Unlocking Research with CRDC and NCI-Cloud

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NIH NATIONAL CANCER INSTITUTE

Success Story 1

Seeking novel therapies for head and neck cancer

PLOS ONE

Illuminating biological pathways for drug targeting in head and neck squamous cell carcinoma

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Challenge:

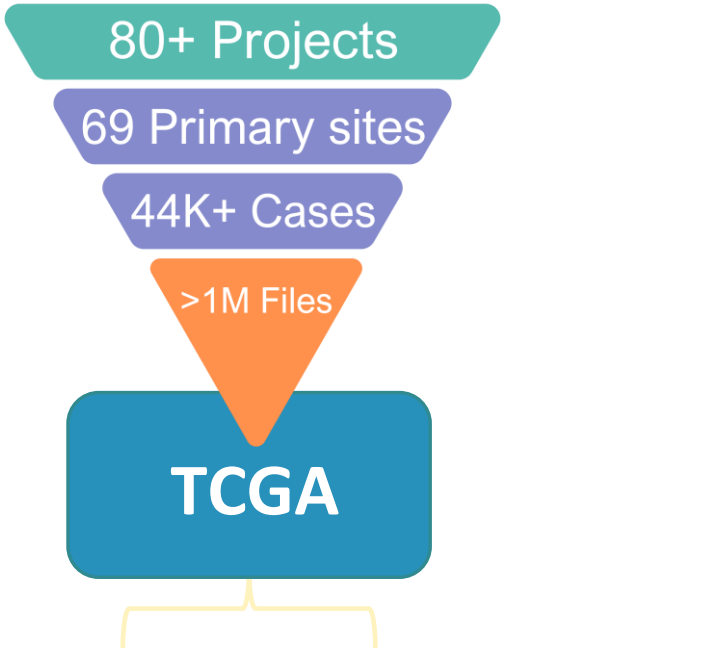
- Very few targeted therapies for HNSCC
- Low survival rate
- Surgeries impair critical functions and quality of life

Goal:

Expand the pool of targeted therapies by aligning FDA-approved cancer drugs with HNSCC biological pathways

Bohn, K. (2010, February 19). *Film critic Roger Ebert lost his jaws to complications from a head and neck cancer*. CNN. https://www.cnn.com/2010/HEALTH/02/19/george.karl.throat.cancer/index.html

Genomic Data Commons (GDC)



HNSCC cohort
- Clinical data
- Mutations
- Copy Number Alterations

GDC mutation impact annotations

+

Cancer Targetome

Pathways with druggable targets

New insights to optimize HNSCC therapies

- Majority of mutation and copy number “light” pathways had all members mutated across the HNSCC cohort

35–38% of the pathways specific to the disease could potentially be treated with existing cancer drugs

- HPV-positive and negative tumors activate distinct pathway alterations

Tumors may benefit from different targeted therapies

Expanding Cancer Treatment Horizons

Pair with GDC's comprehensive genomic and clinical data:

- Combine GDC genomics data + inhibitor panels
- Expand to drug combinations
- Non-cancer drug analysis

GDC 2.0

- Cohort-centric workflow
- New Analysis Center
- Enhanced tool integration

Open-source workflow available and generalizable to other cancers

Success Story 2

Leveraging CRDC to decipher the Pan-Cancer Immune Landscape

Cell

Resource

Pan-cancer proteogenomics characterization of tumor immunity

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Challenge:

- Immunotherapy successful in a only a small proportion of cancer cases

Goal:

Identify immune subtypes and potential therapeutic targets by characterizing the immune landscape across cancer types using CRDC's CPTAC data

Unlocking Cancer Insights Through CRDC's Comprehensive CPTAC Data

Clinical **P**roteomic **T**umor **A**nalysis **C**onsortium

CPTAC

1500+ Cancer Patients

10 Tumor types


Mass spectrometry data (PDC)

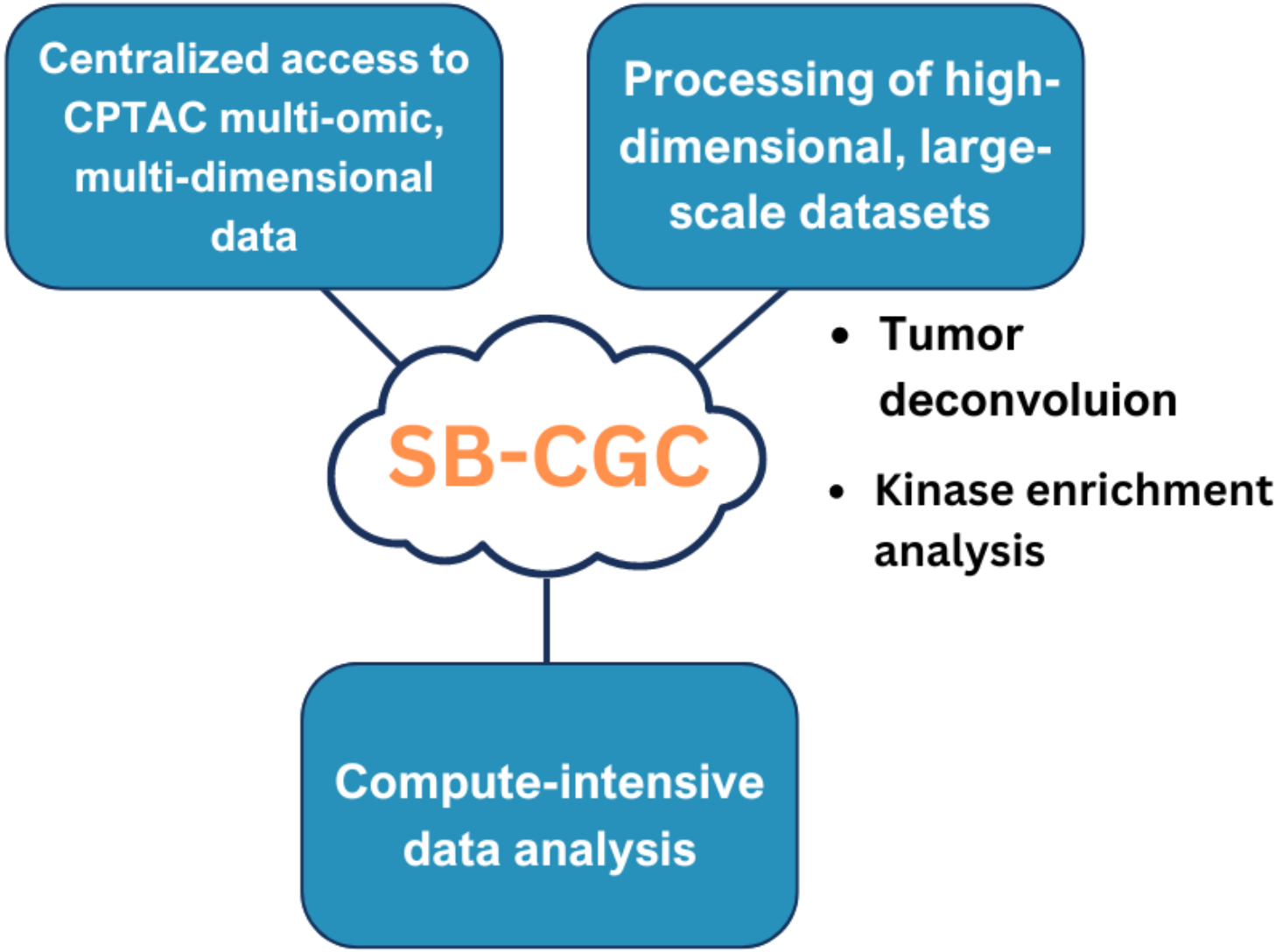

Genomic Data (GDC, CDS)


Clinical Data (GDC, PDC)


Imaging Data (IDC)

NCI Cloud Resources: A Catalyst For Data Discovery

Seven Bridges Cancer Genomics Cloud (SB-CGC) Enabled:



CRDC-Driven Outcomes

- Depth of CRDC data allowed for granular classification of 7 distinct immune subtypes
  - Links between immune cell infiltration and survival outcomes
  - Immune subtype-specific kinase activities

Integration of genomic and clinical data held across CRDC supported interrogation and identification of potential combination therapies

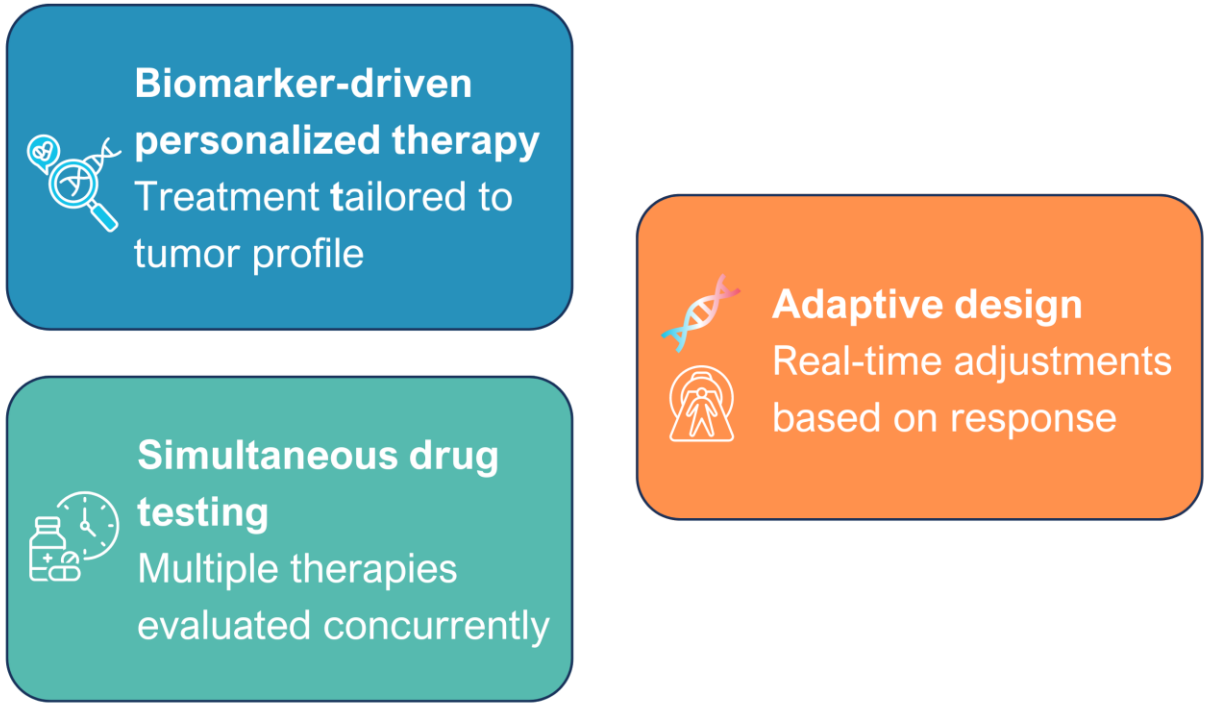
Success Story 3

Powering the I-SPY TRIAL 2 with Cloud Technology: A PRoBE Case Study

I-SPY 2: Pioneering a New Era in Cancer Trials

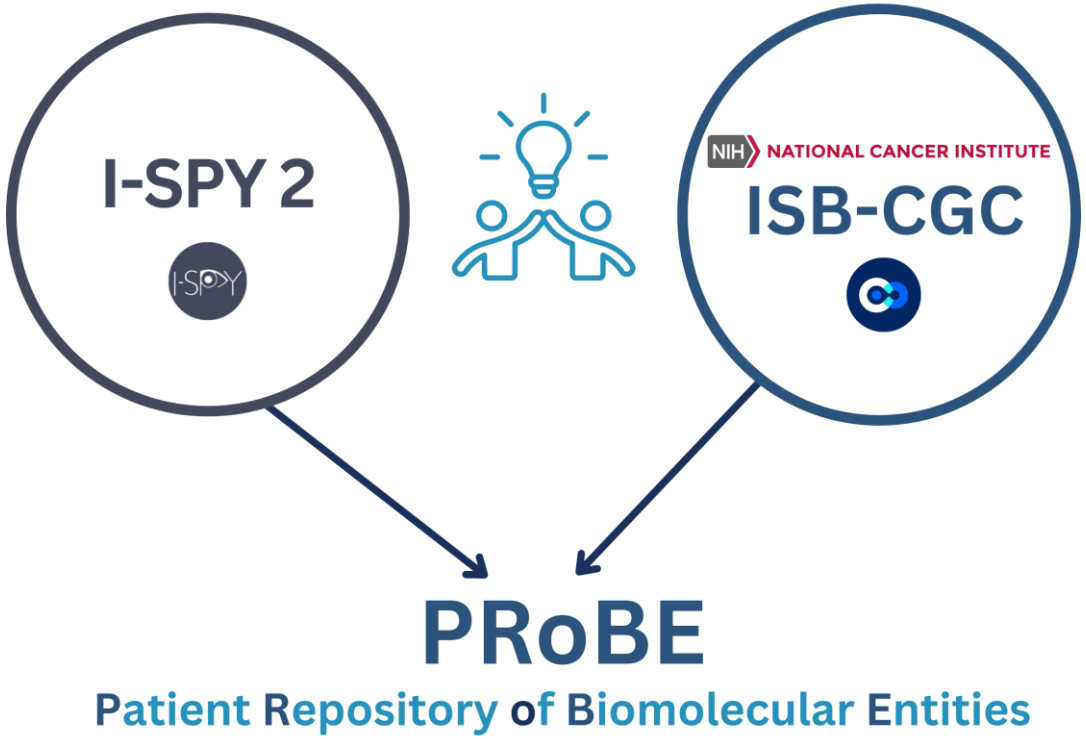
Investigation of **S**erial Studies to **P**redict **Y**our **T**herapeutic **R**esponse with **I**maging **A**nd Mo**L**ecular

Large-scale multi-omics data, multiple collection sites, timepoints



Innovative, complex design requires unique infrastructure

Powering Innovation: CRDC's ISB and I-SPY 2 Collaboration



PRoBE features:

- Cloud-based storage allowing real time access to clinical, molecular, pathology data
- Real-time data mining visualization tools
- Integration with external datasets like TCGA for enriched analysis capabilities
- Research collaboration across secure, interoperable platform

A New Standard in Cancer Trials

Adaptive trial design:

Model for adaptive trial methology

Shortened time to next drug phase:

18 mo. vs. historical **40+** mo.

Higher predicted success rate:

85% vs. **36.7%** std. oncology trials

CRDC and ISB-CGC Successes

- **Enriched Biomarker Discovery:** Access to TCGA data via ISB and CRDC provided vast genomic resources, enhancing the discovery of key biomarkers
- **Regulatory Support:** Helped organize large-scale genomic data for streamlined submissions to FDA
- **FAIR Data:** ISB-CGC ensured I-SPY data was easily shareable and reusable after study

PRoBE's streamlined handling of extensive genomic, clinical, and pathology data via ISB’s robust cloud system was crucial for I-SPY 2's success

Success Story 4
Fast-Tracking Development of the CCDI Hub

Childhood Cancer Data Initiative (CCDI)

CCDI: Exemplar for building a learning health care system for cancer

- Federated Pediatric Cancer Data Ecosystem
- Childhood cancer data and resources from across the nation
    - Hospitals
    - Research repositories
    - Patient registries

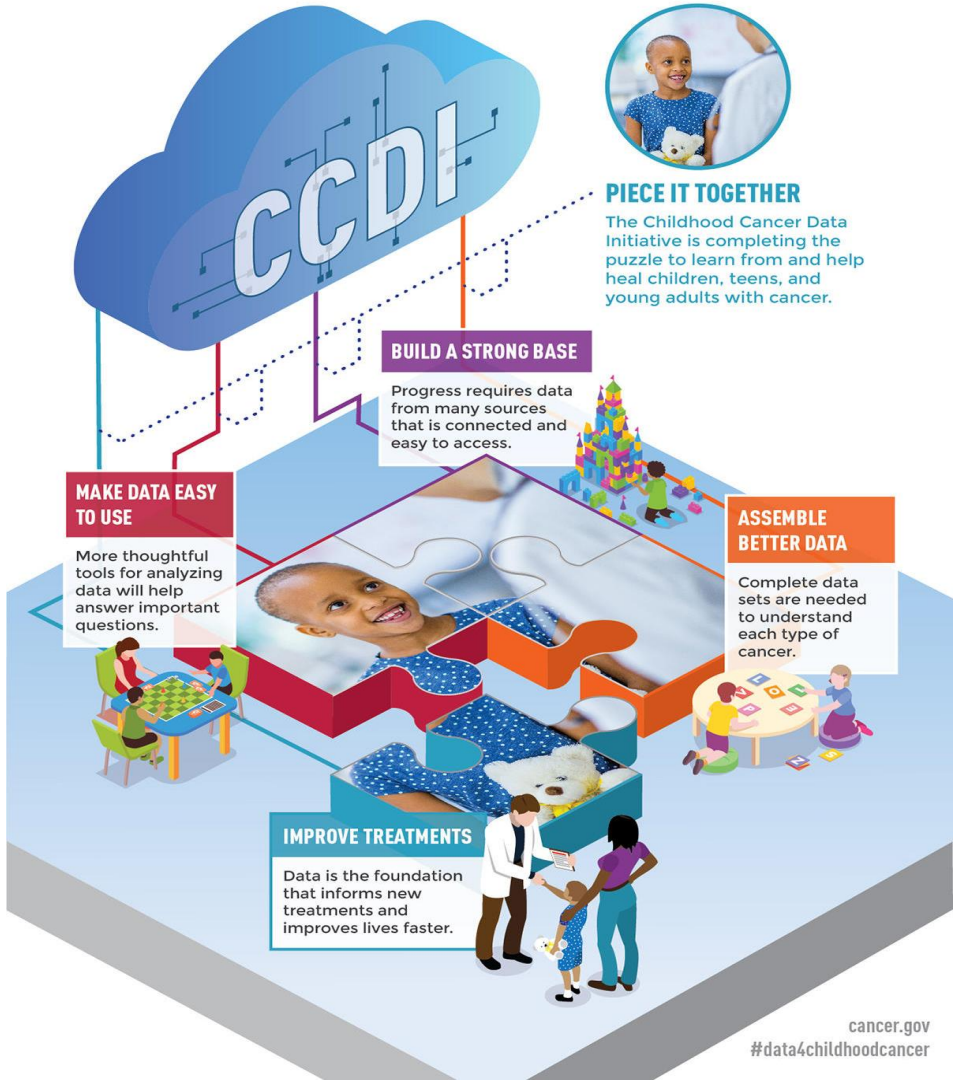


Image: Childhood Cancer Data Initiative. National Cancer Institute. https://www.cancer.gov/research/areas/childhood/childhood-cancer-data-initiative/about

Childhood Cancer Data Initiative (CCDI)

New CCDI Hub

Entry point for researchers looking to use and connect with CCDI-related data and resources

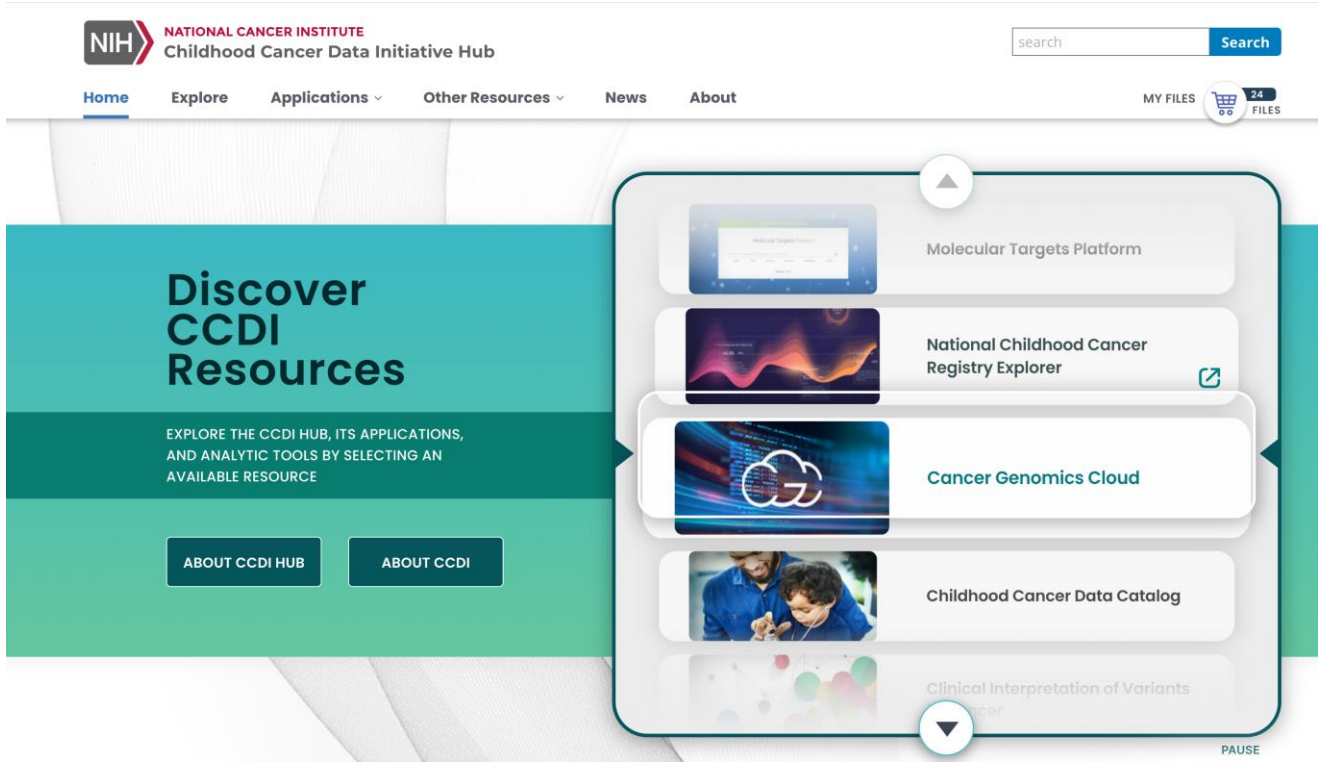


Image: Childhood Cancer Data Initiative Hub. National Cancer Institute. https://ccdi.cancer.gov/

CCDI Data Hub Success Driven by CRDC Resources

Infrastructure Leveraged:

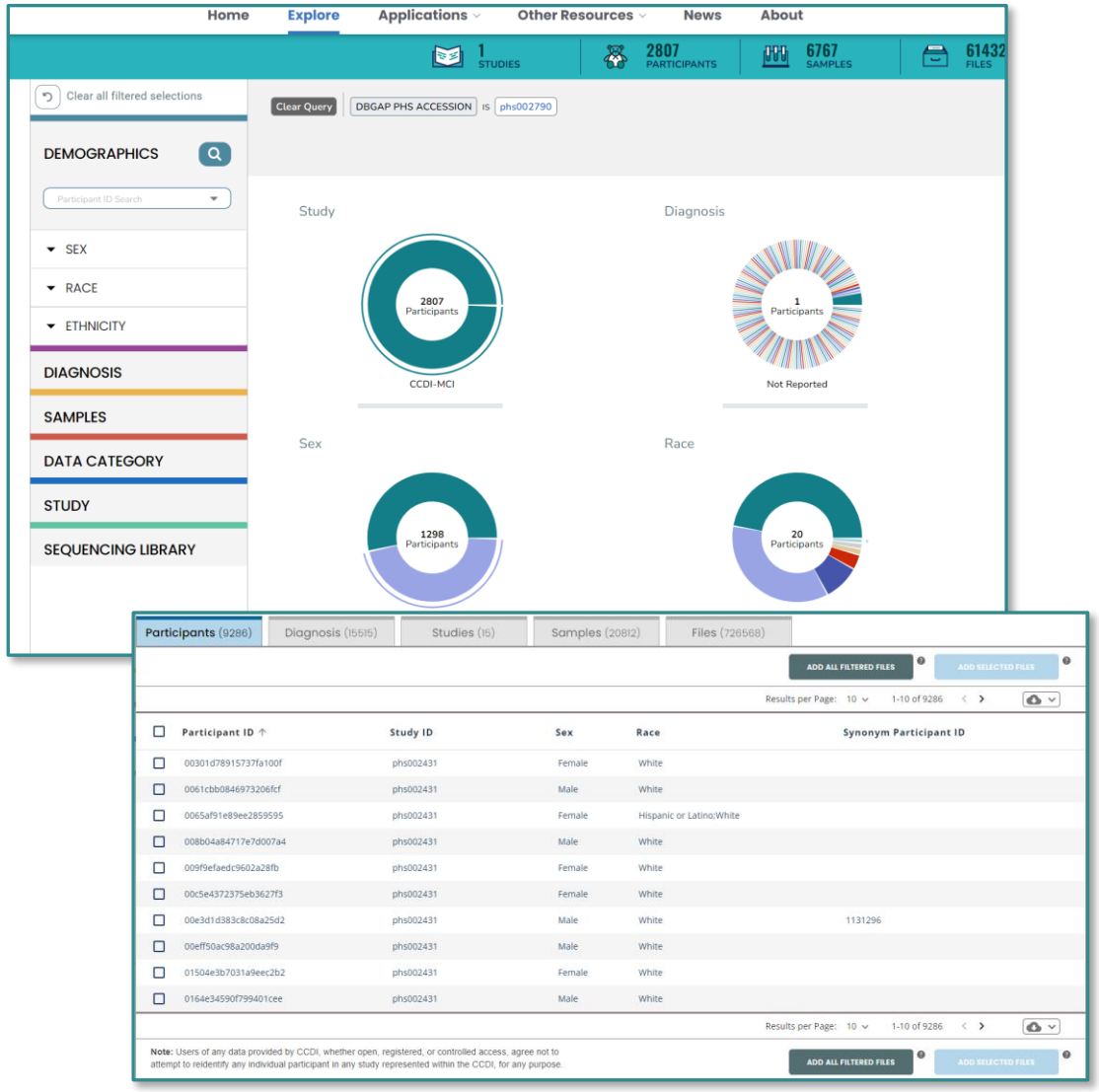
- Built on Bento GUI platform
- Seamless Seven Bridges-CGC integration
- A&A workflows integrated for secure, controlled data access

Data Storage in CRDC Data Commons:

- Access to curated data stored in Cancer Data Service and Imaging Data Commons

NCI Cloud Resource (SB-CGC):

- 500+ bioinformatics tools and workflows
- Collaborative cloud workspaces



Deployment of St. Jude Bioinformatics Tools on NCI Cloud Resources for Cancer Research

CCDI funded the integration of advanced bioinformatics tools from St. Jude Children's Hospital into NCI's Cloud Resources:

- CICERO
- RNAIndel
- Teltale
- NetBID

- Dockerized in Seven Bridges Cancer Genomics Cloud
- Links also available via ISB-CGC, Broad FireCloud

Previously only available through St. Jude, now publicly accessible via NCI's Cloud Resources

CRDC: Advancing Cancer Research from Discovery to Clinical Innovation

- Accelerating Fundamental Discoveries in Cancer Biology
- Fostering innovation in clinical research
- Accelerating development of key data resources such as CCDI Hub
- Democratizing access to advanced bioinformatics

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- Cancer Data Service
- Genomic Data Commons
- Imaging Data Commons
- Proteomic Data Commons

Additional Contributors and Sources:

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- ISB Cancer Gateway in the Cloud (ISB-CGC)
- Seven Bridges Cancer Genomics Cloud (SB-CGC)
- Broad Institute FireCloud
- Childhood Cancer Data Initiative (CCDI)