Invitae Real World Data

Imagine knowing more...
Despite major advances in translational research, 95% of all rare disorders do not have an FDA-approved therapy\(^1\)

- With novel therapeutic approaches, including gene and cell therapies, there is increasing investment in drug development for rare disorders
- Observational data (like natural history) is required for clinical trial readiness, optimizing clinical trial design

“If you do only one thing, create a natural history study” - Neil Kumar, CEO, BridgeBio

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Observational studies are challenging in rare

- Phenotypic variability across distributed populations
- Prohibitively expensive to stand-up, prolonged timelines
- Participation burden for families resulting in attrition
- Fragmentation of care leads to incomplete data
- Traditionally, lack of engagement with the patient community
The Cures Act positions advocacy groups to drive early investments in clinical data collection
A new approach: patient-centric, data-powered healthcare

- Genomic information
- Complete medical records
- Demographics & SES
- Patient-generated data
- Claims datasets
- Imaging (DICOMs)
- EEG files

Patient Data Network

HIPAA right of access

Processed & structured for research

Consent to share

Biopharma Research

Advocacy groups

Healthcare provider
Part 1: Longitudinal data acquisition

Ciitizen collects longitudinal medical records and images from every point of care

Caregiver/Patient onboards to Ciitizen

Caregiver/Patient consents to share data with researchers

Ciitizen uses the patient’s HIPAA right of access to request raw records from all providers (institutions, home offices, etc)

Ciitizen receives all, unstructured medical records (ex: genetic reports, neurology notes, procedure notes) and imaging studies

Regulatory expertise drives industry leading record retrieval rate of 99%

Ciitizen created The Patient Record Scorecard to publicly score hospitals and MD practices on HIPAA compliance
Part 2: Patients are data owners

Ciitizen provides shareable raw records to patients

All medical records and images scanned and uploaded to patient’s account

Patient owns their raw records

Patient can easily share records and images with any provider or person
Part 3: Ciitizen makes data useful

Structured and unstructured machine learning pipeline creates normalized, research ready data

Raw medical records are put through machine learning/NLP-assisted extraction engine

Human assistance and review of pipeline generated data for QA/QC

Data output is structured, coded, queryable and portable

Datasets shared at user’s discretion for longitudinal phenotypic characterization, clinical trial design support, and evaluation of genotype-phenotype correlations, among other uses.
Ciitizen and Praxis: a proof of concept

- **Sept 2020**: Ciitizen launches neuro pilot with FOXG1, SYNGAP1, STXBP1, SLC13A5
- **Dec 2020**: Ciitizen signs first deal with Praxis for SCN2A & SCN8A
- **May 2021**: Ciitizen delivers first SCN2A cohort; n=46
- **Jan 2022**: Praxis submits IND to FDA using Ciitizen data for SCN2A
- **Mar 2022**: Praxis signs new contract for n=900 patients with rare disorders
- **Aug 2022**: FDA approves IND; Praxis to launch phase 1/2 trials

*Through exclusive use of Ciitizen for clinical data, Praxis to launch trials years earlier.*
Praxis obtained investigational new drug (IND) clearance from FDA for PRAX-222\(^1\)

- PRAX-222 - ASO therapy for SCN2A-DEE
- Invitae’s Ciitizen RWD used to demonstrate lived experience of SCN2A-DEE patients
- Invitae’s Ciitizen data was the only natural history data used in submission package
- Using Ciitizen data advanced program by years

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Praxis leverages Ciitizen data to optimize Ph1/2 design

- Inform endpoint selection and characterization
- Refine genotype-phenotype correlations; accurately predict GOF variants
- Define inclusion/exclusion criteria
- Develop and refine an EEG biomarker
- Demonstrate unmet need during key regulatory interactions
- Plan for clinical trial sites and recruitment
Praxis use of Ciitizen data: Seizure frequency as primary endpoint for SCN2A-DEE throughout life

- Literature suggests early onset seizures remit
- Ciitizen found seizures persist
- Data helped confirm primary endpoint and age I/E criteria
Praxis use of Ciitizen data: Exploratory endpoints and clinical trial design
## Praxis use of Ciitizen data: Burden of Disease

<table>
<thead>
<tr>
<th></th>
<th>Medications</th>
<th>Diagnostic &amp; Therapeutic Procedures</th>
<th>Hospitalizations</th>
<th>Hospitalization Duration (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year of Life</td>
<td>14.5</td>
<td>21.1</td>
<td>4.3</td>
<td>69.1</td>
</tr>
</tbody>
</table>

![Graph showing the burden of disease](image-url)
What comes next?

- **Pre-Clinical**
  - Support phenotypic characterization across the lifespan
  - Support endpoint characterization
  - Inform clinical trial design

- **Clinical**
  - Support or confirm efficacy
  - Enable effective recruitment and site planning strategies
  - Serve as external control arm

- **Postmarket**
  - Support or confirm efficacy
  - Monitor for long-term outcomes and/or adverse effects
  - Evaluate real-world prescribing, use, reimbursement
Today, we are expanding our platform

Join our Rare Patient Network

Now supporting childhood onset of epilepsy and/or developmental delay.

Get started
Patient families: Who can join?

Any patient who meets these criteria is invited to join at no-cost:

- ≥1 seizure with onset before the age of 18 years old
- Developmental delay in any domain
- Receiving medical care in the United States

Learn more at ciitizen.com/rarenetwork
Patient benefits

Medical records made easy, research made possible

Say goodbye to the binder
View your existing medical records in one secure account.*

Build a faster way forward
Share summarized medical history with researchers, if you choose.

Be in control
Send a link to clinicians, caregivers and loved ones—or don’t. It’s up to you.
Advocacy Leaders: New Partnership Opportunities

The Rare Patient Network Partnership
You’re driven to make a difference. We are too.

Learn more at ciitizen.com/rare-partners
Advocacy Group benefits

Benefits

Potential benefits to your community include

- Provide caregivers and patients with one resource to access, manage and share medical records
- Obtain best in class, research-ready datasets that can be shared with researchers and biopharma to accelerate therapeutic opportunities and understanding of conditions
- Overcome gaps in understanding of biomarkers, clinical outcomes or critical needs for clinical trial readiness for your condition
- De-risk your condition to biopharma and position your community as a strong partner