Transforming Cancer Research and Care: Convergence of Data Science, Artificial Intelligence and Virtual/Digital Platforms

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The Stephen and Barbara Slaggie Executive Director
Mayo Clinic Cancer Programs and Comprehensive Cancer Center
The David A. Ahlquist, M.D. Professor in Cancer Research

National Academies Cancer Engineering Workshop I May 20, 2025

Our Values:

- The needs of the patient come first
- **RICH-TIES: R**espect, **I**ntegrity, **C**ompassion, **H**ealing - **T**eamwork, **I**nnovation, **E**xcellence, **S**tewardship

Our Mission and Aims:

- To reduce the cancer burden by driving exceptional transdisciplinary and translational research and delivering expert prevention and care
- To use our unique platforms, digital technologies, artificial intelligence (AI), and intelligent automation, to foster innovative research and transform the delivery of cancer care and clinical trials in clinical, home, and community settings
- To engage and support the patients and communities we serve to enhance access, overcome cancer disparities, and drive health equity
- To educate, train, and mentor the next generation of cancer physicians, scientists, healthcare providers, and leaders
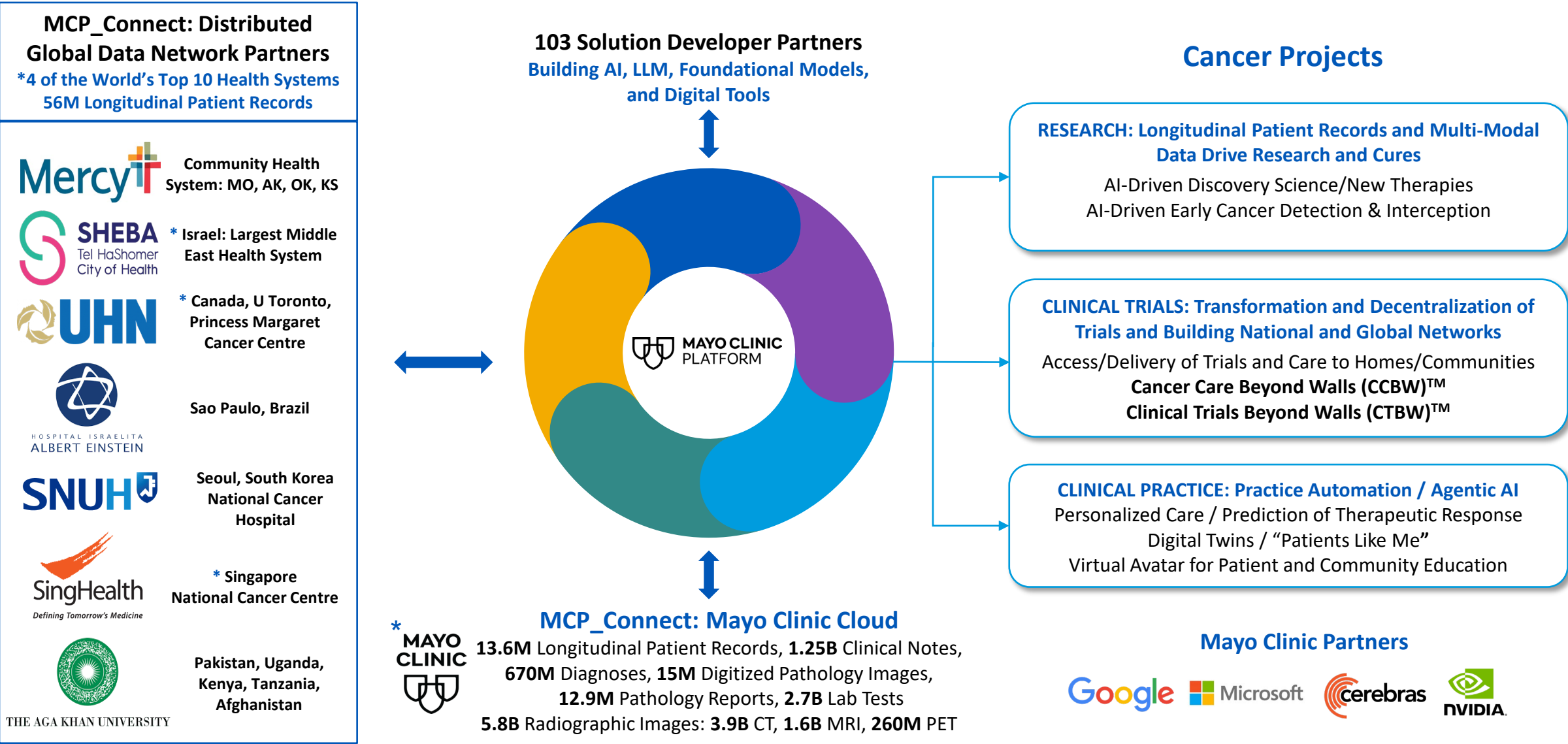
Our Vision:

- To share our platforms, data, knowledge and expertise nationally and globally to assure that cancer research and care are accessible to all, within and beyond our walls, at anyplace and anytime


"Within its walls, all classes of people, the poor as well as the rich, without regard to color or creed, shall be cared for without discrimination." William Mayo, 1914

Mayo Clinic Platform (MCP): Transforming Cancer Research, Trials, and Care Delivery

MCP_Connect: Distributed Global Data Network Partners
***4 of the World's Top 10 Health Systems
56M Longitudinal Patient Records**

Mercy — Community Health System: MO, AK, OK, KS

SHEBA Tel HaShomer City of Health — * Israel: Largest Middle East Health System

UHN — * Canada, U Toronto, Princess Margaret Cancer Centre

HOSPITAL ISRAELITA ALBERT EINSTEIN — Sao Paulo, Brazil

SNUH — Seoul, South Korea National Cancer Hospital

SingHealth Defining Tomorrow's Medicine — * Singapore National Cancer Centre

THE AGA KHAN UNIVERSITY — Pakistan, Uganda, Kenya, Tanzania, Afghanistan

103 Solution Developer Partners
Building AI, LLM, Foundational Models, and Digital Tools

MAYO CLINIC PLATFORM

MCP_Connect: Mayo Clinic Cloud
* **13.6M** Longitudinal Patient Records, **1.25B** Clinical Notes, **670M** Diagnoses, **15M** Digitized Pathology Images, **12.9M** Pathology Reports, **2.7B** Lab Tests **5.8B** Radiographic Images: **3.9B** CT, **1.6B** MRI, **260M** PET

Cancer Projects

RESEARCH: Longitudinal Patient Records and Multi-Modal Data Drive Research and Cures
AI-Driven Discovery Science/New Therapies
AI-Driven Early Cancer Detection & Interception

CLINICAL TRIALS: Transformation and Decentralization of Trials and Building National and Global Networks
Access/Delivery of Trials and Care to Homes/Communities
Cancer Care Beyond Walls (CCBW)™
Clinical Trials Beyond Walls (CTBW)™

CLINICAL PRACTICE: Practice Automation / Agentic AI
Personalized Care / Prediction of Therapeutic Response
Digital Twins / "Patients Like Me"
Virtual Avatar for Patient and Community Education

Mayo Clinic Partners

Google   Microsoft   cerebras   NVIDIA

Multi-modal, Multi-Step AI Algorithms for Early Detection of Visually-Occult Pancreatic Cancer

- Developed AI-powered radiomics-based machine learning method capable of detecting visually occult pancreatic cancer in a normal-appearing pancreas on pre-diagnostic CTs at a median of 386 (97–1092) days prior to clinical diagnosis (AUC: 0.98)

- In contrast, inter-reader radiologist agreement was poor: AUC=0.66 (95% CI: 0.46–0.86; p< .001)

- Validation: The algorithm performed with high specificity in an independent NIH imaging data set (96.2)

- *Development of a Population-Based Screen: AI-PACED Feasibility Study: Automated Risk Stratification, Serial Artificial Intelligence-Augmented Imaging, and Biobanking for Early Detection of Pancreatic Cancer*

  - 10,000 individuals with an elevated risk for PDA will be recruited from all Mayo Clinic sites using an AI-driven screening algorithm: **E**nriching **N**ew Onset for **D**iabetes (**NOD**) for **Pa**ncreatic **C**ancer (**ENDPAC**) score and other metabolic and metabolic parameters to stratify individuals (Petersen, Chari (*Gastroenterology* 2018; 155(3):730-739)

  - **Individuals with ENDPAC scores ≥3 exhibit a 20-fold increased risk of PDA within 3-years**

  - Participants will undergo AI-augmented CT scans at regular intervals, serial biosampling and psychosocial support
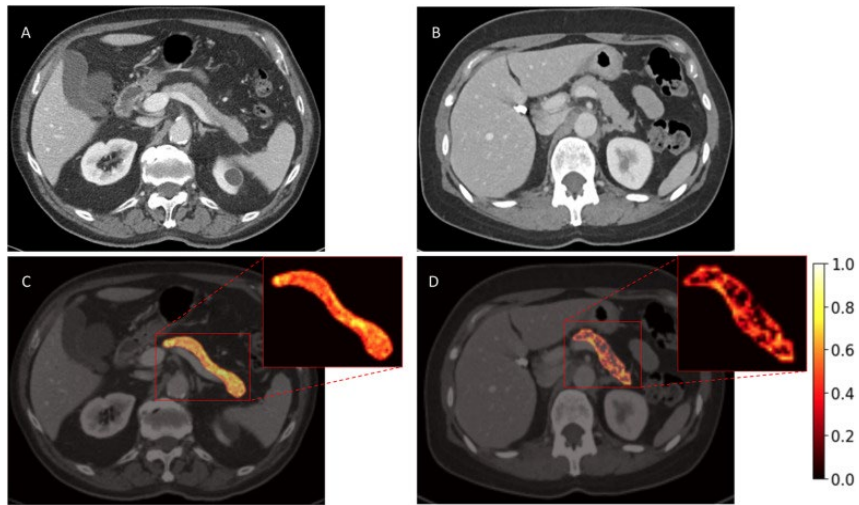
IMPACT ➤ *Potentially Paradigm Shifting, Practice Changing, and Policy Impacting: this prospective population-based study will seek to validate the AI-based early detection approach on a large scale, with the goal of improving outcomes of sporadic PDA through earlier detection and interception*
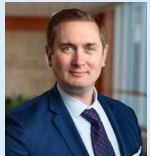
A. Goenka, MD
(REDI/ACTS, MCR)

G. Petersen, PhD
Deceased

S. Chari, MD
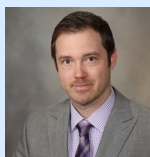(MD Anderson)

J. Kisiel, MD
(REDI, MCR)

S. Majumder, MD
(REDI, MCR)

M. Wallace, MD
(REDI, MCA)

K. Ballman, PhD
(ACTS, MCR)

N. Larson, PhD
(MCR)

Transforming Cancer Care Delivery: Cancer Care Beyond Walls™

Driving Access, Reducing Patient Financial Burden and Toxicity, and Health Equity
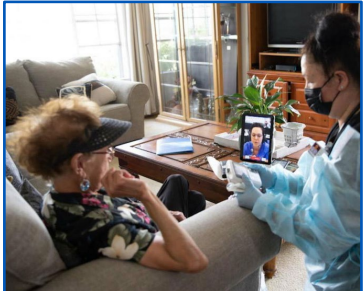
OUTPATIENT CARE AT HOME
- Telehealth (virtual visits, remote patient monitoring/RPM)
- Home healthcare
- Supportive care/home infusion

CHEMOTHERAPY AT HOME
- Home cancer-directed therapy (chemotherapy, immunotherapy) infusion
- Home labs
- Telehealth (virtual visits, RPM)

SUPPORTIVE CARE AT HOME
- Palliative care
- Non-medical home care
- Virtual visits with other members of the care team (*e.g.* nutritionist, social worker)

Active CCBW™ Trials and Accruals

23-2025 Volume Metrics	Proof of Concept	RCT NCT05969860	BMS NCT06265285 Sub Q Nivolumab	Total
Enrolled	N/A	• 77 • 6 Hispanic/Latino Ethnicity • 7 Black/African American • 62 NH White • 2 Did Not Disclose	• 15 • 15 NH White	92
Accrued	N/A	72	15	87
Patients Treated In-Home	10	47	11	68
Treatments	117	249	37	403

IMPACT

Paradigm Shifting, Practice Changing, and Potentially Policy Impacting:
- *A transformative project to enhance access to cancer care and health equity*
- *Ongoing comparative effectiveness research to assess costs and impact to promote necessary policy and reimbursement changes for in-home care*
- *First distant, rural site opened:* **Altru** *Grand Forks, North Dakota; expansion to MCHS, MCR, MCA in 2025*
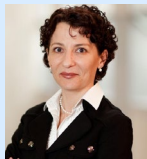
Team
- **R. Dronca, MD** (ACTS, MCF)
- **T. Haddad, MD** (ACTS, MCR)
- **M. Maniaci, MD** (MCF)
- **J. Jones, MD** (ACTS, MCF)
- **G. Colon-Otero, MD** (CPCS, MCF)
- **C. Willman, MD** (CGSM, MCR)
- **John Halamka, MD** (CPCS, MCP, MCR)
- **Rosanna Fahy** (MCP)
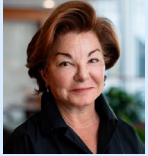
Funding
Emerson Collective
State of Florida Funds
Industry Trial Support
MCCCC Philanthropy

Shared Resources
Biostatistics
Biospecimens

Center for Digital Health
Advanced Care at Home
Mayo Clinic Platform

Clinical Trials Beyond Walls

Enabling Decentralized Capabilities for All Clinical Trials

Tufia Haddad, M.D.
CTBW Medical Director

Rebecca Kottschade, M.A.
CTBW Research Administrator

Piloting Foundational Capabilities With Study Teams
To Enable, Test and Learn

Transportation Barriers in Research - A Decentralized Approach for Tailored Community Engagement in a Vitamin-D Study. (1)

Gerardo Colon-Otero M.D.
Oncology - FLA

Remote capabilities added 9/1/2023

Home-Based Prehabilitation before Complex Gynecologic Oncology surgery at a Destination Surgical Practice. (2)

Amanika Kumar, M.D.
Gyn Surgery - RST

Activated 3/1/2024

Pilot Clinical Trial of a home-based program of rehabilitation with health coaching to improve outcomes in post-intensive care syndrome patients. (3)

Rodrigo Cartin-Ceba, M.D.
Pulmonology - ARZ

Activated 4/22/2024

Neuro-Oncology Anywhere: Remotely assessing the impact of metformin on cognition and quality of life in patients with history of cranial radiation. (4)

Ugur T. Sener, M.D.
Neurology - RST

Activated 5/31/2024

REMOTE CONSENT WITH VIDEO

VIDEO VISITS

REMOTE BIOSPECIMEN COLLECTION

REMOTE PARTICIPANT MONITORING

DEVICE SERVICES

Study #	Accrual	Target	Activation to 1st Patient On Study	# of Days Study Open
1	- -	- -	- -	- -
2	29	40	7 days	312 (1 patient every 10 days)
3	31	60	16 days	251 (1 patient every 8 days)
4	52	100	0 days	228 (1 patient every 4 days)

Total Patients Accrued =
112 across 3 of 4 RFA trials

Composable Capabilities Enable Flexible Trial Design

Clinical Trials Beyond Walls

COMMUNICATE		CONNECT	COLLECT			CARE
PROVIDE CONSENT	**CONTACT STUDY TEAM**	**ACCESS DEVICES**	**SHARE BIOSIGNALS**	**SHARE BIOSPECIMENS**	**PROVIDE HEALTH INFO**	**RECEIVE MEDICATION**
Remote Consent with Video	Video Visit	Tablets	Remote Vitals and Activity Collection	Remote Phlebotomy	Surveys	Medication Delivery
Screen Sharing	Phone Call	Wearables	Asynchronous Remote Vitals and Activity Collection	Self-collected Blood Samples	eCOA	IP Delivery
	Messaging	Connectivity	Live Remote Patient Monitoring	Remote Stool, Saliva, etc. Collection	ePROs	Remote Infusion
	Chat	Device Configuration	ECG, Voice and Video Collection		Journals	
	Two-Way SMS	Device Logistics				

Capability at Scale (all Sites, all Depts)
2024 MVPs or Case-by-Case Availability
Future Roadmap

Clinical Trials Beyond Walls – National Reach

of Clinical Trials
🔴 at Mayo Clinic

2,566

of Clinical Trials
🔴 with DCT Capability*

687

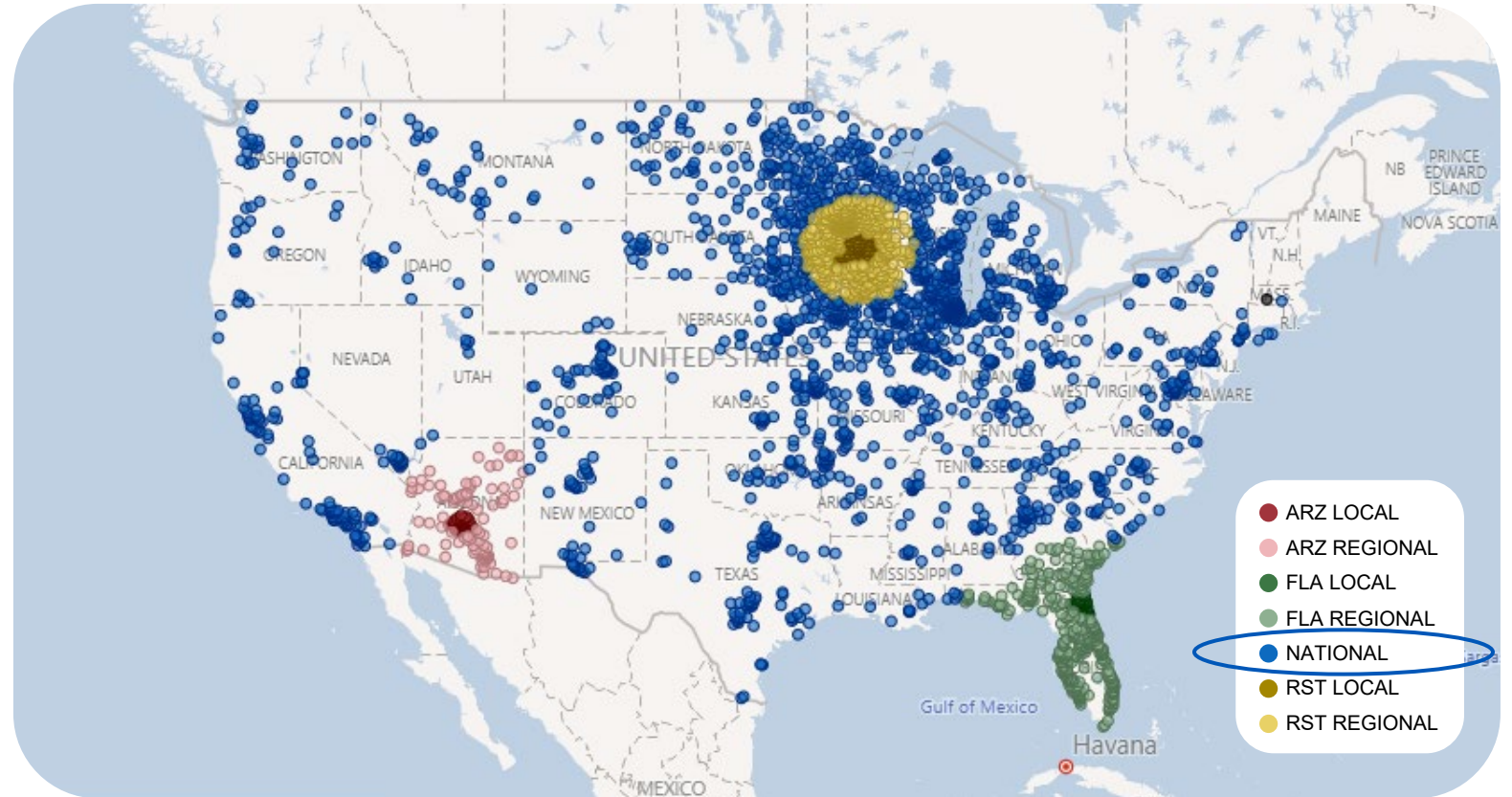## # of Cancer Clinical Trials
🔴 with DCT Capability*

378

% of National Patients
🔴 on a study with DCT Capability

25.7%

*Any capability beyond remote consent

Mayo Clinic Defined Local, Regional, & National Zip Codes w/ Participants Accrued in Decentralized Trials

Legend:
- ARZ LOCAL
- ARZ REGIONAL
- FLA LOCAL
- FLA REGIONAL
- NATIONAL
- RST LOCAL
- RST REGIONAL

Inclusive Cancer Care Research Equity (iCCaRE) for Black Men Consortium

Folakemi Odedina, PhD
Consortium Director
CPCS (MCF)

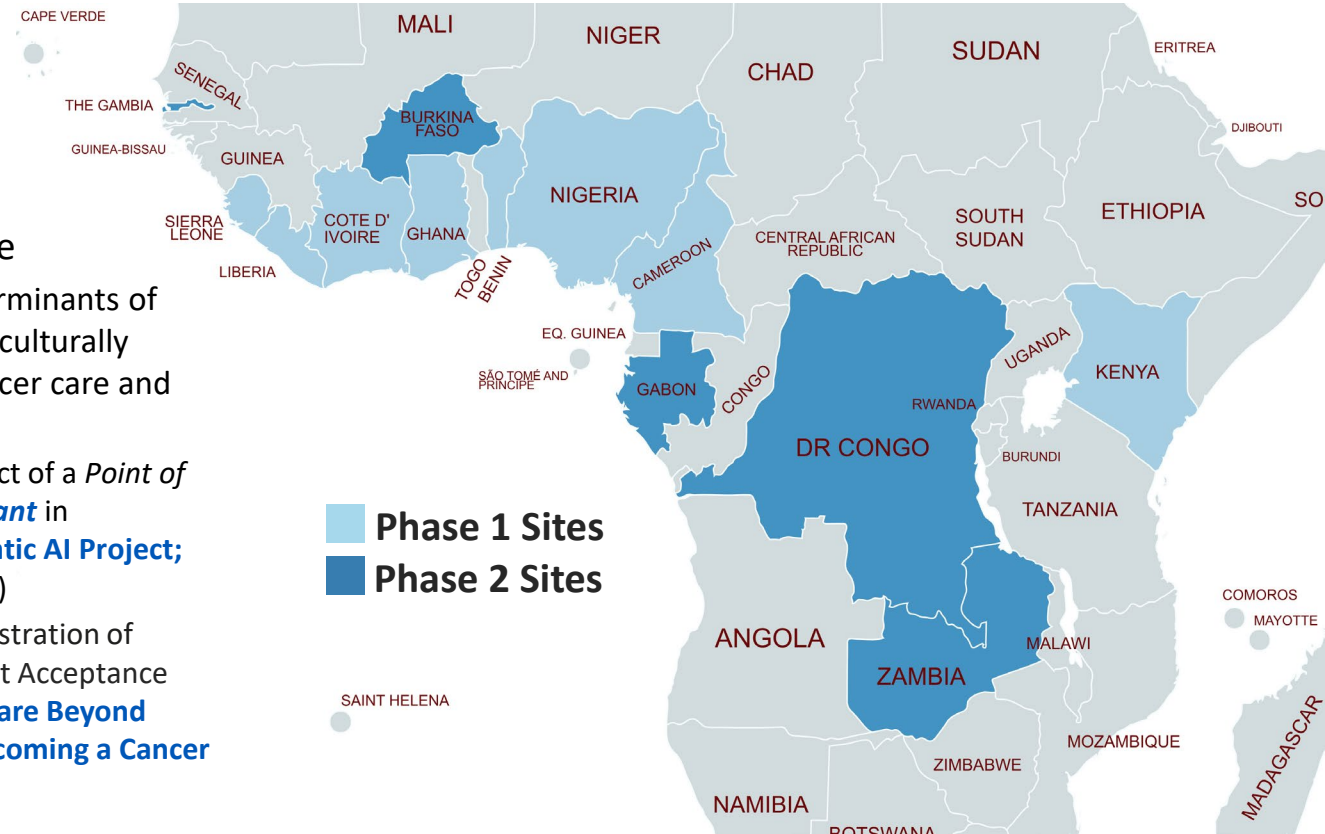**Roxana Dronca, MD**
ACTS (MCF)

Mr. Arnold Merriweather
Community Director
Project 1 Co-Lead
(Advocate/Survivor)

Che Ngufor, PhD
(MCF)
Project 1 Co-Lead

- **DOD HEROICA Award ($17,671,199)**
- **Phase II: 2024-2028**
- **Global Sites**: North America, Africa , Europe
- **Project Goal:** Understand the socio-biologic determinants of prostate Cancer disparities and develop tailored, culturally responsive interventions to improve prostate cancer care and survivorship among ethnically diverse Black men
- **Project 1**: Pragmatic Clinical Trial to Evaluate the Effect of a *Point of Care Prostate Cancer Diagnosis Virtual Reality Assistant* in Supporting Newly Diagnosed Black Men (**GenAI/Agentic AI Project; Virtual Education and Supportive Care Delivery Tool**)
- **Project 2**: A Clinical Trial to Evaluate Whether Administration of Cancer Therapy in Patient Homes Increases Treatment Acceptance for Advanced Prostate Cancer in Black Men (**Cancer Care Beyond Walls Program Trial: 1st CCBW Trial Focused on Overcoming a Cancer Mortality Disparity**)

Phase 1 Sites
Phase 2 Sites

15 Countries & 9 Universities

United States | United Kingdom | The Gambia | Nigeria | Cameroon | Kenya | Ghana | Benin | Ivory Coast | Liberia | Sierra Leone | Zambia | Congo, DRC | Gabon | Burkina Faso

Mayo Clinic Comprehensive Cancer Center Continuous Arc of Science and Care