





EVERY 3 SECONDS

EVERY 3 SECONDS

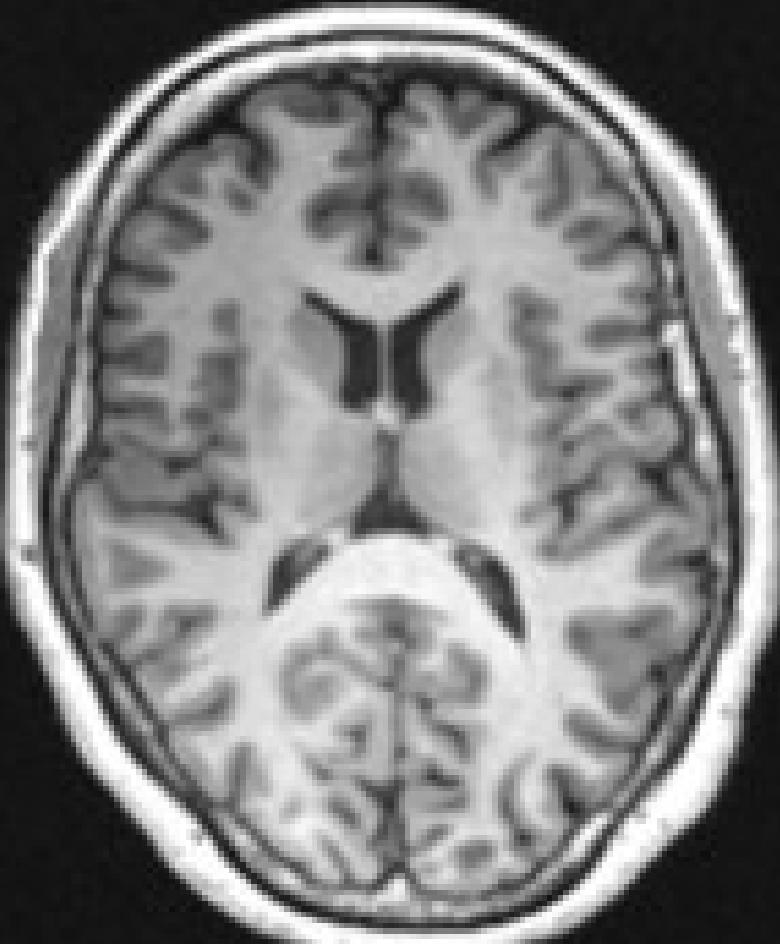
**SOMEONE IN THE
WORLD BEGINS TO
FORGET**



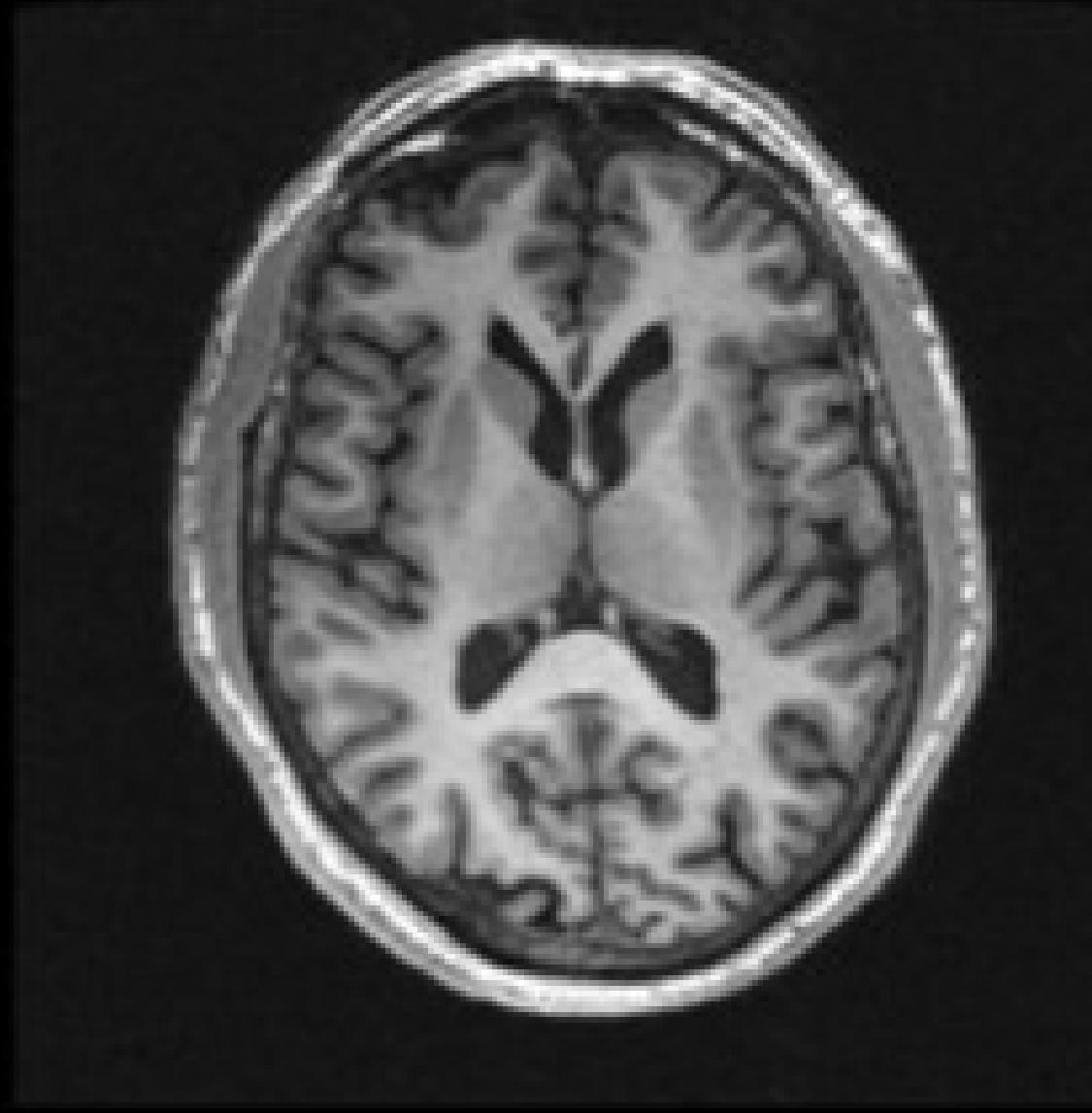
Qu-Alz

By The Qure

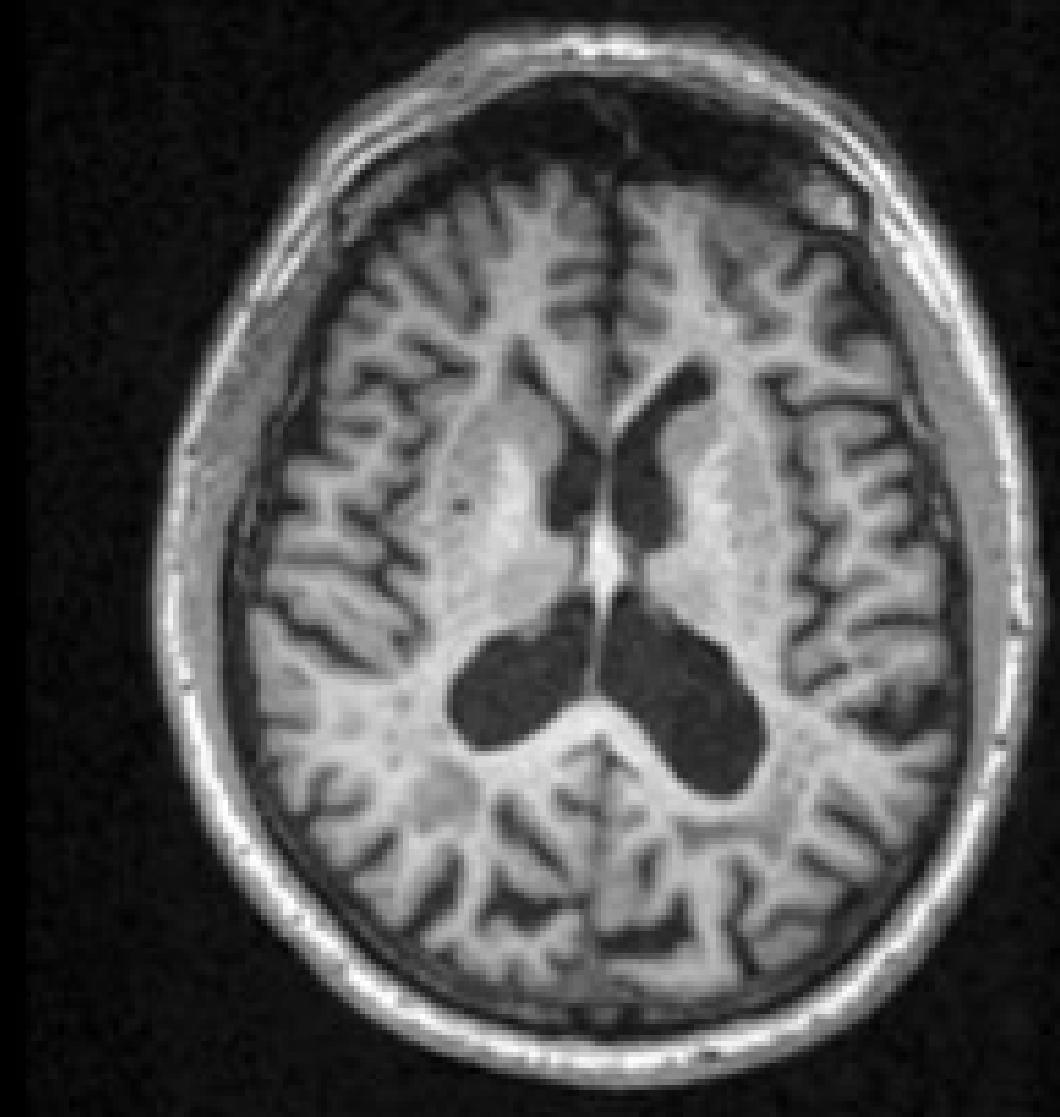
Quantum Alzheimer's Prediction



Normal



MCI



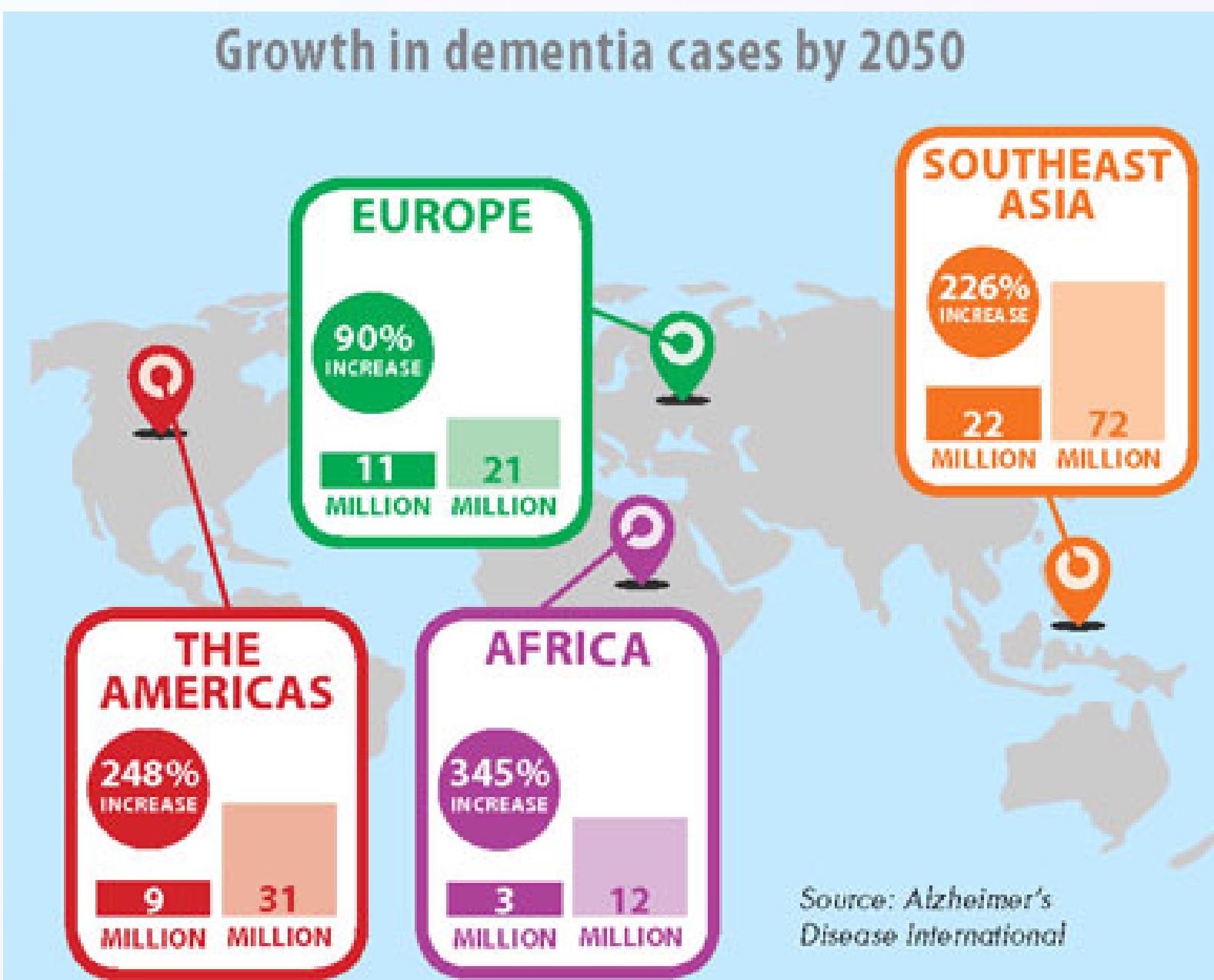
AD

**NEURODEGENERATION
BEGINS
(INVISIBLE)**

**FIRST SYMPTOMS
(5-10 YEARS LATER)**

**DIAGNOSIS
(OFTEN TOO LATE)**

Growth in dementia cases by 2050



Alzheimer's in SEA

ALL SECTIONS SEARCH

THE DIPLOMAT

READ THE DIPLOMAT, KNOW THE ASIA-PACIFIC

ASEAN BEAT

Is Southeast Asia Ready for a Future Dementia Epidemic?

Governments need clear plans to tackle an expected surge in dementia cases as the region ages.

Mortality from Alzheimer's disease in SEA

~29 000 in 1990 to ~95 000 in 2021

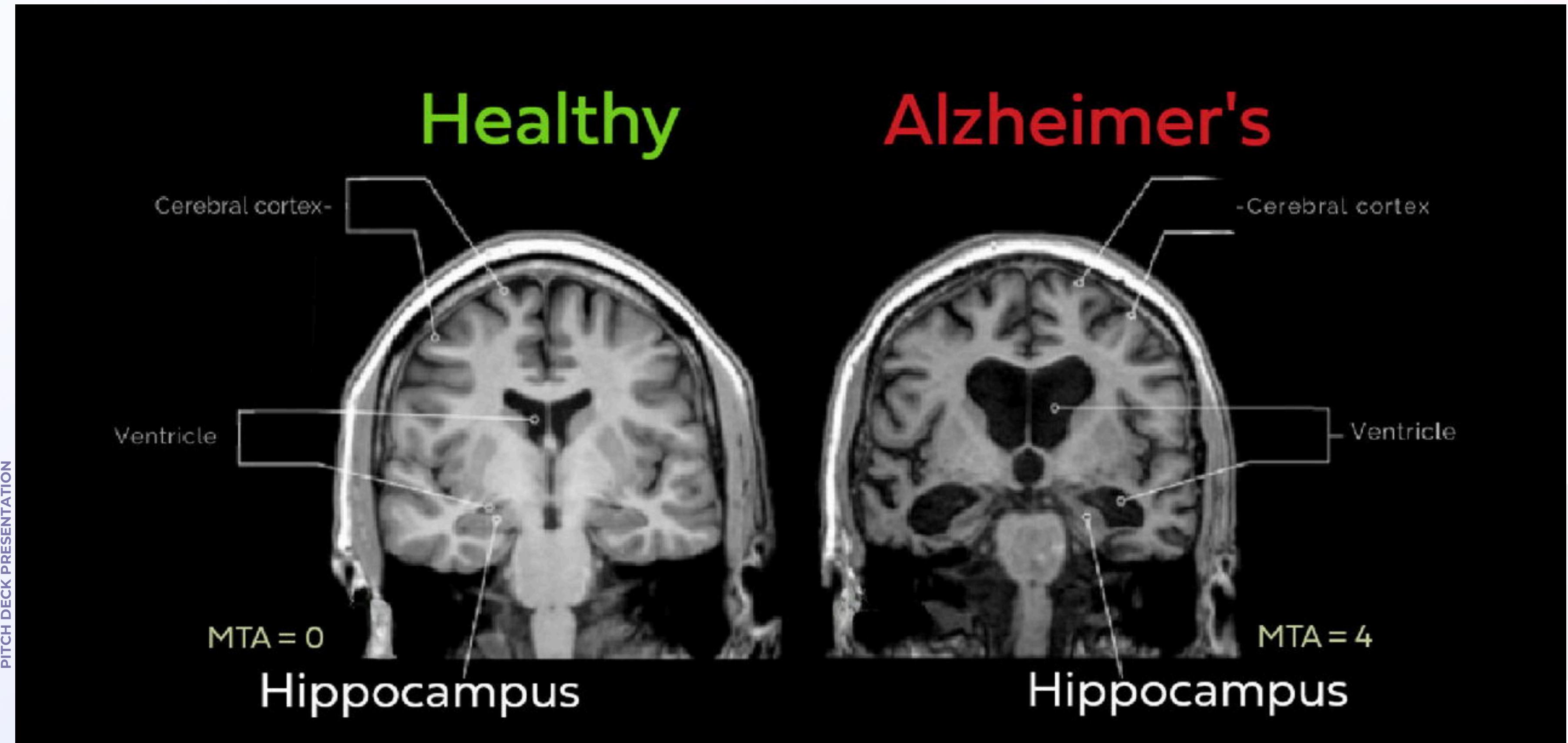
Problem Statement

Alzheimer's is often diagnosed too late, when significant brain damage has already occurred.

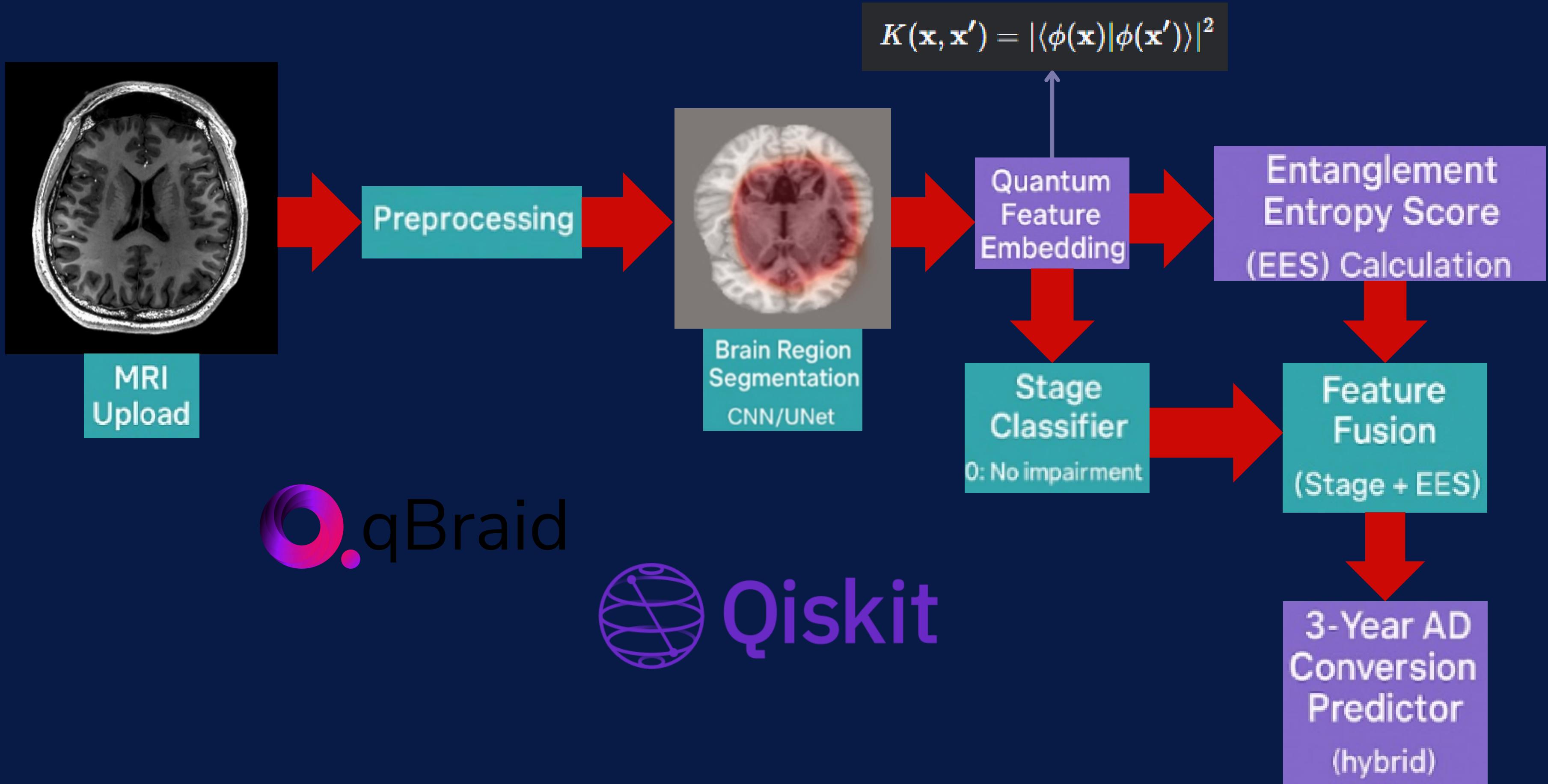
Quantum computing can unlock subtle MRI patterns or new metrics missed by classical models but hasn't yet been applied effectively to real-world diagnostic pipelines.



How do we diagnose?



What we're doing



Quantum Advantage

Classical

Optimized for small,
local datasets



Quantum

Novel, entanglement-
based biomarker (EES)

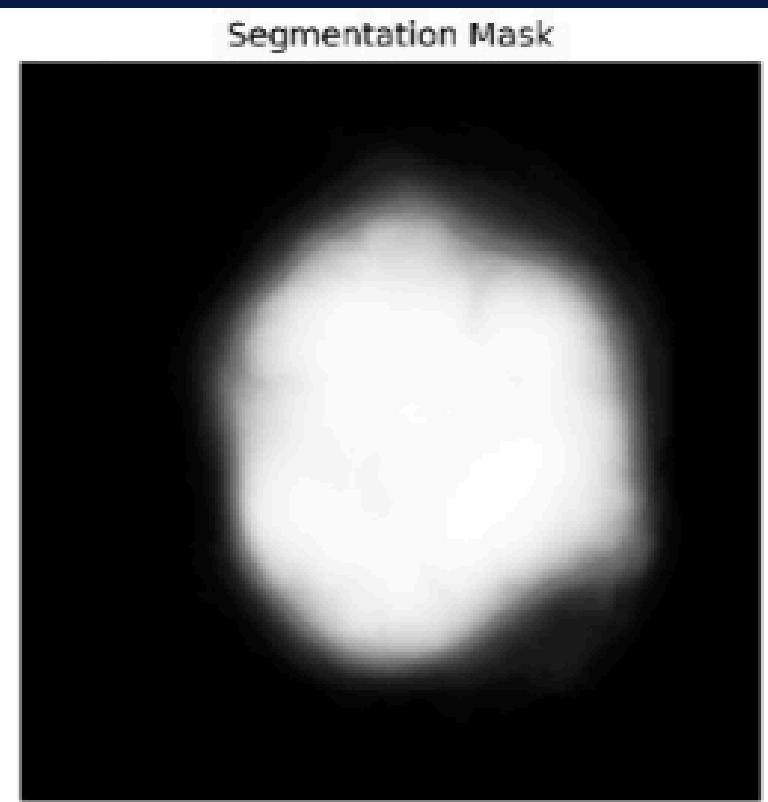
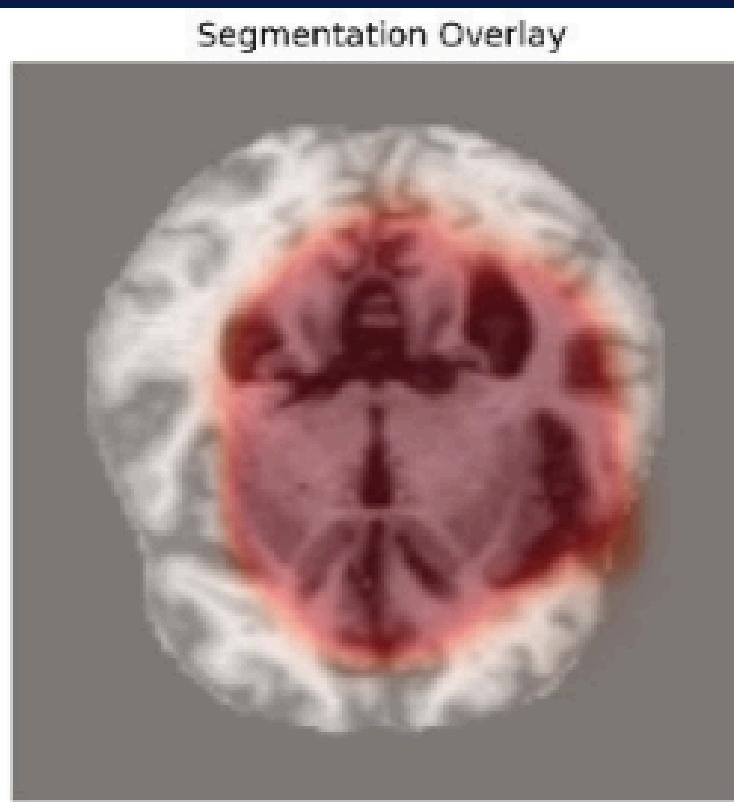
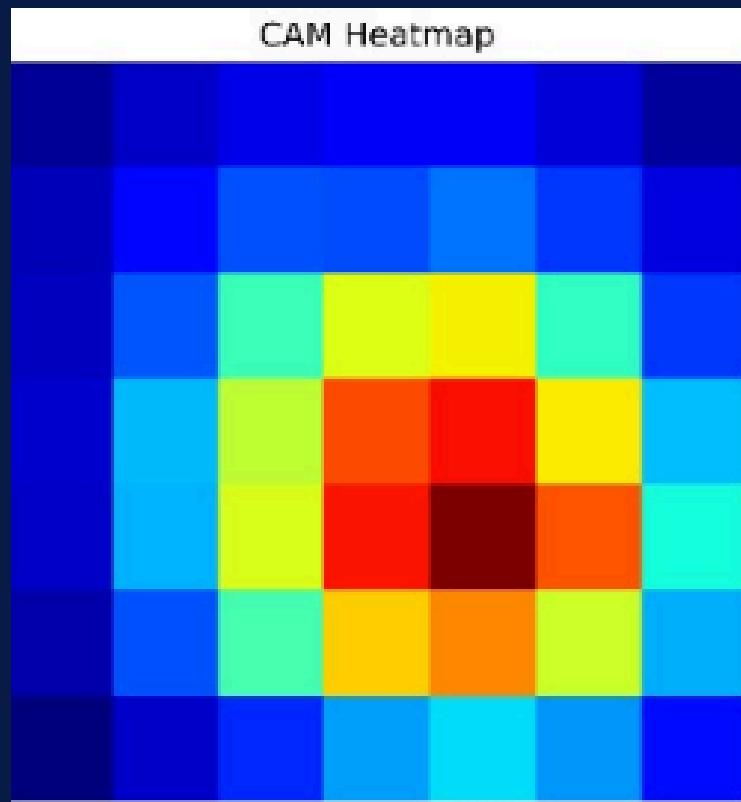
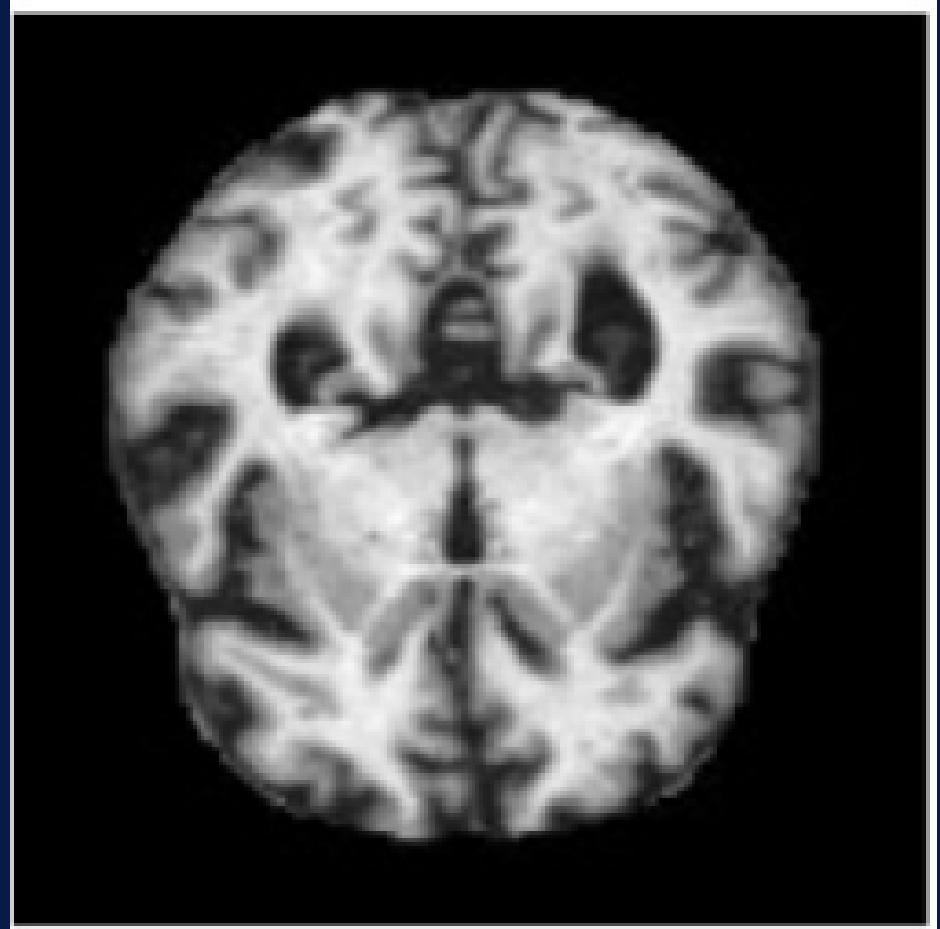


Lower risk of
overfitting



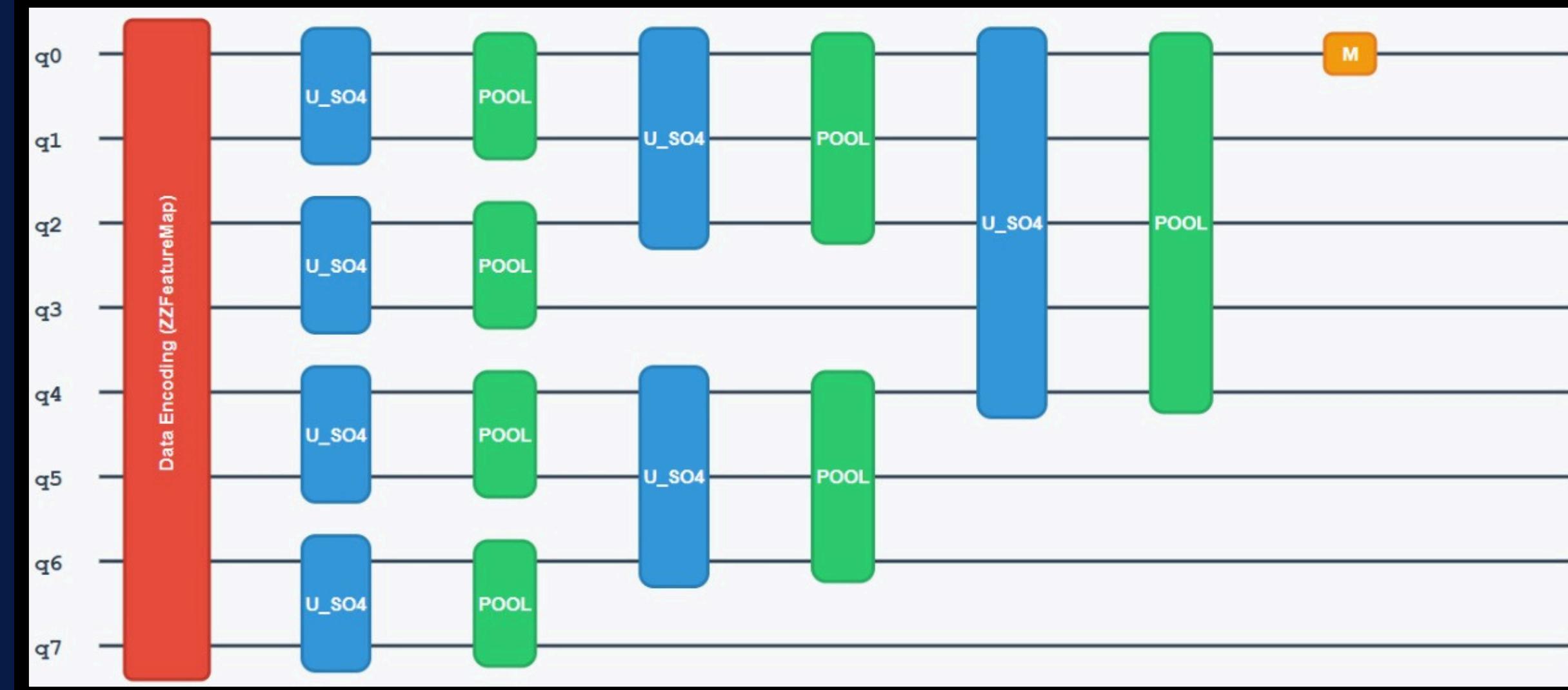
The Segmentation

```
● ● ●  
  
# Train classifier (30 epochs)  
model = train_classifier(train_dir='data/train', num_epochs=30)  
  
# Generate CAMs → pseudo-masks  
cam_generator = CAMGenerator(model)  
pseudo_masks = generate_pseudo_masks_batch(cam_generator, data_loader)  
  
# Train U-Net (3 epochs, frozen encoder)  
unet = LightUNet(freeze_encoder=True  
train_unet(unet, pseudo_masks, epochs=3)
```



The Stage Classifier

QCNN



```
1 def U_SO4(params, wires, noise_model='noiseless', noise_strength=0.0):
2     qml.RY(params[0], wires=wires[0]); qml.RY(params[1], wires=wires[1])
3     qml.CNOT(wires=[wires[0], wires[1]])
4     qml.RY(params[2], wires=wires[0]); qml.RY(params[3], wires=wires[1])
5     qml.CNOT(wires=[wires[0], wires[1]])
6     qml.RY(params[4], wires=wires[0]); qml.RY(params[5], wires=wires[1])
7
```



```
1 def Pooling_ansatz1(params, wires):
2     qml.CRZ(params[0], wires=[wires[0], wires[1]])
3     qml.PauliX(wires=wires[0])
4     qml.CRX(params[1], wires=[wires[0], wires[1]])
5
```

Entanglement Entropy Score (EES)

EES (Entanglement Entropy Score) is a quantum-inspired metric derived from MRI slices. It quantifies how disordered or entangled a brain region appears [1][2].

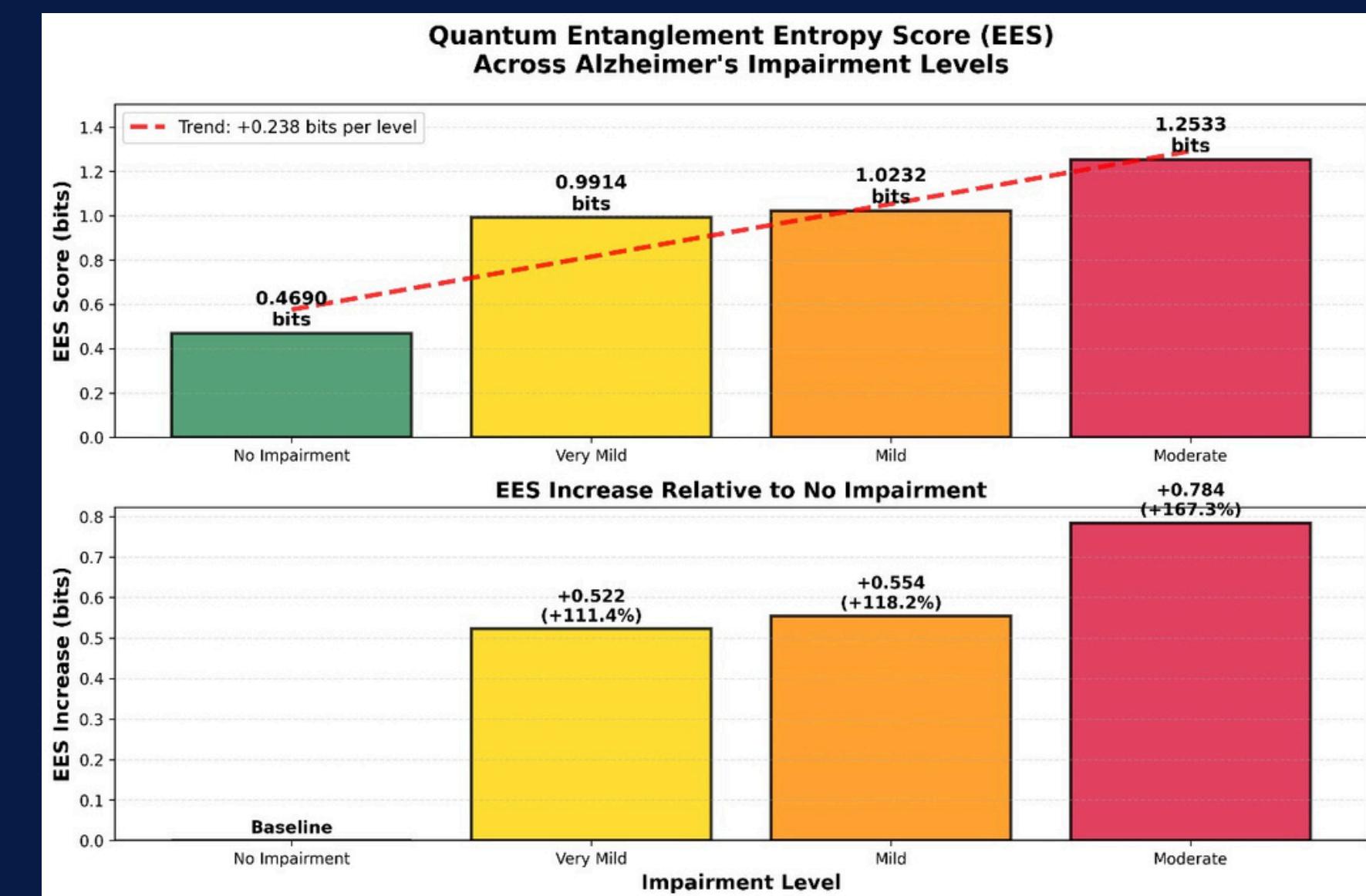
$$\text{EES} = -\text{Tr}(\rho_A \log_2 \rho_A)$$

```
● ● ●  
def compute_ees(self, mri_features: np.ndarray) -> Tuple[float, dict]:  
    # Step 1: Encode features in quantum circuit  
    circuit = self.create_feature_map(mri_features)  
  
    # Step 2: Compute reduced density matrix (5:5 partition)  
    rho_reduced = self.compute_reduced_density_matrix(circuit)  
  
    # Step 3: Calculate von-Neumann entropy - this is the EES!  
    ees_score = self.von_neumann_entropy(rho_reduced)
```

```
● ● ●  
def von_neumann_entropy(self, rho: np.ndarray) -> float:  
    # S = -Tr(ρ log₂ ρ) = -Σ λᵢ log₂(λᵢ)  
    eigenvals = np.linalg.eigvals(rho)  
    eigenvals = eigenvals[eigenvals > 1e-12] # Remove ~0 eigenvalues  
    entropy = -np.sum(eigenvals * np.log2(eigenvals + 1e-12))  
    return float(entropy)
```

As Alzheimer's progresses, the brain's spatial structure becomes noisier and more disorganized, especially in critical regions like the hippocampus.

This increases entanglement in the quantum state → higher EES. Thus, EES could serve as a stage-sensitive biomarker.



[1] Babu, A., Ghatnekar, Saurabh G, Saxena, A., & Mandal, D. (2024). Can Entanglement-enhanced Quantum Kernels Improve Data Classification? ArXiv (Cornell University). <https://doi.org/10.48550/arxiv.2406.0194>

[2] Belanche-Muñoz, L. A., & Wiejacha, M. (2023). Analysis of Kernel Matrices via the von Neumann Entropy and Its Relation to RVM Performances. Entropy, 25(1), 154. <https://doi.org/10.3390/e25010154>

The Probability

Prediction data based on stage classification

+

EES



```
def predict_alzheimer_risk(image_path, category):
    # 1. Extract MRI features (64-D)
    mri_features = extractor.extract_features(image_path)

    # 2. Compute quantum EES score
    ees_score = quantum_ees.von_neumann_entropy(
        quantum_ees.compute_reduced_density_matrix(
            quantum_ees.create_feature_map(mri_features)
        )
    )

    # 3. Neural network: [MRI + EES + Category] → Risk probability
    risk_prob = model(mri_features, ees_score, category).item()

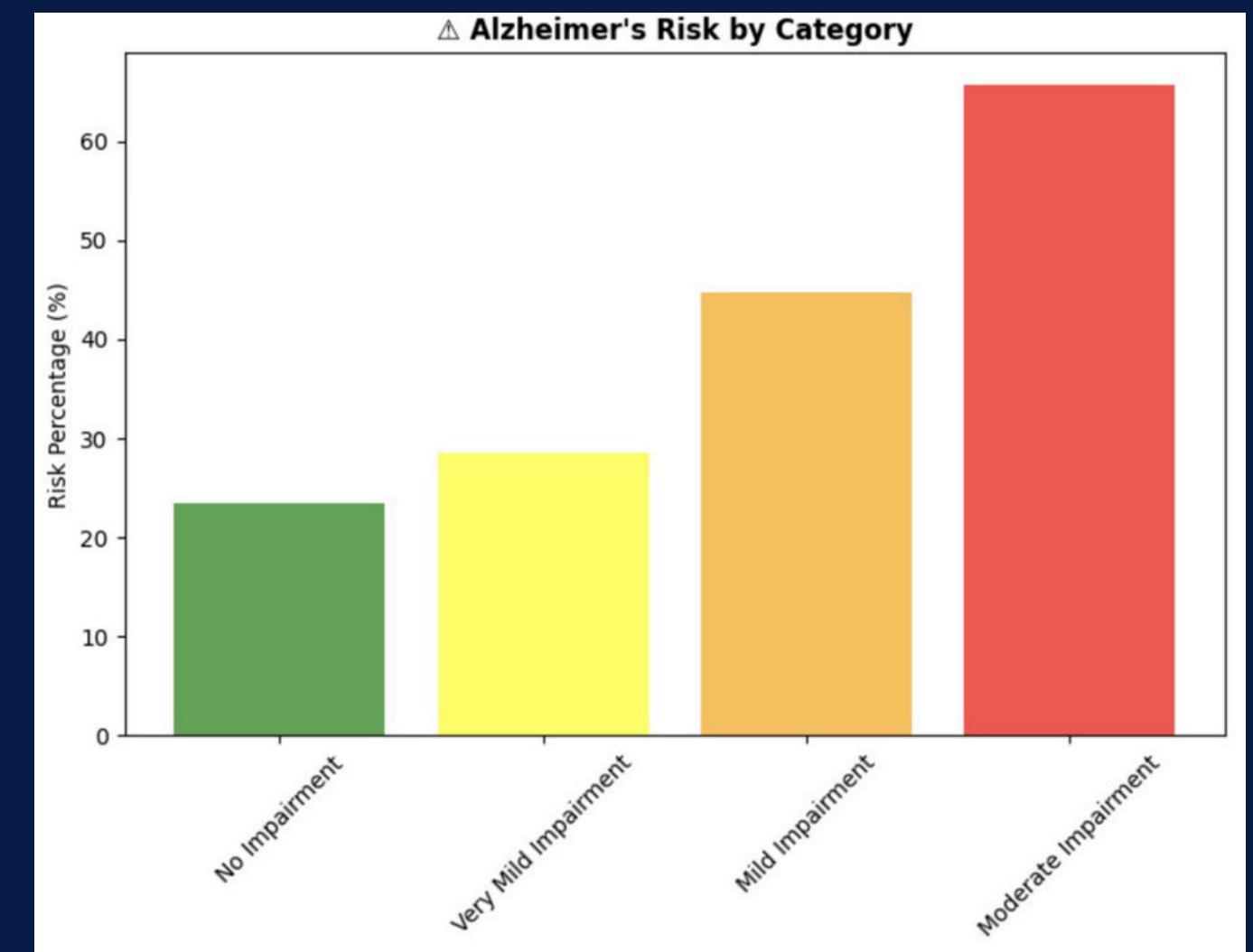
    return risk_prob # [0, 1]
```

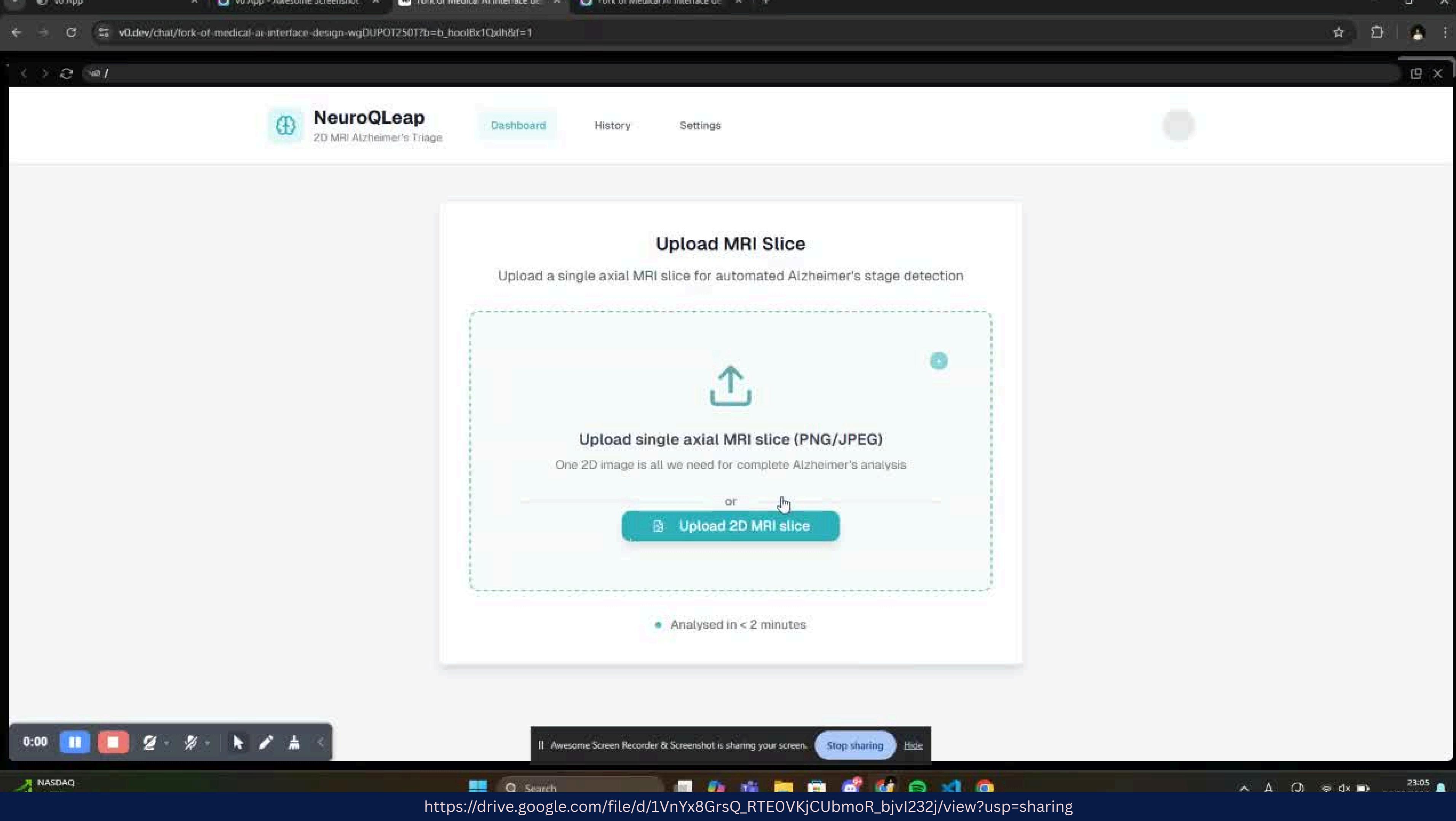
ALZHEIMER'S RISK ASSESSMENT REPORT
=====

RISK PREDICTION:
Primary Assessment: 78.6% chance of Alzheimer's within 36 months
Uncertainty Band: ±0.2%
Risk Range: 78.4% – 78.8%

QUANTUM BIOMARKER:
EES Score: 0.926294 bits
Category: Moderate Impairment

INTERPRETATION:
VERY HIGH RISK – Urgent clinical assessment advised





Sustainable Development Goals

3 GOOD HEALTH
AND WELL-BEING



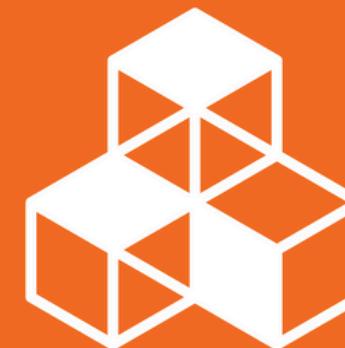
Targets early detection and reduces burden of Alzheimers

Developing Qu-Alz requires collaboration between quantum research, clinics, and governments.

17 PARTNERSHIPS
FOR THE GOALS



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



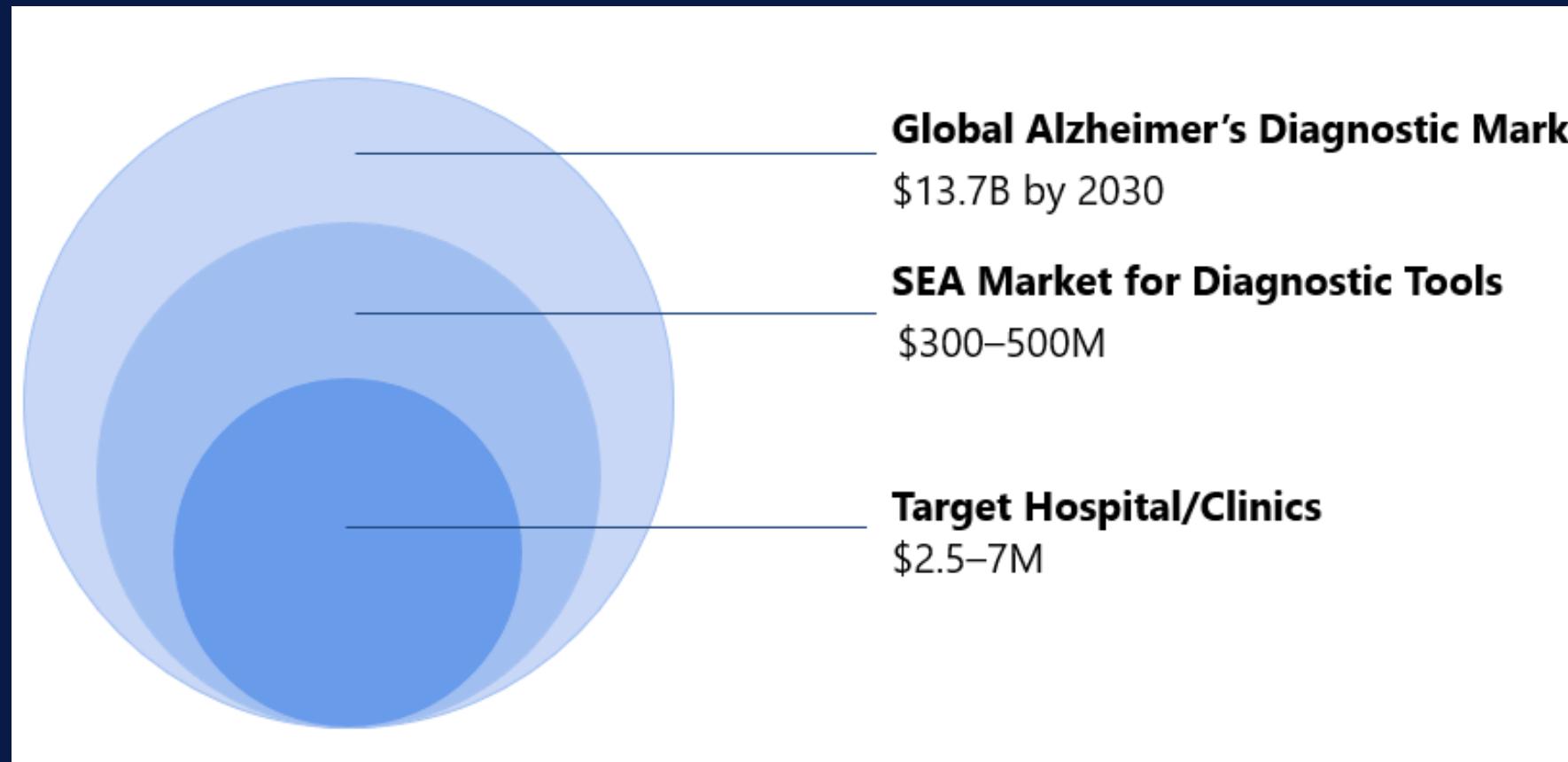
Qu-Alz enables cutting-edge medical technology, driving innovation in healthcare infrastructure.

By enabling affordable, accessible, and early-stage Alzheimer's prediction, we bridge the diagnostic gap between high- and low-resource settings in Southeast Asia

10 REDUCED
INEQUALITIES



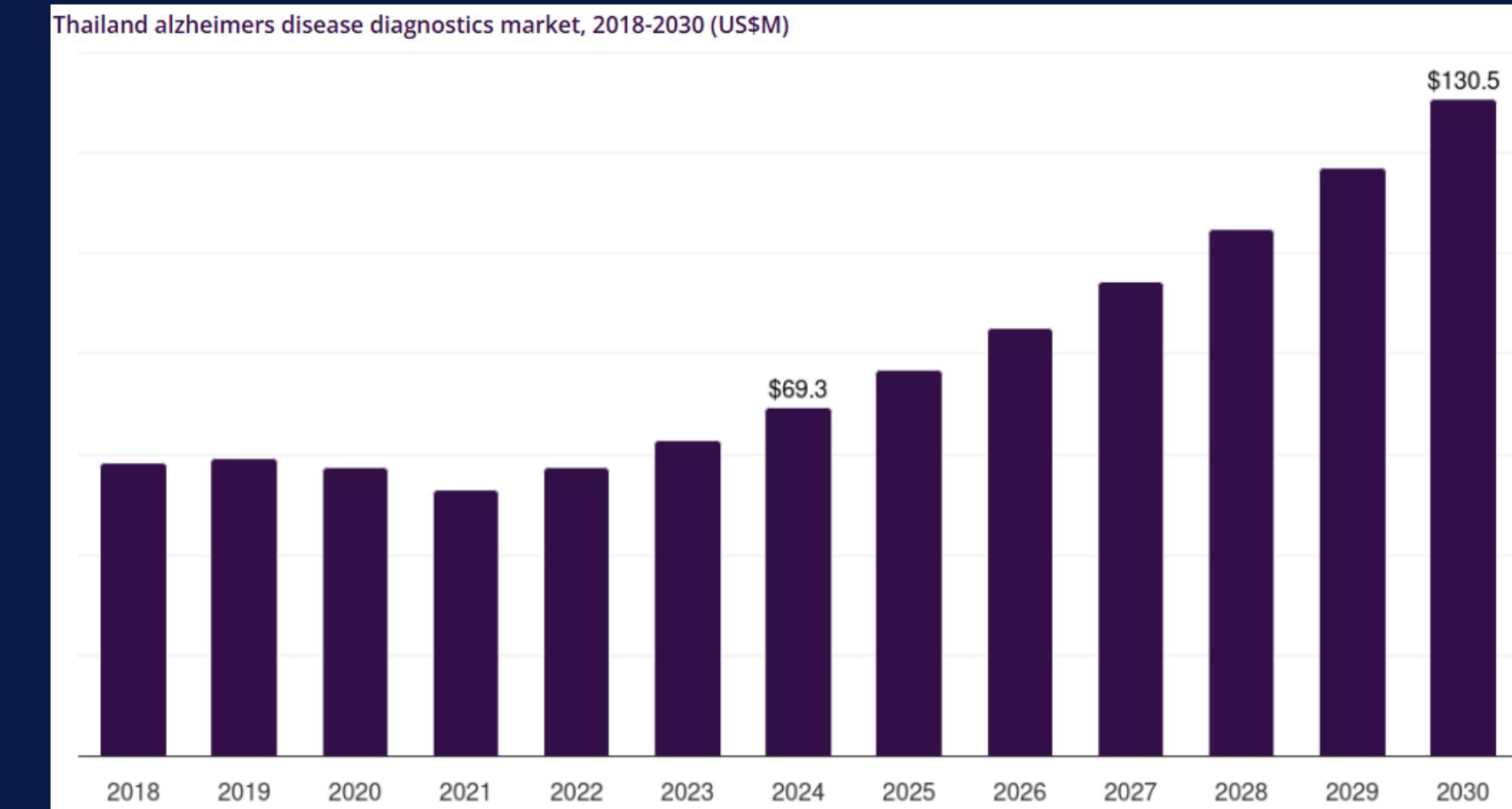
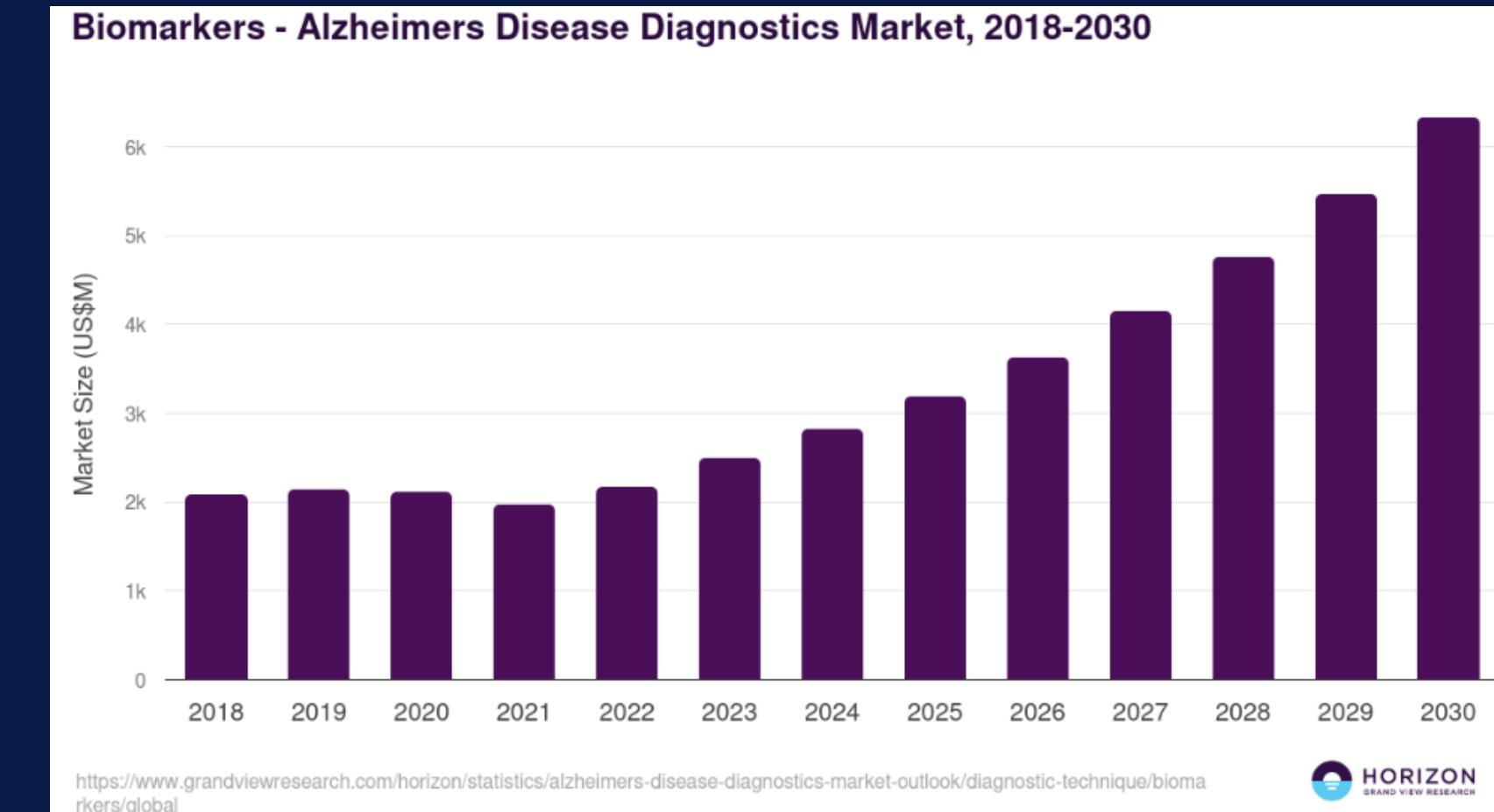
Now, let's talk feasibility.



Ageing population to boost ASEAN medical diagnostics market

The market is expected to grow at a CAGR of 12.6% over the medium term.

An increasing geriatric population in Southeast Asian countries is expected to boost the region's medical diagnostics market, which is projected to reach \$14.53b in 2026, according to a report from ResearchAndMarkets.



Where do we go from here?

\$ Possible Revenue Channels

Licensing to research labs



Screening subscriptions
for clinics



Insurance partnerships for early
detection tests



Phase 1 (Research)

Collaborate with
neuroscience labs using
public datasets

Phase 2 (B2B SaaS)

Integrate via cloud with
SEA hospitals/clinics.

Phase 3 (Global Collaboration)

Scale to LMICs and global
partners.

“Because forgetting is cruel. But prevention can be beautiful.”

Meet the Team

Sayed

Nawwar

Roi

Dimas

