Alzheimer's & Dementia, The Journal of the Alzheimer's Association (retired), Founding executive-editor of Alzheimer's & Dementia: Translational Research & Clinical Intervention (retired), Founding executive-editor of Alzheimer's & Dementia: Diagnoses, Assessment & Disease Monitoring (retired); Executive Officer and Director, Brain Watch Coalition; Senior Research Fellow, University of Nevada Las Vegas, National Supercomputing Institute & Dedicated Research Network; Received payments through organizational affiliations for grants, contracts, consulting fees, honoraria, meeting support, travel support, in-kind research/professional support over the last 36 months from the Alzheimer's Association, Acadia Pharmaceuticals, Alzheon, Biogen, Clinical Trials Alzheimer's Disease Conference, Davos Alzheimer's Consortium, Eisai, Eli Lilly & Company, RELX Plc, High Lantern Group, International Neurodegenerative Disorders Research Center, and Serdi Publishing.

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