



Health AI: Optimizing Access to Improve Health Outcomes

Dr. Abiel Roche-Lima, PhD | UPR Medical Sciences Campus | Continuum 2026

Continuum 2026 • June 22-24, 2026 • Puerto Rico



Academic & Research Role

- Associate Professor, UPR Medical Sciences Campus (San Juan, PR)
- Director, Integrated Informatics Service Core (IIS) — RCMI Program
- Coordinator, Research Capacity Core (RCC) — RCMI Program

Research Focus

- AI/ML methods for biomedical data: clinical informatics, pharmacogenomics, cardiovascular risk, infectious disease, population health & health fairness, with emphasis on insufficiently represented Hispanic/Caribbean populations

Education & Training

- Ph.D. Computer Science - University of Manitoba, Canada
- MsC. Computer Science – University of Santa Catarina, Brazil
- BSc. Science – University of Havana, Cuba

Agenda

Part 1

Understanding AI & Generative AI

Part 2

The Health Fairness Challenge

Part 3

Research: AI for Health Fairness in Puerto Rico

Part 4

AI Optimizing Access - Practical Tools & Vision

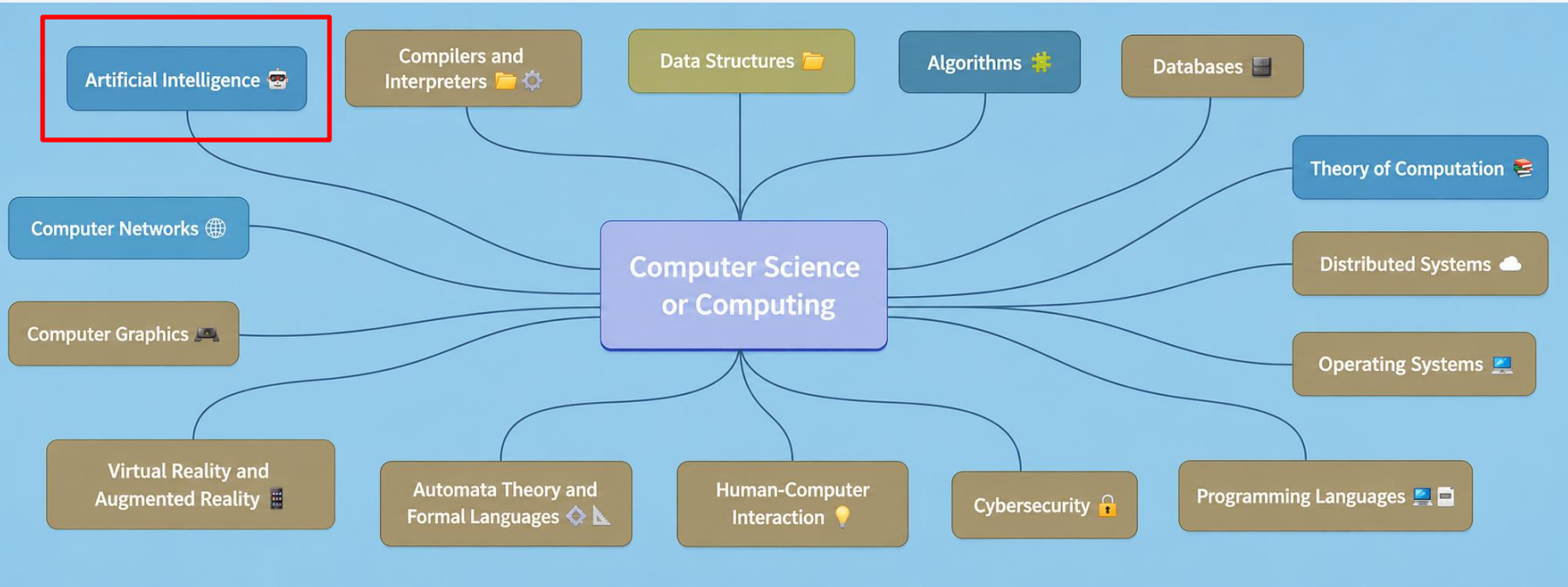




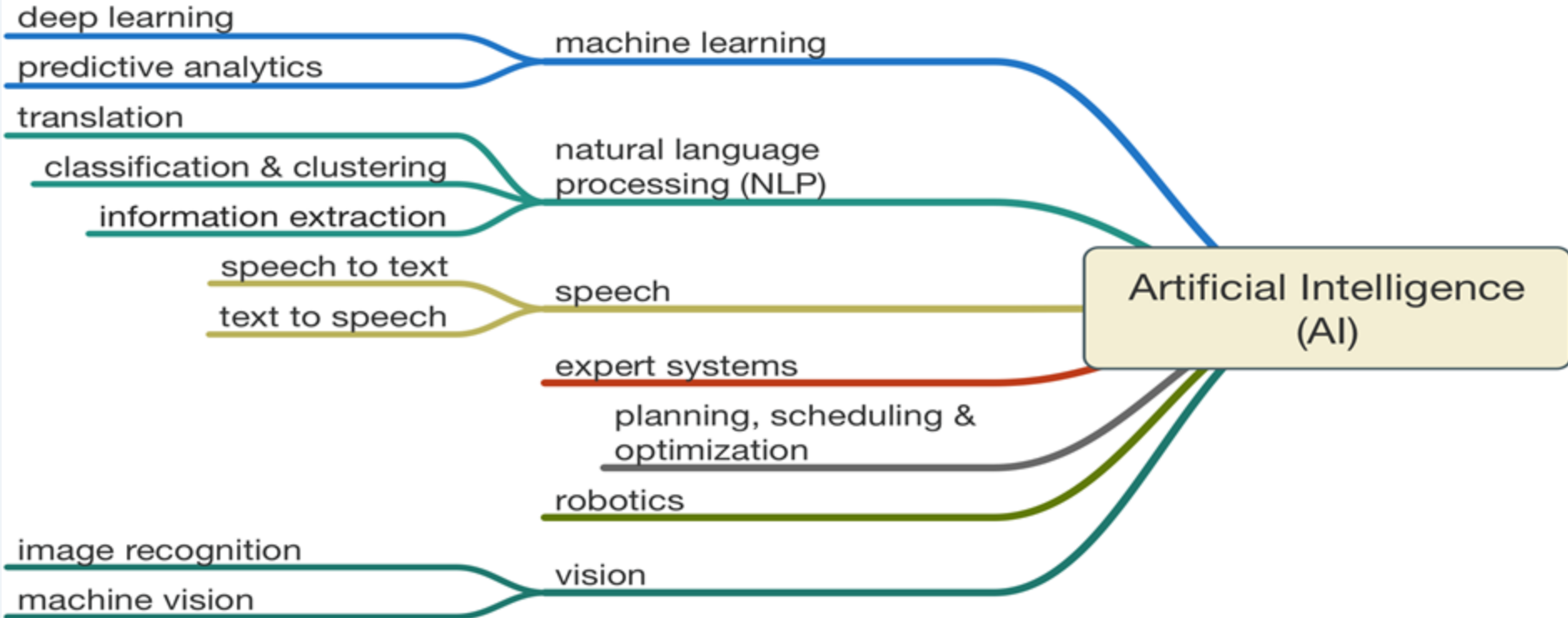
PART 1

Understanding AI & Generative AI

Artificial Intelligence: A Computer Science Area



Artificial Intelligence: AI Branches



Artificial Intelligence: A 60-Year Journey

From Theory to Transformation

1950s-1970s Symbolic AI, rule-based systems. Turing Test, early chess programs, LISP.

1980s-1990s Expert systems. Machine learning emerges. Neural network research resumes.

2000s-2010s Big data + GPU computing. Deep learning revolution. ImageNet breakthrough (2012).

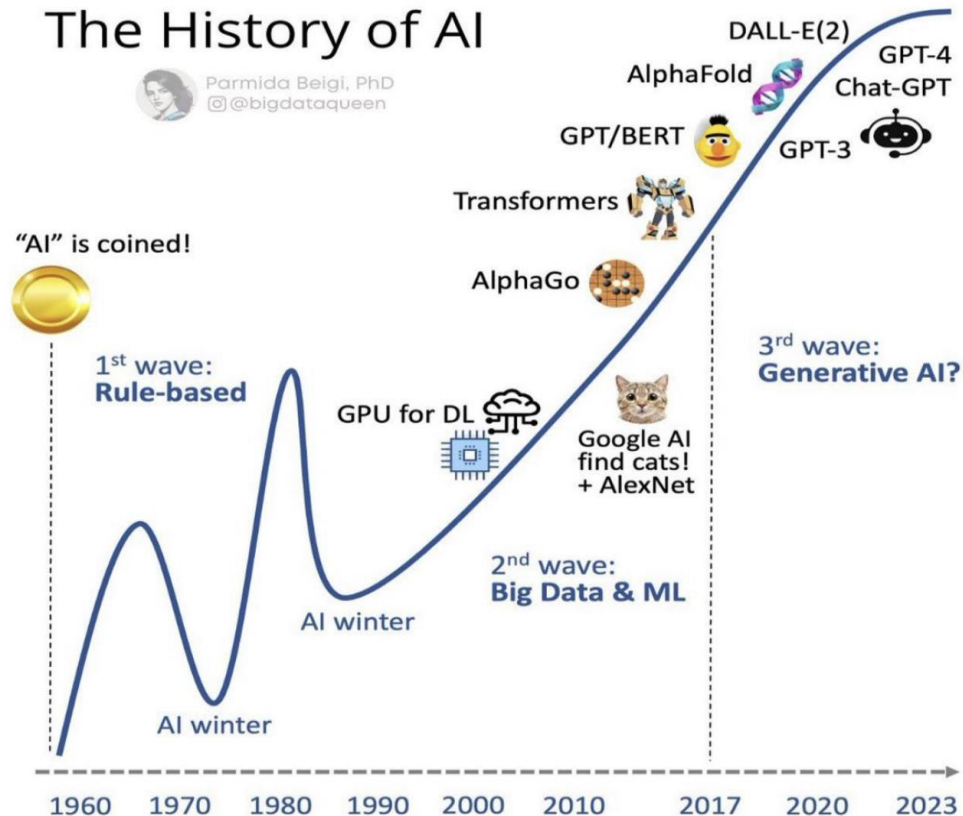
2017-present Transformer architecture. Large language models. Generative AI enters healthcare.

Each wave brought new capabilities - and new questions about safety, bias, and equity.

The History of AI



Parmida Beigi, PhD
@bigdataqueen



AI in Healthcare: Key Application Domains

Five Key Domains

Clinical Decision Support AI-assisted diagnosis, differential reasoning, treatment recommendations at the point of care.

Medical Imaging Deep learning for radiology, pathology, retinal scans - matching specialist accuracy.

Drug Discovery Protein structure prediction (AlphaFold), molecular screening, accelerating research pipelines.

Genomics & Precision Medicine Variant interpretation, polygenic risk, pharmacogenomics tailored to populations.

Population Health Predictive analytics for disease surveillance, readmissions, and resource allocation.



The AI Landscape: From ML to Generative AI

Artificial Intelligence (AI)

(Theory & Methods)

Machine Learning (ML)

(Learning from Data)

Deep Learning

(Neural Networks)

Generative AI

(Text, Image, Audio, Video)

Machine Learning (ML)

- Learns patterns from labeled data
- Supervised, unsupervised, reinforcement
- Risk prediction, drug dosing models

Deep Learning (DL)

- Multi-layer neural networks
- Radiology AI, EEG, medical imaging
- Requires large training datasets

Generative AI (GenAI)

- Creates new content: text, images, code
- LLMs, GANs, diffusion models
- ChatGPT, Claude, Gemini - clinical notes, RAG, Agentic AI

The breakthrough behind all modern LLMs (GPT, Claude, Gemini).

- **Embedding** words become numeric vectors
- **Output** probability distribution over next token (e.g., "way" 52%)

- Explore interactively: poloclub.github.io/transformer-explainer

Explore interactively: poloclub.github.io/transformer-explainer

The AI Ladder: 4 Levels of Implementation

4

Agentic AI Multi-agent systems orchestrating complex workflows autonomously (e.g., Medica.AI-Agents for primary care)

3

AI Agents LLMs that plan, call tools, and act step-by-step (e.g., literature review agents, clinical workflow automation)

2

RAG LLMs + external knowledge bases — reduces hallucinations, enables verifiable evidence (e.g., clinical guidelines)

1

LLM (Chat) General-purpose reasoning from internal knowledge (e.g., ChatGPT, Claude, Copilot)

#CONTINUUM2026



PART 2

The Health Fairness Challenge

AI in Health: A Powerful Tool — With Fairness Risks

The Promise

- AI improves diagnosis, risk prediction, drug dosing, and clinical efficiency
- GenAI accelerates literature review, documentation, and decision support
- Potential to reach disadvantaged populations at scale

The Risk

- Models trained on non-Hispanic white populations generalize poorly
- Skewed predictions can widen, not close, health disparities
- Insufficient representation in data → underperformance in care

Why It Matters for Hispanics

- Caribbean Hispanics have unique genetic admixture (European + African + Native American)
- High prevalence of diabetes, asthma, cardiovascular disease
- Puerto Rican patients insufficiently represented in landmark AI training datasets

The Imperative

- We cannot simply import AI models built elsewhere
- We must build population-specific, fairness-centered AI

Puerto Rico: A Natural Laboratory for All-Encompassing Biomedical AI

3.2M

Population with unique
genetic admixture

~32%

Prevalence of diabetes
(vs. 11% national avg)

~25%

Prevalence of asthma —
highest in U.S.

>60%

HIV cohort with
preventable mortality
factors

Legislative & Organizational Framework

- **PR Government AI Act (2025):** AI Officer, Advisory Council, transparency regulations
- **UPR Certification 66 (2024-25):** Ethical AI policy for academic & clinical use (HIPAA/FERPA)
- PR designated “**AI Corridor of the Americas**” investment hub (Feb 2026)

Our Vision: *Puerto Rico as the benchmark for ethical, all-encompassing AI for Hispanic/Caribbean communities*



PART 3

Research: AI for Health Fairness in Hispanics



Pharmacogenomics

Warfarin dosing for
Caribbean Hispanics

Cardiovascular

TAVR/TMVR mortality
risk prediction

Infectious Disease

HIV mortality ·
MLSyPred drug
synergy

Neurology

EEG-based seizure
prediction (non-
invasive)

Computational Biology

Aptamer discovery via
ML · WFST methods

Population Health

Lab reference intervals
for Puerto Rico (NIH
AIM-AHEAD)

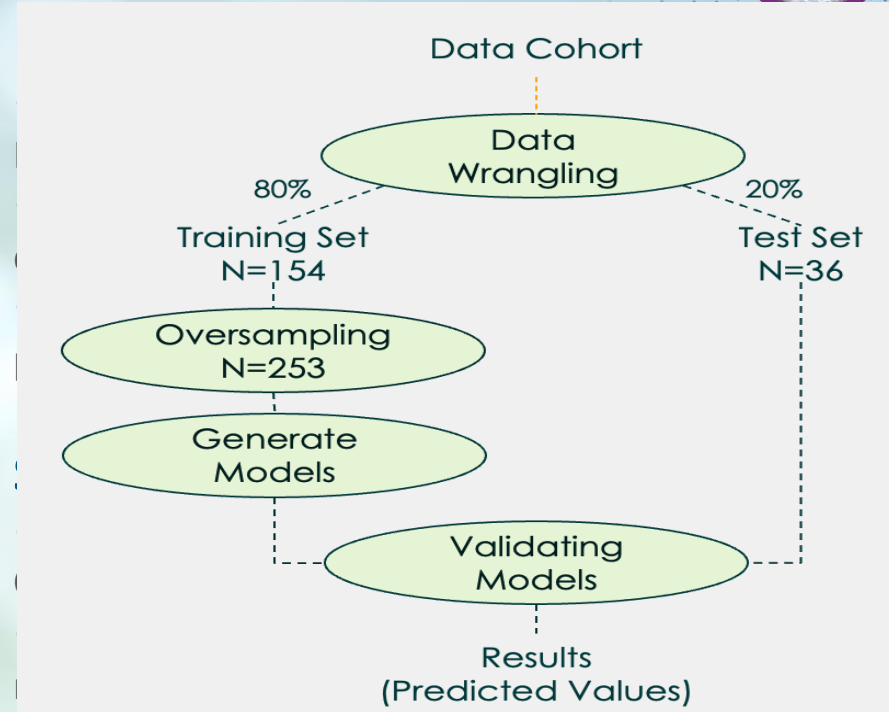
Precision Pharmacogenomics for Puerto Rico

The Problem

- Warfarin has a narrow therapeutic index — small errors cause bleeding or thrombosis
- Standard IWPC algorithm based on European/Asian populations
- Caribbean Hispanics have unique genetic admixture → poor algorithm performance

Our Approach

- Population-specific ML model integrating clinical + genetic variables (VKORC1, CYP2C9, NQO1)
- Extended to predict warfarin sensitivity (Random Forest, XGBoost)
- Classifies patients as normal / sensitive / highly sensitive



Key findings: reduced dosing errors vs. IWPC algorithm — first Caribbean Hispanic warfarin ML model

Cardiovascular Medicine: ML-Driven Mortality Risk

TAVR & TMVR: The Clinical Problem

- Transcatheter Aortic (TAVR) and Mitral (TMVR) Valve procedures carry in-hospital mortality risks
- Traditional clinical scores miss non-obvious predictors

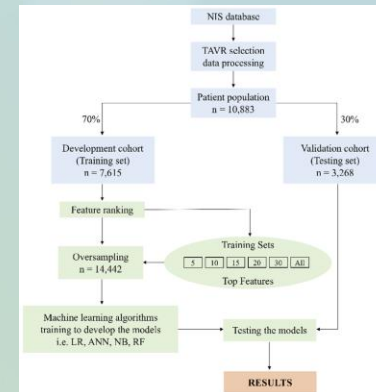
ML Approach & Discovery

- ML models identified non-traditional mortality predictors: specific comorbidities + lab values
- Outperformed traditional clinical scoring systems for risk stratification
- Same ML framework generalized successfully to both TAVR and TMVR

Vision: Unified ML-driven risk assessment platform for structural heart disease

Atrial Fibrillation & Genetic Admixture

- ML analysis revealed higher Native American ancestry correlates with lower AFib risk
- Highlights the importance of including diverse populations in cardiovascular genomic research



HIV Mortality Study: Bayamón, Puerto Rico

Study Context

- Prospective cohort: 1,929 persons with HIV (PWH) in Bayamón, PR (since 2000)
- Matched with PR Health Department Mortality Registry
- 32.2% mortality by December 2022
- 67.9% male; 67.1% had history of injected drug use

Methods

- ML algorithms: Logistic Regression, Linear Discriminant Analysis, Support Vector Classifier
- 80/20 train-validation split; sex-stratified analyses
- Best model: LDA (0.78 overall) | SVC: 0.83 men, 0.86 female patients

Key Findings

- Cancer, anemia, and HCV infection: predominant predictors in the full cohort
- Men: liver conditions, injected drug use, alcohol
- Female patients: anemia, cancer, injected drug use

Significance

- ML reveals preventable, actionable risk factors beyond HIV itself
- Underscores need for comprehensive, integrated care in HIV management
- Findings support targeted prevention strategies for this vulnerable Hispanic population

Collaborators: A. Mayor — UPR/UCC

Lab Reference Intervals for Puerto Rico

The Problem

- Clinical “normal” lab ranges derived from non-Hispanic white populations
- Can lead to misdiagnosis or delayed treatment in Hispanic patients
- CKD markers (creatinine, eGFR) are particularly affected

Our Method

- Unsupervised ML to separate healthy from pathological results in large real-world datasets
- Established accurate, PR-specific reference intervals without needing pre-screened healthy donors





PART 4

AI Optimizing Access — Practical Tools & Vision

Research to Action: Clinical & Population Health

AI Certification for Healthcare Professionals

- NIH/NNLM funded — currently executing first cohort
- Track 2: Application of AI in Biomedical Research
- Curriculum: prompt engineering, RAG systems, and Agentic AI for biomedical workflows

AIML+HDR Training Initiative

- Training program for Hispanic researchers in Python, ML, and Health Disparities Research
- Builds local capacity to analyze complex biomedical data
- Directly addresses brain drain by creating a sustainable research pipeline in Puerto Rico



The poster features a dark background with a grid of small white dots. At the top left are two circular logos: the University of South Carolina and the Institute of Medicine (IOM). To the right is a square image showing a network of white lines on a yellow background. The main text is in white and yellow. The title 'ARTIFICIAL INTELLIGENCE' is in large, bold, white letters. Below it, 'FOR HEALTH CARE PROFESSIONALS' is in smaller white letters, and 'OFFERED BY THE DEANSHIP OF ACADEMIC AFFAIRS, MEDICAL SCIENCES CAMPUS' is in yellow. The body text describes the 40-hour certification program, its tracks, and the application deadline. A QR code is located at the bottom center. At the very bottom, small text mentions project sponsorship by the Network of the National Library of Medicine.

PROFESSIONAL CERTIFICATION IN
ARTIFICIAL INTELLIGENCE
FOR HEALTH CARE PROFESSIONALS
OFFERED BY THE DEANSHIP OF ACADEMIC AFFAIRS, MEDICAL SCIENCES CAMPUS

This fully online, asynchronous 40-hour certification provides structured, interdisciplinary training in AI applications for healthcare. Participants can choose one of two tracks — **Education & Clinical Practice** or **Research** — designed to bridge the critical skills gap in healthcare technology integration.
Program dates: January 15 – April 16, 2026

ONLY 14 SPOTS AVAILABLE — ALL COSTS COVERED!
Health professionals and researchers selected as NNLM Scholars will receive full funding through an NNLM Award. Apply now using the form below.



Continue education credits can be obtained

PROJECT SPONSORED BY THE NETWORK OF THE NATIONAL LIBRARY OF MEDICINE, REGION 2
SUBAWARD FROM MEDICAL UNIVERSITY OF SOUTH CAROLINA #A21-0296-S045

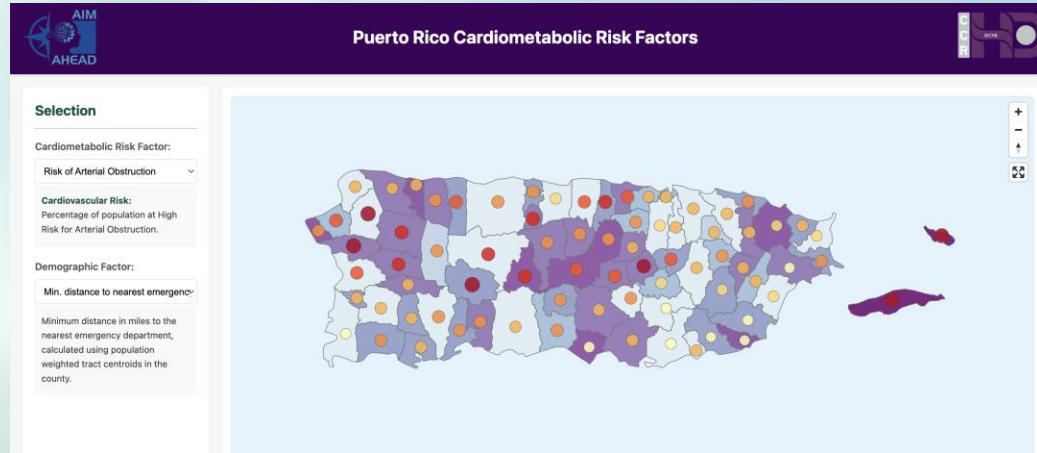
Research to Action: Clinical & Population Health

SDOH Interactive Dashboard

- sdoh-rcmi.rcm.upr.edu — publicly available
- Integrates social determinants of health data for Puerto Rico
- Enables population-level health risk visualization for researchers and policymakers

MLM-RInPR Clinical Reference Tool

- Population-specific lab reference intervals for Puerto Rico
- Directly integrated into clinical workflows to improve diagnostic accuracy
- Reduces misdiagnoses caused by applying non-Hispanic reference ranges



Medica.AI-Agents: Agentic AI for Primary Care in Puerto Rico

The Concept

- Agentic AI to automate clinical workflows and support physician decision-making
- Two primary care clinics in Puerto Rico as implementation sites
- AWS-native architecture: Bedrock Agents, HealthLake, SageMaker

Current standing

- Submitted to Amazon Research Awards (under review)

Clinical Workflow Automation

- Ambient documentation, prior authorization, referral management
- AI-assisted risk stratification at the point of care

PRIMAIR: AI for Cardiometabolic Risk

- Submitted to NIH FAIR-MED (under review)
- Trustworthy AI/ML Clinical Decision Support for cardiometabolic risk
- Co-designed with frontline primary care physicians
- Language-based AI Agent to help providers interpret outputs and communicate next steps

Access Optimization

- Reduce administrative burden on physicians — more time for patients
- AI acting as a force multiplier in resource-limited settings
- Measurable target: improve care access for disadvantaged PR communities

Puerto Rico: Strategic Position in the AI Health Ecosystem

The Strengths

- Unique genetic and epidemiological profile — an invaluable natural laboratory for biomedical AI
- High disease burden (diabetes, asthma, HIV, cardiometabolic) creates urgent, tractable research questions
- Strong research institutions: UPR-MSH, UCC, RCMI program infrastructure
- Bilingual, socially connected researchers bridging Hispanic/Caribbean communities globally

The Challenges

- Brain drain: talent retention remains a critical obstacle to sustaining research capacity
- Puerto Rican clinical data insufficiently represented in large national AI datasets
- Risk: if not addressed, AI gaps will perpetuate rather than reduce health disparities

The Opportunity

- PR designated as “AI Corridor of the Americas” investment hub (February 2026)
- PR Government AI Act (2025) creates framework for ethical, transparent AI governance
- Window to become the benchmark for all-encompassing, ethical AI for all Hispanic and Caribbean populations

Key Takeaways

1

AI is transforming health care — but fairness is not automatic — Models built on skewed data produce skewed outcomes. All-encompassing AI requires intentional, population-specific design.

2

Puerto Rico has a unique, urgent role to play — Our genetic variability and disease burden make PR an indispensable laboratory for AI that works for Hispanic populations.

3

Our research demonstrates AI can optimize health outcomes for insufficiently represented populations — From warfarin dosing to HIV mortality, ML reveals actionable, preventable factors.

4

Agentic AI is the next frontier for access optimization — Medica.AI-Agents and PRIMAIR represent the shift from prediction to action — AI as a clinical partner.



Thank You

Dr. Abiel Roche-Lima, PhD

Associate Professor | UPR Medical Sciences Campus

abel.roche@upr.edu | aroche.rcm.upr.edu | arl-lab.rcm.upr.edu

Continuum 2026 · June 22-24, 2026 · Caribe Hilton, San Juan, Puerto Rico