Creating a coordinated data approach to help address COVID-19

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NIH Data Science is sprinting ahead to help fight COVID-19

- TransNIH efforts since spring are advancing mechanisms to meet the imminent needs of researchers
- We have established a network of activities
- We recognize that we are only at the beginning of a much bigger process

- Enhanced Data
- Interoperability
- Discoverability
Coordinated Data Approach, Key Accomplishments, and Next Steps

The NIH has made great progress to enrich COVID specific data platforms and datasets for the scientific community

Key Accomplishments over the last 8 Months

- Enhanced existing data repositories
- Evaluated various ways to extract data
- Piloted a method to link participant data across data repositories that will maintain data governance and data sharing policies
- Created Common Data Elements specific to COVID-19, across all projects
- Stood up a new prototype RADx Data Hub repository for anonymized data gathered from the RADx project
Moving to a Connected Data Platform Capability for COVID Researchers

Enriched data repositories and connections for COVID

Enhanced Repositories and Interoperability

Data Access Platform and Discovery

Research Use Cases:
- Long-term conditions, complications and health care utilization behaviors
- Prevalence of and risk factors for long-term morbidity following COVID-19 infection
- Geographic differences in patient outcomes

Efforts
- Clinical and related COVID-19 efforts
- Multi-System Inflammatory Syndrome in Children (MIS-C)
- RADx

Discovery Gateway
This Gateway will enhance capabilities for researchers by helping to search, find, and analyze COVID data.
Enhancing COVID data and data sharing

*Enriching data repositories for COVID and identifying mechanisms for data interoperability*

- NCATS’s National COVID Cohort Collaborative
- All of Us
- NHLBI’s BioData Catalyst
- MIS-C
Data in the N3C includes electronic health records from participating institutions. Early adopters include institutions supported by NIH Clinical and Translational Science Awards Program and the IDeA Clinical and Translational Research Centers.

As of today, the NC3 has 102 primary projects, 243 collaborators for a 345 total investigators.
The All of Us Research Program collects repeat longitudinal assessments of key factors contributing to health outcomes.

During COVID-19 they have:

- A new Health-Provider Organization model to efficiently enroll participants and collect EHR data
- Captured COVID-19 perception and symptoms through a COPE survey
- Captured trends of COVID spread among patients using a COVID Phenotype
- COVID-19 IgG Antibody Testing

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### Preliminary Program COVID Phenotype Data

<table>
<thead>
<tr>
<th>Unique participants with some report of COVID positive status in EHR records</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2,569</td>
</tr>
<tr>
<td>Test code</td>
<td>2,080</td>
</tr>
<tr>
<td>Diagnosis code</td>
<td>1,336</td>
</tr>
</tbody>
</table>

### COVID-19 IgG Antibody Testing: Specimen Distribution

Test participant serum samples in batches of 5,000 starting with the most recent collected (March 16, 2020) and extending back at least until January 1, 2020.
Biodata Catalyst will accelerate COVID research to broadly consented clinical trial and cohort data:

- Collaborating Network of Networks for Evaluating COVID-19 Therapeutic Strategies (CONNECTS)
- Prevention and Early Treatment of Acute Lung Injury (PETAL)

Efforts to enhance discovery and analysis include PIC-SURE:

- Phenotypic/genomic correlations
- Variable/cohort selection and export
- Genomic variant browsing

### COVID Clinical Trials and Observational Studies

<table>
<thead>
<tr>
<th>Studies</th>
<th>Study Details</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORCHID</td>
<td>Hydroxychloroquine Trial on PETAL patients</td>
<td>Data Received</td>
</tr>
<tr>
<td>COLCORONA</td>
<td>Testing Colchicine in symptomatic out-patients</td>
<td>Enrolling</td>
</tr>
<tr>
<td>C3PO</td>
<td>Testing convalescent plasma in symptomatic out-patients</td>
<td>Enrolling</td>
</tr>
<tr>
<td>ACTIV-4 (A&amp;B)</td>
<td>Inpatient and Outpatient Thrombosis Prevention Trial</td>
<td>Enrolling</td>
</tr>
<tr>
<td><strong>Observational</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RED CORAL</td>
<td>Retrospective registry of COVID patients in PETAL network</td>
<td>Data Received</td>
</tr>
<tr>
<td>BLUE CORAL</td>
<td>Prospective registry of COVID patients in PETAL network</td>
<td>Ongoing</td>
</tr>
<tr>
<td>C4R</td>
<td>Collaborative Cohort of Cohorts for COVID-19 research</td>
<td>Planning</td>
</tr>
</tbody>
</table>

### Data Search and Analyze Capabilities

- Search Portal
- Analysis Portal
The MIS-C Cohort studies will improve understanding of the spectrum of COVID-19 illness, ascertain outcomes, and characterizing the disease.

The MIS-C will give researchers COVID consented EHR and imaging Data:

- Metadata and Data Exchange
- Data Linking and Search
- Interoperable sharing across platforms

### MIS-C Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Full Name</th>
<th>Study Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIAID/PRISM</td>
<td>Pediatric Research Immune Network on SARS-CoV-2 and MIS-C</td>
<td>Immunologic mechanisms, immune signatures, and predictive biomarkers</td>
</tr>
<tr>
<td>NICHD/POPS</td>
<td>Pediatric Opportunity Pharmacology Study</td>
<td>Genetic factors, metabolic and protein profiles, PK/PD, drug safety profile</td>
</tr>
<tr>
<td>NHLBI/MUSIC</td>
<td>Long Term outcome after the Multisystem Inflammatory Syndrome in Children</td>
<td>Coronary Artery involvement and ventricular dysfunction, inflammation</td>
</tr>
<tr>
<td>PREVAIL</td>
<td>Predicting Viral-Associated Inflammatory Disease in Children with Laboratory Diagnostics and Artificial Intelligence</td>
<td>Understanding disease spectrum, predict longitudinal risk, artificial intelligence algorithms</td>
</tr>
</tbody>
</table>

### MIS-C Collaborative Data Efforts

- omics data stewardship, MIS-C Project investigator support
- Immune profile data curation & visualization
- FHIR-based clinical data modeling
- BioData CATALYST
- IMMPORT Shared Data
RADx Data Hub

Access to deidentified COVID-19 RADx and related data, algorithms, and other capabilities generated by RADx program and related technologies.

- Working with the RADx Data Coordinating Centers to keep as much of the data curation and management effort with the investigators.
RADx CDCCs are working with their communities on CDEs, data management, de-identifying data, with NIH on developing metadata, and depositing this in the RADx data hub.
RADx-UP Coordination and Data Collection Center (CDCC) serves as a hub for all RADx-UP funded projects

- Assists RADx-UP projects to optimize engagement, outreach, testing strategies, **data collection and integration**, and co-learning opportunities across projects and to the communities that are served

Led by the **Duke Clinical Research Institute (DCRI)**, the **Center for Health Equity Research at UNC-Chapel Hill** with support the Community-Campus Partnerships for Health
**Mission:** To design and oversee the evaluation of point-of-care (POC) assays from the RADx TECH pipeline. Focus on rigorous clinical studies in diverse populations and settings.

<table>
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<tr>
<th>Robust Research Center Network</th>
<th>Eureka Digital Study Platform</th>
<th>UMMS Data Core</th>
</tr>
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<tbody>
<tr>
<td>POCTRN serves as core research center network for COVID-19 Test Us enrollment</td>
<td>Using the Eureka Digital Study Platform with a Data Safety Board and Single IRB</td>
<td>Data Coordination and Integration with COVID-19 Data Hub</td>
</tr>
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</table>

**Milestones**

- Completed its first two investigations (n=450+ participants) and created consolidated analytic data set (and data dictionary)
- De-identified, harmonized data transferred into the RADx Data Hub as well as study descriptive information for each study
Data harmonization across COVID projects

We’re paying attention to data security, participant privacy, and encouraging the use of common data elements across studies to enable future researchers to make use of the data.

- Common Data Elements
- Mapping to Data Models
TransNIH efforts to coordinate the capture of data in a common with an agreed upon core set of elements that should be captured across studies

Minimum (Tier 1) CDE:
Data element that is common to multiple datasets across different studies

Core (Tier 2) CDE:
Standardized data elements that have consensus regarding names, meaning, values, and characteristics. Encouraged to use when collecting the relevant information.
Mapping Common Data Elements to Common Data Model

**OMOP OHDSI Common Data Model**
- Person
- Specimen
- Observation
- Condition
- Device
- Procedure
- Measurement
- Drug
- Visit
- Death
- Location

**NIH COVID Tier 1 CDEs**
- Age, Ethnicity, Race, Sex
- Symptoms (Physical, Psychosocial, and Mental), Physical Exam, Comorbidities, Pregnancy, Diagnosis, Disease Status
- Adherence to Mitigation Strategies, Employment, Healthcare Access, Education, Informed Consent, Housing
- Complications
- Risk Behaviors, Case Classification
- Imaging
- Treatment
- COVID Tests/Results, Vital Signs
- Medications
- Hospitalization, Discharge
- Death
- Address
Data linkages across COVID projects

A unifying method to locate, de-duplicate and link data and information across IC specific data repositories, while ensuring that data governance, sovereignty, and policies are respected

- Coordinating Data Access
- Privacy Preserving Record Linkages
Researcher Authentication Services enable researchers to have coordinated access to a variety of platform

Researchers login once and receive an authentication token and data authorization visa, valid as they navigate to any of the four initial data platforms.
Pilot: Privacy-Preserving Record Linkages (PPRL)

Privacy-Preserving Record Linkages enable disparate datasets to be linked without having the patient’s identity.

John Smith
- Admitted to N3C Hospital
- Participates in a COVID Clinical Study
- All of Us data contributor

Metadata used to create a set of unique tokens

Tokens Linked by a third-party Honest Broker

Patient 123
Patient 456
Patient 789

De-identified ‘Rosetta Stone’ process that unifies records

Match & De-duplicate

Output de-id tokens
Patient 123
Output de-id tokens
Patient 456
Output de-id tokens
Patient 789
Moving Forward

• Continue to enhance data sources and coordinate an approach to sophisticated analytics capabilities

• Yield greater data interoperability
  • Map clinically related data to a consistent data model
  • Link participant data across studies and repositories using a standard methods

• Build new capabilities to enhanced data discovery and stand up an ‘on-demand’ temporary researcher workbench
  • This will help researchers find, aggregate, and analyze datasets
Acknowledgement and Thanks

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