Reinventing Oncology through AI
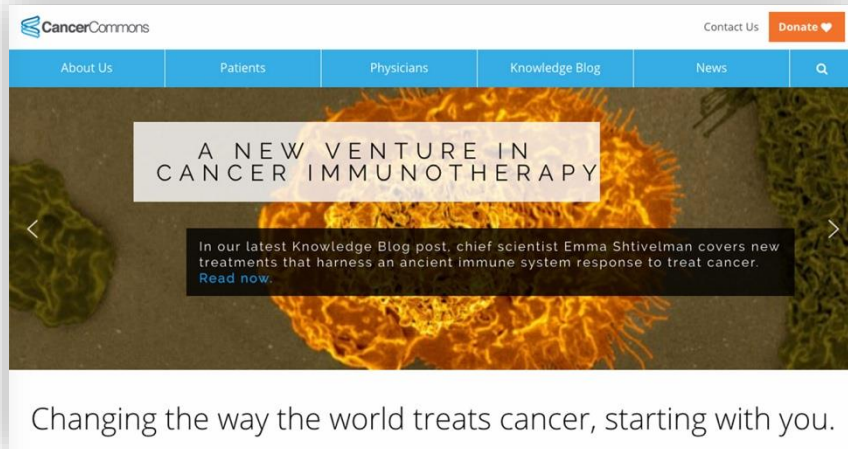
Marty Tenenbaum
Founder and Chairman

April 24, 2019

Precision Oncology Network

CancerCommons

Patients and Physicians

- Network of world-class physicians and researchers
- ~4,000 patients who have benefitted from ASK virtual tumor boards
- Multiple peer reviewed publications
- American Cancer Society collaborator

A NEW VENTURE IN CANCER IMMUNOTHERAPY

In our latest Knowledge Blog post, chief scientist Emma Shtivelman covers new treatments that harness an ancient immune system response to treat cancer.
Read now.

Changing the way the world treats cancer, starting with you.

XCURES

Software and Services

- **Share Knowledge** across virtual tumor boards
- **Facilitate Access** to recommended therapies
- Capture resulting **real-world data**
- **Coordinate treatment** across patients to optimize outcomes and learning

ARIANNA

Patient with DIPG holding her investigational drug she got access to with xCures

Cancer Commons and xCures:

A perpetual trial that continuously learns from all patients, all physicians, all therapies, all the time.

An AI-based precision oncology platform that coordinates treatment plans to globally optimize individual outcomes and collective knowledge.

Creating value

- Faster, cheaper development of drugs and tests
- Payers pay only for what works
- Patients get the best outcomes

CancerCommons   XCURES

For Advanced Cancer Patients, Getting the Best Care Is a Nightmare

No one knows the optimal way to treat any cancer,

many patients **can't get or pay for** the drugs they need

and treatment **outcomes vary** widely

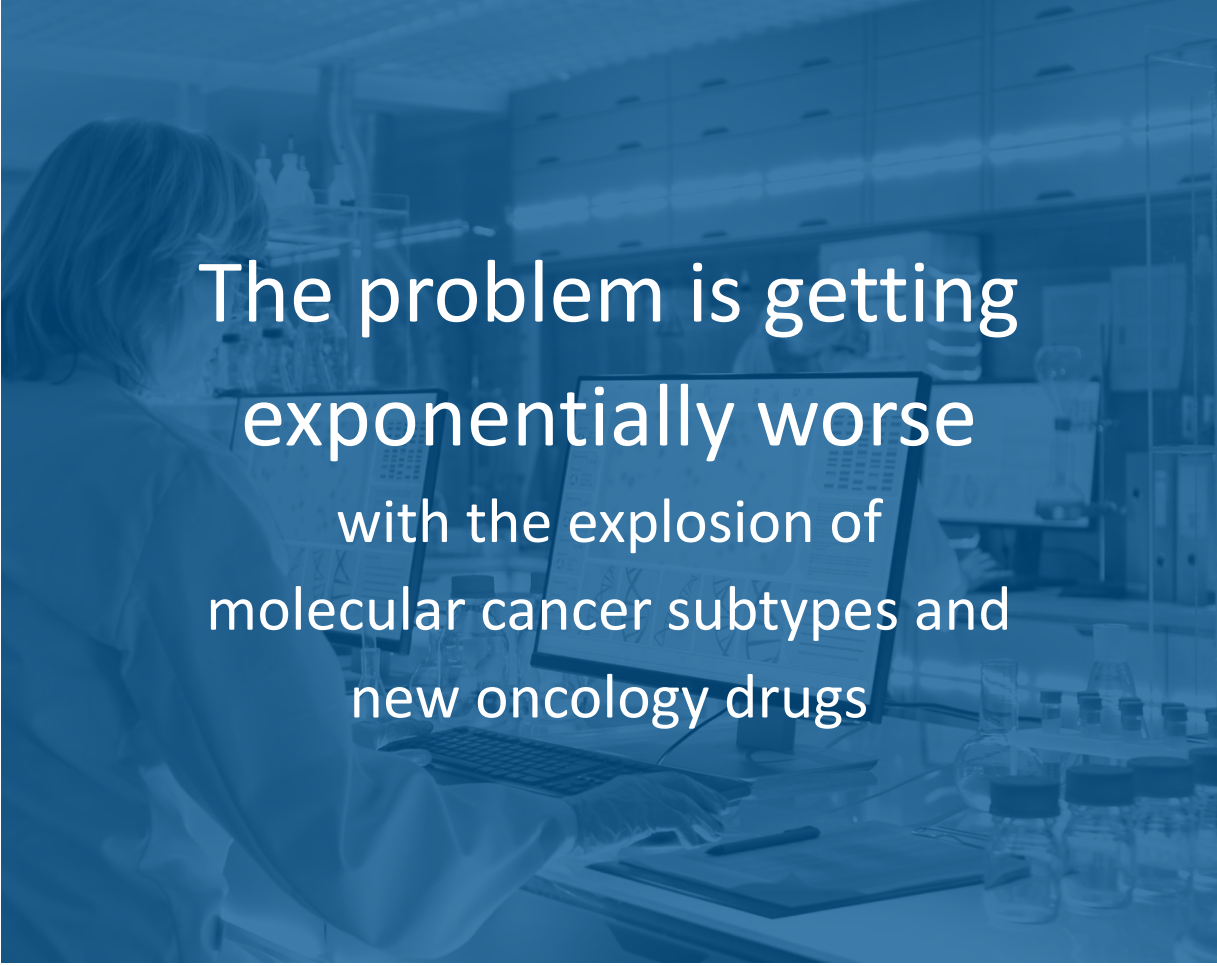**Each year thousands die unnecessarily**

CancerCommons

XCURES

Drug Development Is About to Hit the Wall

CLINICAL TRIALS ARE UNSUSTAINABLE

Too slow (5-10 years)

Too expensive ($100M+)

Outcomes vary widely

TOO MANY DRUGS, TOO FEW PATIENTS

~3500 open IO trials in the US

Requiring ~600,000 patients

Only ~50,000 patients / year enroll in trials

The problem is getting exponentially worse

with the explosion of
molecular cancer subtypes and
new oncology drugs

CancerCommons

XCURES

Regulators Agree That Change Is Needed

" *We must bridge clinical research and health care or the entire enterprise is going to fall down.* **"** *Janet Woodcock, Director, CDER. FDA*

- Master protocols
- Adaptive designs
- Seamless trials
- Expanded access
- Real-world evidence (RWE)

Helpful but not enough to solve the existential problem: too many options, too few patients
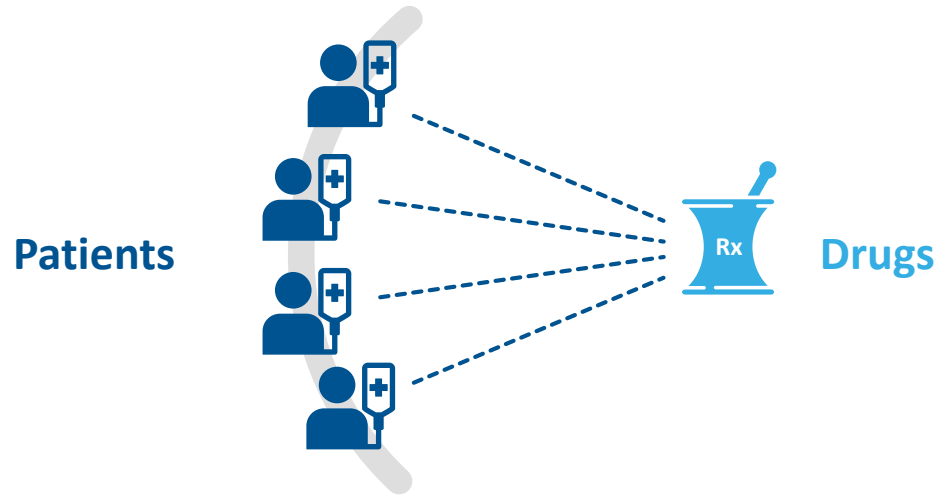
We need a
paradigm shift
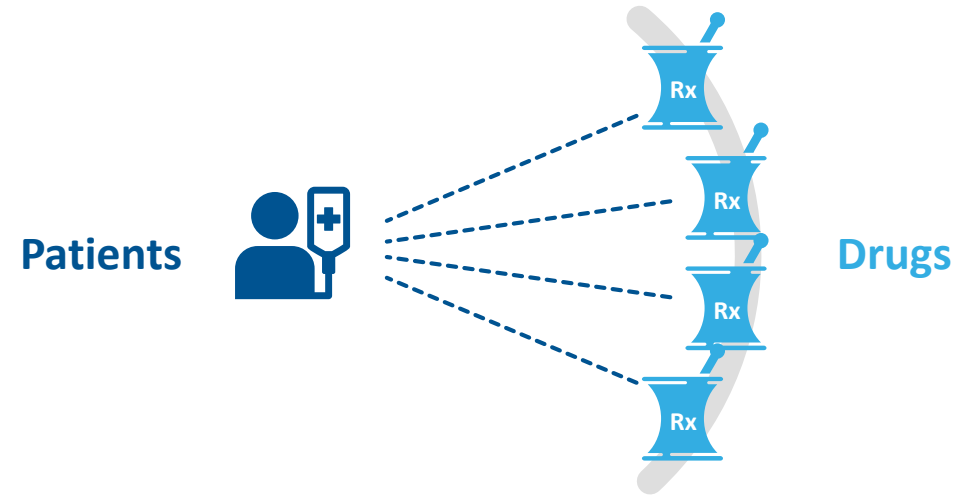to integrate clinical research and care

CancerCommons

XCURES

From Approving Drugs to Curing Patients

OLD WAY

Trials finding best patients
for a given drug

Patients   Rx   Drugs

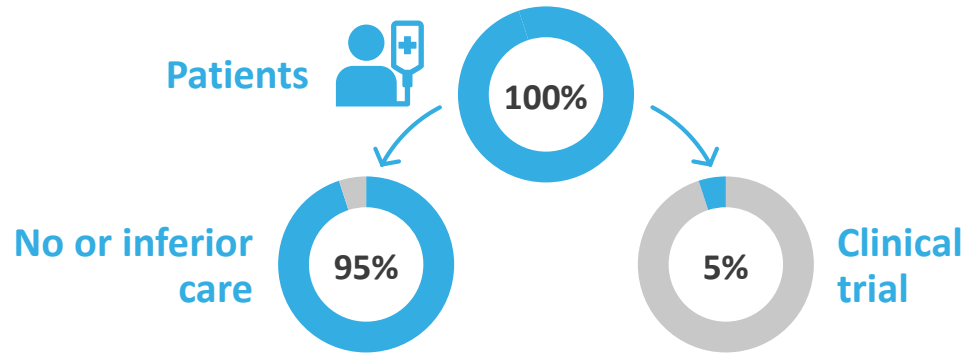## CancerCommons

Leveraging knowledge and AI to find the
best drug regimens for each patient

Patients   Drugs

**xCures globally optimizes the allocation of patients and drugs to ensure superior outcomes
and prioritize development of the most promising therapies**

CancerCommons   XCURES

Slashing the Time and Cost of Drug Development

TRADITIONAL TRIALS

Patients **100%**
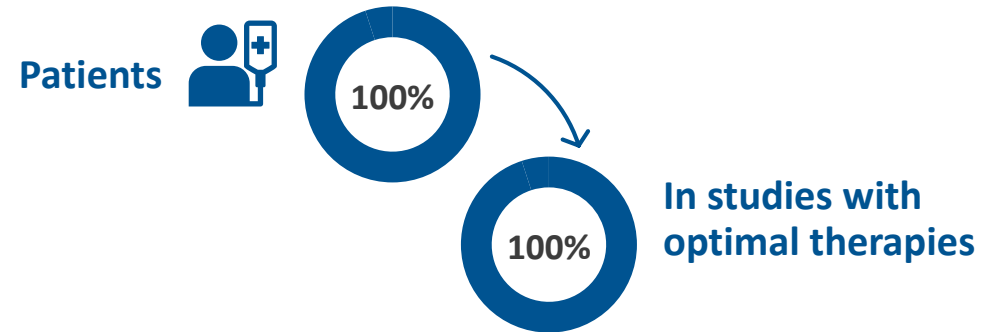
No or inferior care **95%**   **5%** Clinical trial

- Inclusion/exclusion criteria
- Randomized control
- Geographic disparity

5-10 years, 200 patients @ $50,000

Each site / phase starts anew
New sites take months
Trials compete selfishly for patients

XCURES TRIALS

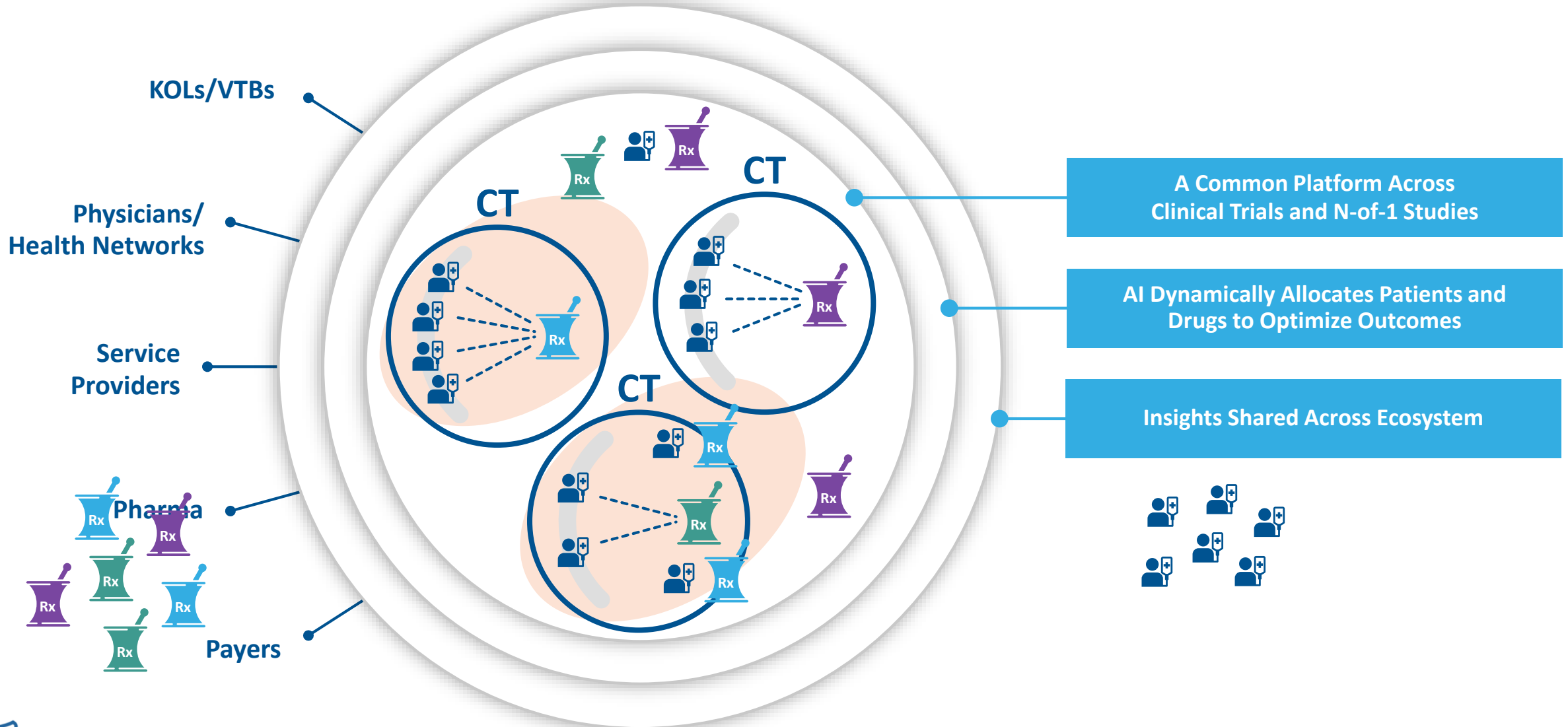Patients **100%**   **100%** In studies with optimal therapies

- No inclusion/exclusion
- No randomized control
- All geographies

1 year, 20 patients @ $2,000

Always on and siteless
Costs amortized across all drugs
Globally optimize patient utilization in trials

CancerCommons   XCURES

Creating Value Through a Master Platform and AI

KOLs/VTBs

Physicians/
Health Networks

Service
Providers

Pharma

Payers

A Common Platform Across Clinical Trials and N-of-1 Studies

AI Dynamically Allocates Patients and Drugs to Optimize Outcomes

Insights Shared Across Ecosystem

CancerCommons

XCURES

Cancer Commons
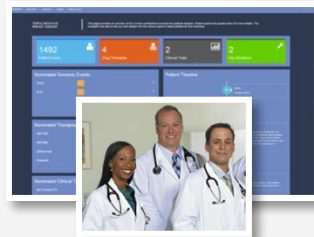
4000 patients, 40+ countries

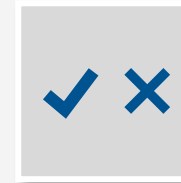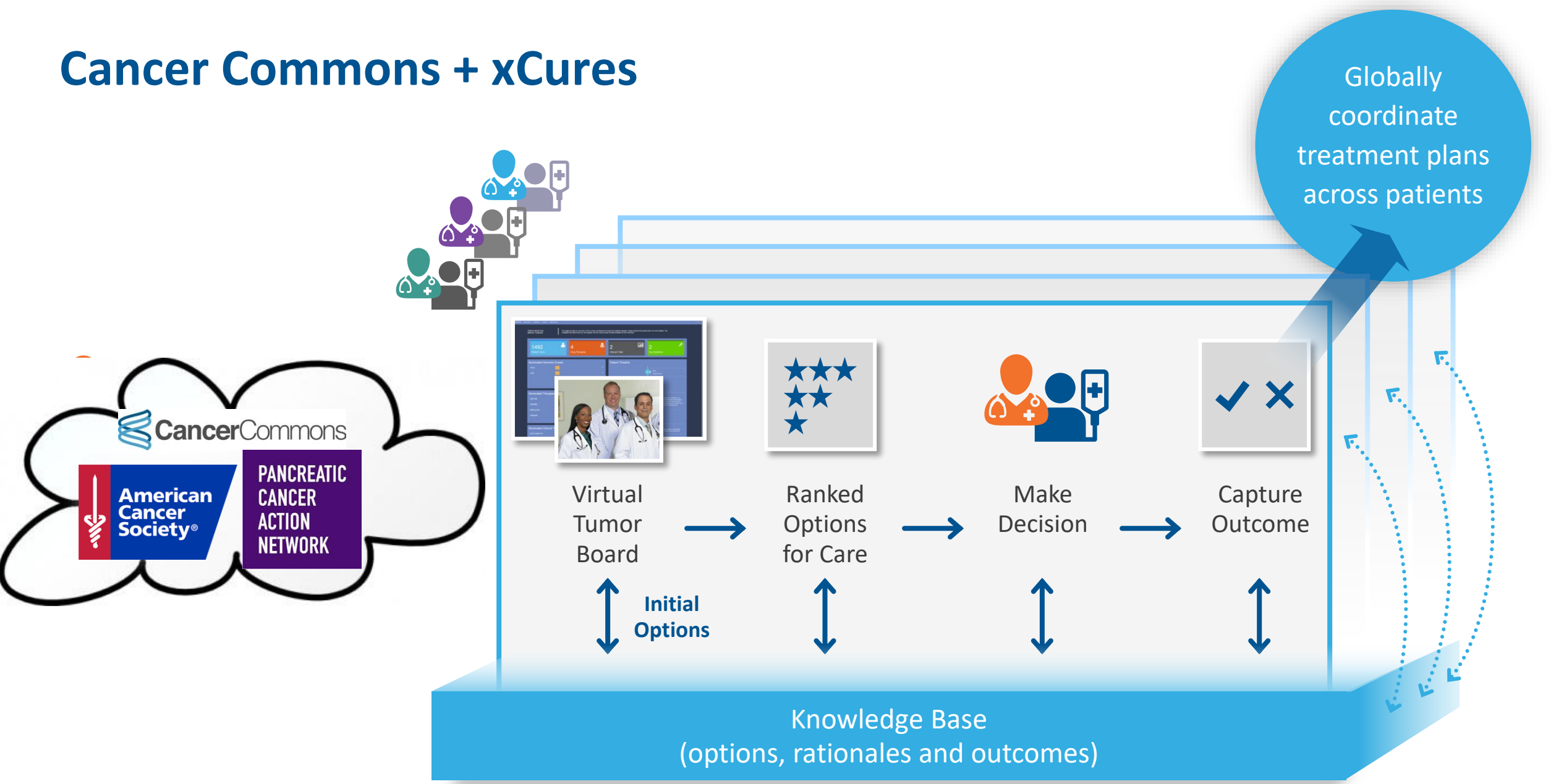Patient and Physician → Cancer Network Partner → **Case Referral** → Virtual Tumor Board → Ranked Options for Care → Make Decision → Capture Outcome

Cancer Commons + xCures

Globally coordinate treatment plans across patients

Virtual Tumor Board → Ranked Options for Care → Make Decision → Capture Outcome

Initial Options

Knowledge Base
(options, rationales and outcomes)

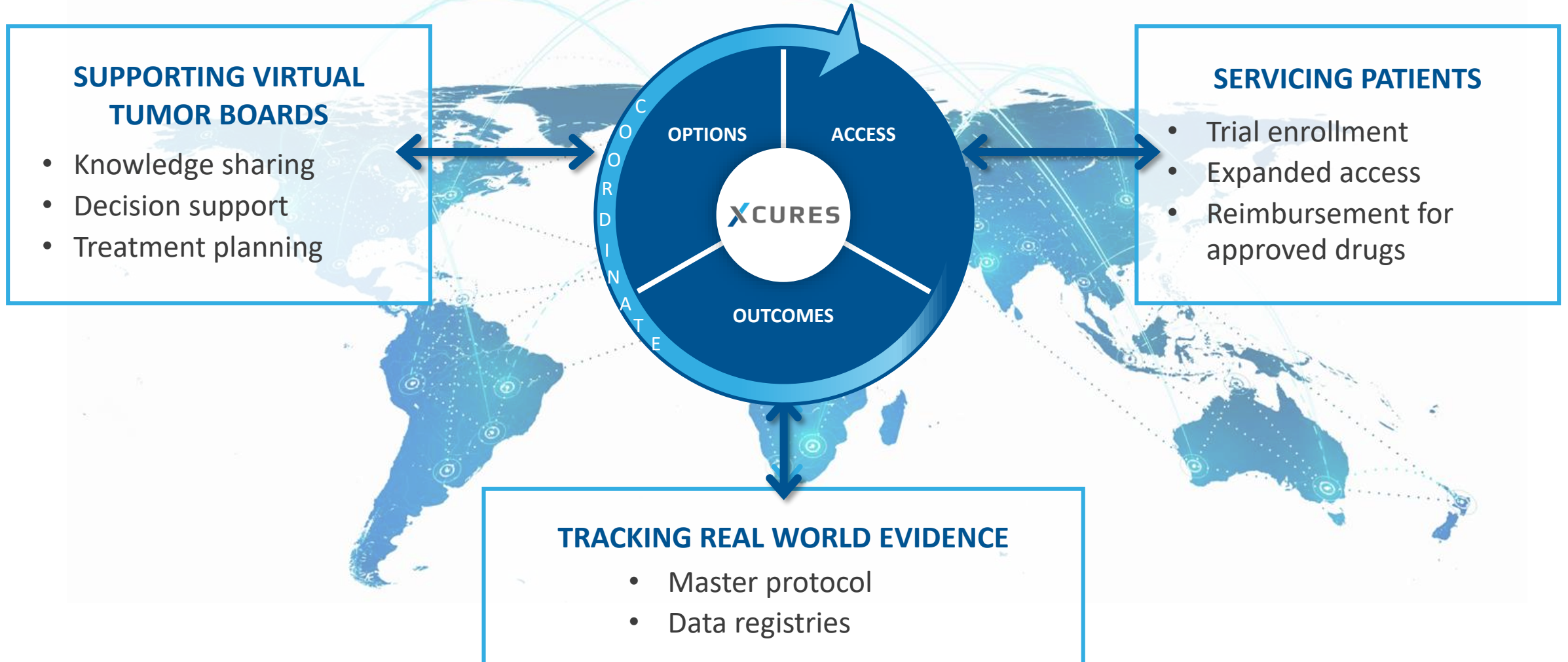CancerCommons
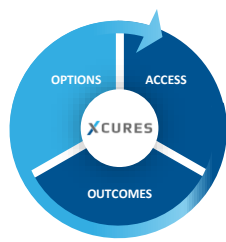
American Cancer Society®

PANCREATIC CANCER ACTION NETWORK

CancerCommons

XCURES

xCures Platform: Options, Access and Outcomes

LEARNING FROM ALL PATIENTS. ALL PHYSICIANS. ALL THERAPIES. ALL THE TIME.

SUPPORTING VIRTUAL TUMOR BOARDS
- Knowledge sharing
- Decision support
- Treatment planning

SERVICING PATIENTS
- Trial enrollment
- Expanded access
- Reimbursement for approved drugs

TRACKING REAL WORLD EVIDENCE
- Master protocol
- Data registries

COORDINATE

OPTIONS   ACCESS

XCURES

OUTCOMES

CancerCommons

XCURES

Options – Using Experts and AI to Optimize Care

Knowledge Sharing

NLP to capture treatment options, recommendations, and rationales from literature, conferences, social media, and real-world evidence
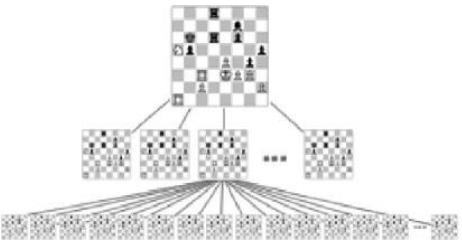
Decision Support

Virtual Tumor Boards develop treatment options for each patient, balancing personal insights against outcomes data and new options injected by researchers and industry.
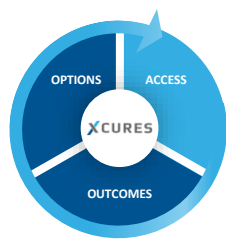
Treatment Planning

Evaluating patient's treatment longitudinally with multiple drug regimens, to maximize shots on goal

Source: stanford.edu
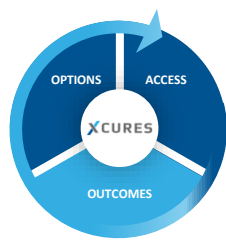
Access – Getting Right Drugs to Patients

xCures SERVICES

- Trial matching and enrollment (ethical)
- Manage expanded access programs and trials
- Pay-for-performance program
- Clearinghouse for EA and off-label drugs

BENEFITS

- Patients get access to the latest drugs
- xCures gets hot drugs on our platform for use by patients in Virtual Trials
- Companies get real world data to accelerate approvals, label extensions, reimbursements
- Physicians get administrative support
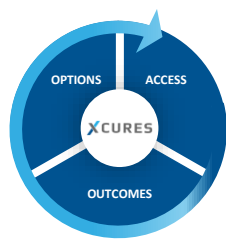
Outcomes – Generating Real World Evidence

XCELSIOR Study

- IRB-approved Master Protocol
- Always-on: All patients and all treatments
- Add new sites, PIs, and drugs in days through amendments, sub-PIs, and subprotocols
- Patient-centric design: minimal inclusion / exclusion criteria; no randomized controls
- Level 1: Observational registry captures longitudinal, regulatory grade, treatment and outcomes data
- Level 2: Virtual Tumor boards and Virtual Trials seek to optimize individual outcomes and collective learning
- Innovative statistics for efficient signal generation from small data sets

REDCAP CLOUD

- 21 CFR Part 11 Validated, HIPAA & FISMA compliant, and WHODrug and MedDRA certified EDC system
- All access and activity in the system is tracked
- Audit trail shows who made a change, the date and time, and the old and new values
- Standardized data reporting forms support precision oncology studies for most solid tumors
- Reporting forms can be quickly customized to capture study-specific fields

CancerCommons

XCURES

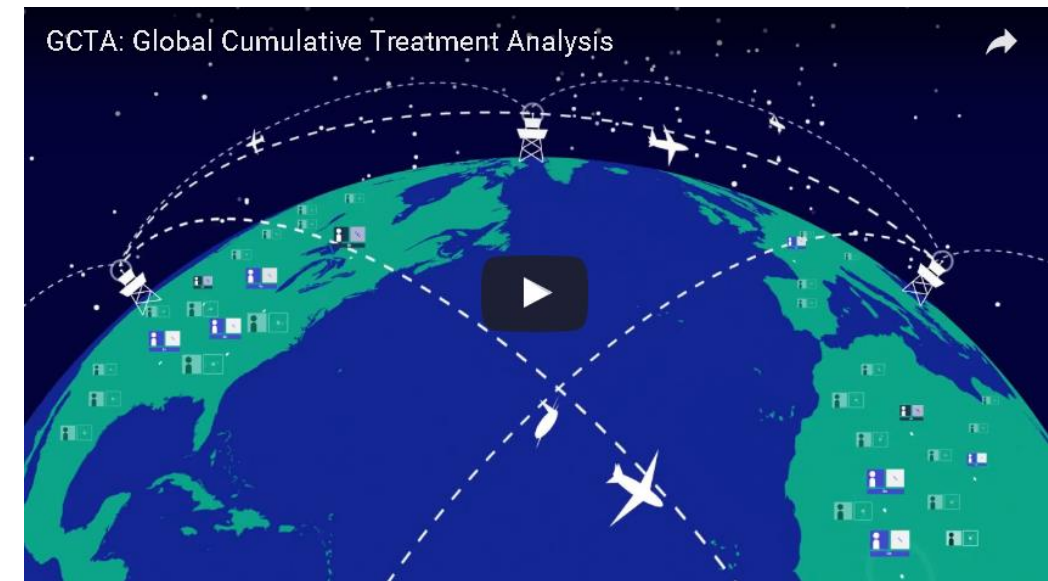# Coordination – Planning, Search, Optimization

Global Cumulative Treatment Analysis

Coordinate treatment plans across patients to maximize information gain and collective learning:

- Rapidly replicate successes and quash failures

- Optimally allocate patients so therapies succeed or fail fast, using the fewest patients

- Run 'Pop-up' experiments to resolve equipoise sets, where it's unclear which option is best

- Efficiently search the vast space of plausible combination therapies

- Prospectively plan experiments to get the data you need, not just the observational data in EHRs

An 'Air Traffic Control System' for Cancer

GCTA: Global Cumulative Treatment Analysis

Pilot: Brain Cancer

UNMET NEEDS

Glioblastoma Multiforme (GBM)

20,000 / year, prognosis 1 year

Diffuse Intrinsic Pontine Glioma (DIPG)

250 kids / year, prognosis: 9 months

xCures SOLUTION

Expanded access program makes promising drugs available to patients

Perpetual trial continually refines treatment regimens and cohorts

IMPACT

Better outcomes for GBM and DIPG patients

Regulatory-grade real-world data for pharma

Royalty payments from future sales

> " *All the gratitude and thanks goes to you [xCures] and Cancer Commons! ...You give us hope and options to save our baby girl's life!* "
>
> **– Patient's Mother**

Building Pipeline of Pharma Collaborations

Oncoceutics

CancerCommons

XCURES

Pilot: Pancreatic Cancer

UNMET NEED

Stage 4 Pancreatic Cancer

40,000 adults / year, 35,000 die
prognosis: 14 months

**xCures
SOLUTION**

Use Perpetual Trial to explores novel regimens
(e.g., Mekinist + Chloroquine)

Pay for performance program covers drugs used
off-label…when they work.

IMPACT

Giving advanced stage patients new options
Generating real-world evidence for FDA filings
Drug salvage and repurposing
Potential label expansion

> " ..If we'd been using your platform,
> we'd already know the answer. We'll
> use it for the next combo in our
> pipeline
>
> **– Medical oncologist with exciting
> new combo therapy**

CancerCommons

XCURES

Value for All Stakeholders

PATIENTS

Consults with VTB experts; Access to top drugs; Superior Outcomes

PHARMA

Faster, cheaper trials → approvals, label expansions, compendia listings. Early signals. Salvage drugs abandoned for business reasons.

PROVIDERS

Improved outcomes. Patient referrals and retention. Access to novel treatments. Knowledge sharing with peers.
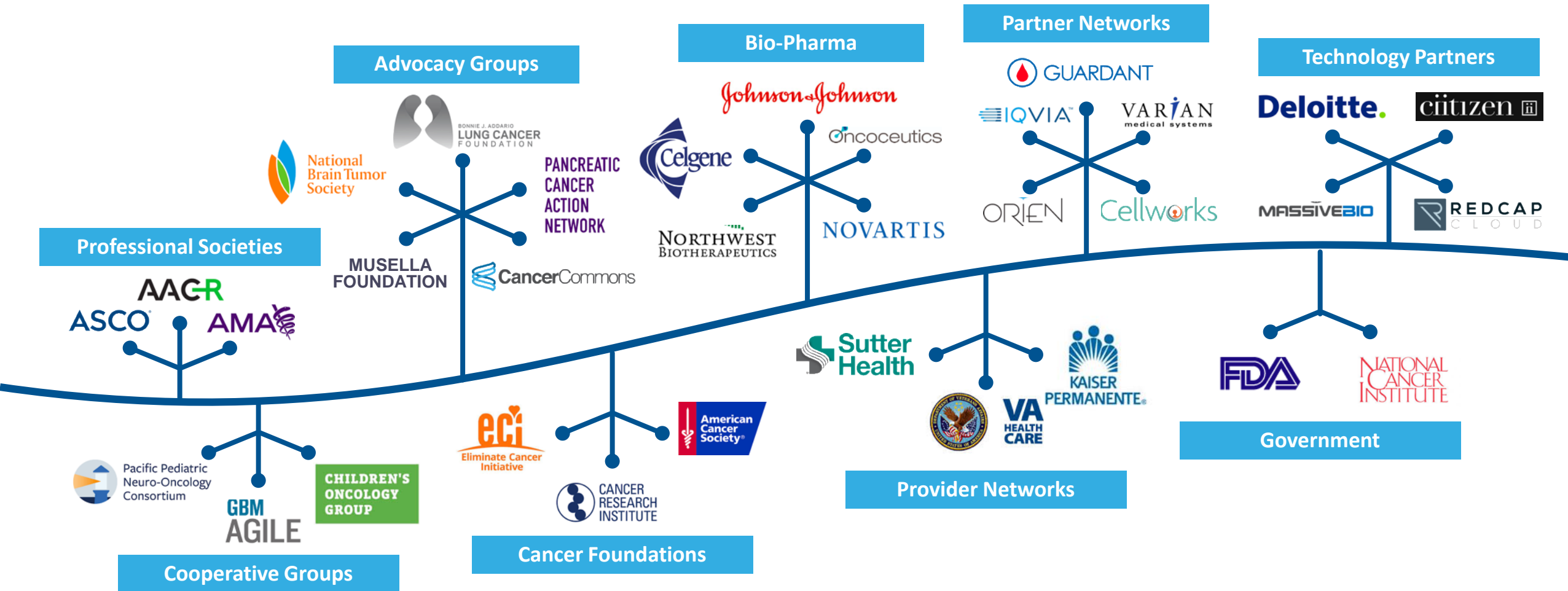
RESEARCHERS

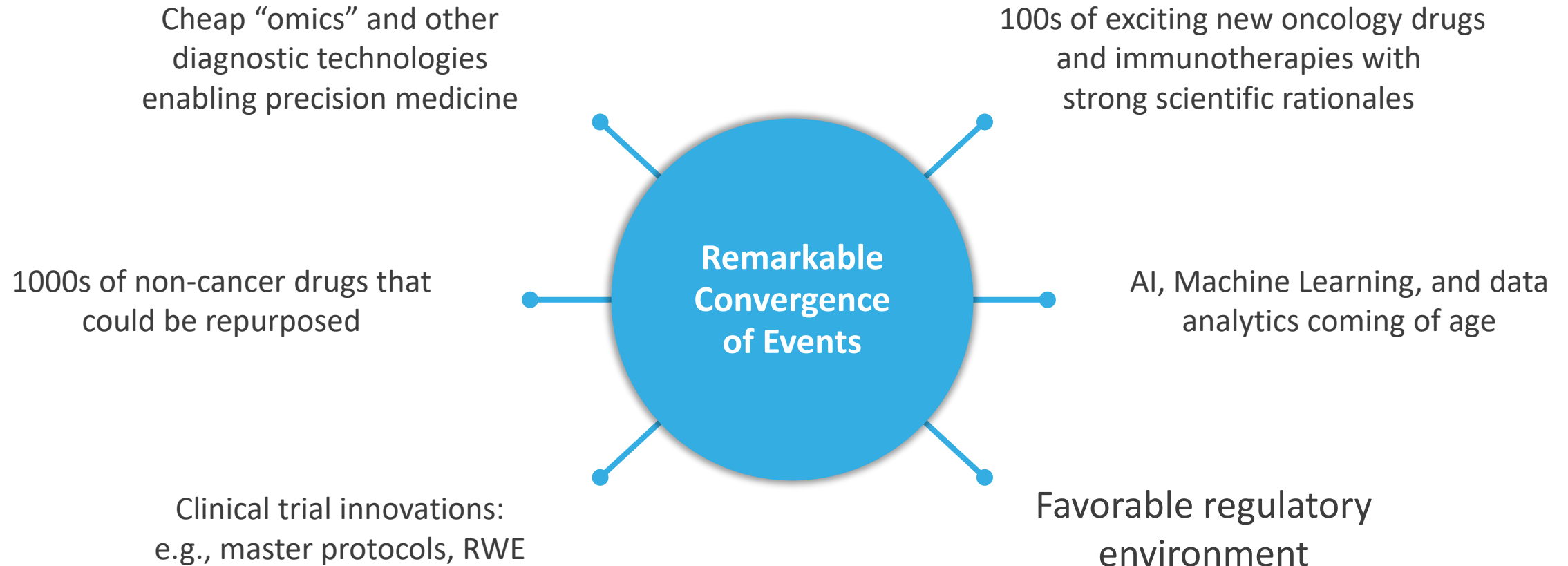Clinical data. Outcomes data. Rapid Investigator Initiated Studies.

PAYERS

Pay only when drugs work. Trusted data for claims adjudication.

The Timing Is Perfect

Cheap "omics" and other diagnostic technologies enabling precision medicine

100s of exciting new oncology drugs and immunotherapies with strong scientific rationales

Remarkable Convergence of Events

1000s of non-cancer drugs that could be repurposed

AI, Machine Learning, and data analytics coming of age

Clinical trial innovations: e.g., master protocols, RWE

Favorable regulatory environment

CancerCommons

XCURES

Seize the Moment:
Join the Commons

Huge unmet need for patients

Existential crisis for pharma

Paradigm shift to patient-centric clinical trials

Transformative clinical oncology network/platform

Powered by AI, ML and Collective Intelligence

Yes, It's Personal

This could save your life or the life of your spouse or child

CancerCommons

XCURES

JOIN THE COMMONS

jmt@cancercommons.org
650.799.1767