# Quantum Artificial Intelligence in Healthcare

*Urgent Opportunities and Gaps in Epilepsy-Psychiatry*

University of CINCINNATI

Cincinnati Children's
changing the outcome together

Joanne.osuchukwu@cchmc.org

Joanne Osuchukwu, MD[1,2], Judith W. Dexheimer, PhD[1,2] , John P. Pestian, PhD, MBA[1,2]

[1]Division of Biomedical Informatics, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio;

[2]Department of Biomedical Informatics, University of Cincinnati College of Medicine, Cincinnati, Ohio

## BACKGROUND

- Quantum Artificial Intelligence (QAI) combines quantum computing and AI to analyze complex healthcare data beyond classical limits.
- It may uncover nonlinear neurobehavioral patterns enabling precision psychiatry and integrated epilepsy-mental health care.
- Current work centers on imaging and drug discovery, while epilepsy-psychiatry remains unexplored, limiting equitable innovation.

**Objective:** Identify QAI applications, trends, and translational gaps in epilepsy-psychiatry.

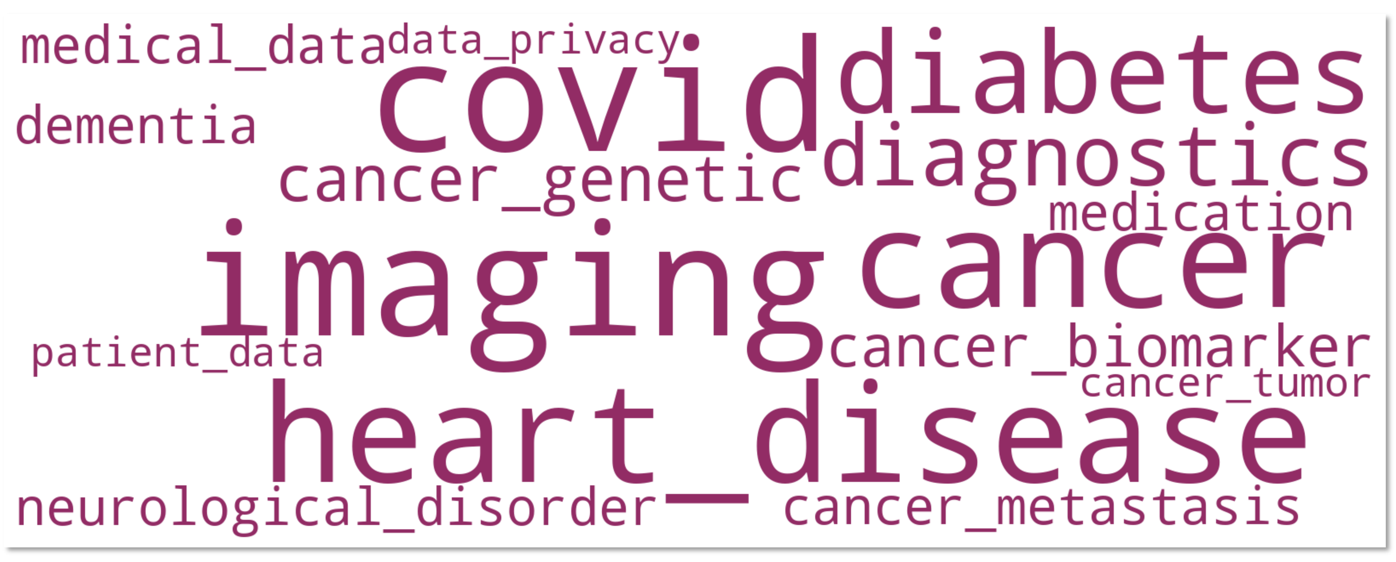


*Figure 1. Increasing Pool of QAI Publications over the Years.*

## RESULTS

- Most work focused on drug discovery and imaging; mental health uses appeared only after 2020.
- Hybrid QAI models (quantum + classical) dominate; built mostly on IBM Q and PennyLane.
- QAI often matched or beat classical AI on small, noisy, or complex data.

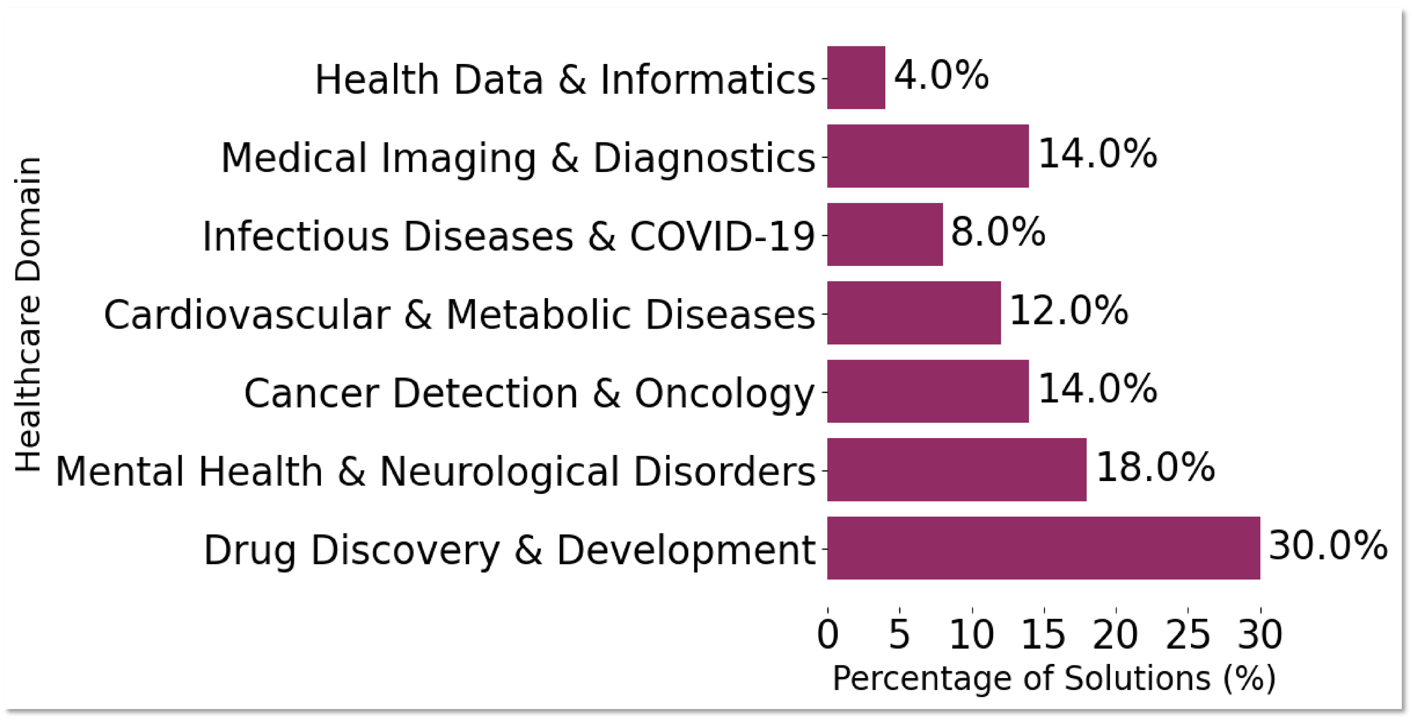


*Figure 3. Health Domain Distribution of QAI Applications.*

**Early wins:**

- Drug design: quantum GANs improved molecule quality (+30%).
- Toxicity prediction: QSVCs reached AUC 0.8-0.95.
- Mental health: quantum LSTM hit F1 = 0.99 for continuous monitoring.

## METHODS

- **Systematic Review** (2004-2025) following PRISMA 2020 guidelines.
- Databases: PubMed, IEEE Xplore, Scopus, WOS, ACM DL
- Included studies applying quantum or hybrid AI to healthcare with reported outcomes.
- Extracted data on algorithms, hardware, datasets, performance, and ethics.
- Excluded non-healthcare or theoretical studies

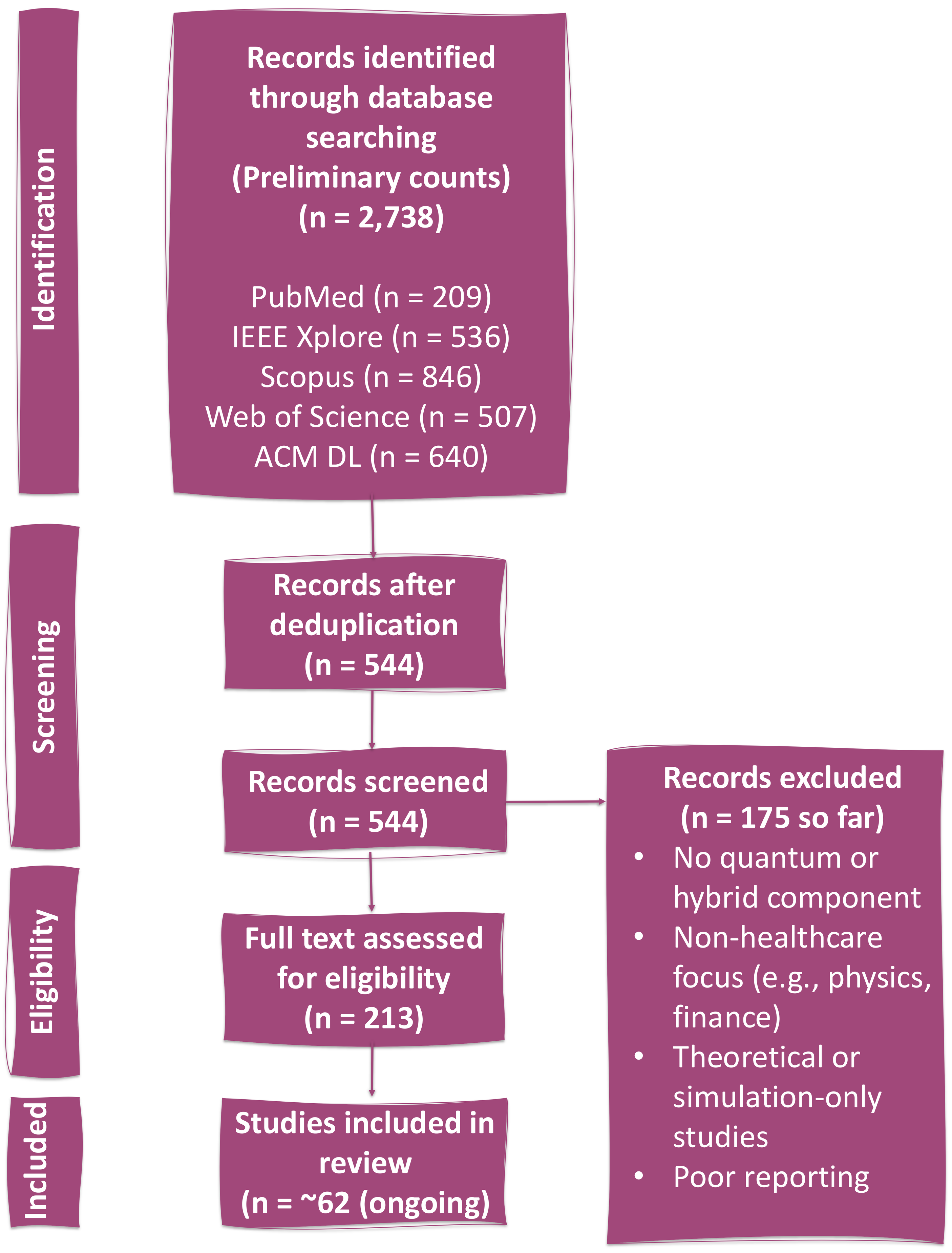


*Figure 2. PRISMA 2020 Flow Diagram*

## DISCUSSION

- QAI shows real promise where classical AI struggles - few samples, messy signals, nonlinear patterns.
- These methods capture biological complexity better but remain largely experimental.
- Neuropsychiatry is just emerging as a use case, revealing how early the field still is.

**Challenges**

**Hardware noise** and few qubits restrict scale.

- Models hard to interpret and rarely benchmarked on clinical data.
- Heavy reliance on simulators, not real devices.

**Gaps**

No studies yet in epilepsy-psychiatry or related comorbidities.

- Missing clinical validation and ethical frameworks.
- Sparse quantum-ready neuro data (EEG, EHR, speech).

**Future Directions**

- Test QAI on real neuropsychiatric datasets.
- Build trustworthy, interpretable quantum models for clinicians.
- Explore privacy-preserving quantum learning for sensitive health data.
- Use epilepsy-psychiatry as a pilot testbed for next-gen translational QAI.

## ACKNOWLEDGEMENTS

- Supported by the University of Cincinnati, and Division of Biomedical Informatics, Cincinnati Children's Hospital Medical Center.
- Special thanks to Dr. John Pestian and Dr.Judith Dexheimer for mentorship and guidance.

*Preliminary poster; updated findings to be presented in person.*