The Colorado Health Observation Regional Data Service (CHORDS): Creating a Shared Distributed Data Network for Local Public Health and Research Needs
Presenters

• Rachel Zucker, Adult and Child Consortium for Health Outcomes Research and Delivery Science (ACCORDS)
BACKGROUND: CHORDS
CHORDS is a network conceived in 2011 that uses electronic health record (EHR) data to support public health evaluation, monitoring and research efforts.
CHORDS: A Primer

• **Data Partners:**
  Twelve health provider organizations in Colorado

• **Data Users:**
  Public health agencies serving the seven-county Denver Metro region and three public health agencies serving northern Colorado counties and local researchers from a variety of fields

• **Goal:**
  Expanded use of EHR data to achieve public health and research goals through reliable and location-specific information

• **Funding:**
  Primary support is provided by the Colorado Health Foundation (CHF); two-year renewal of grant began May 2018
CHORDS Data Partners

Health Systems
- Children’s Hospital Colorado
  - Denver Health
  - Kaiser Permanente Colorado

Mental Health Centers
- Mental Health Center of Denver
- Jefferson Center for Mental Health

Safety Net Providers
- Clinica Family Health
- Colorado Alliance for Health Equity and Practice
  - Colorado Coalition for the Homeless
  - High Plains Community Health Center
  - Metro Community Providers Network
  - Salud Family Health Centers
  - Clinica Tepeyac
CHORDS Data

• Approximately 3 million patients’ EHR data
• Limited dataset
• Geocoded home addresses
CHORDS: A Primer

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CHORDS Catchment in Colorado
# CHORDS Coverage

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The CHORDS Network

Data Users:
Denver Metro Public Health Agencies

Technology Partner:
University of Colorado Anschutz Medical Campus

Convener: CHI

Technology Partner:
CORHIO & CCMCN

Data Partners:
Health Care and Mental Health Partners
BACKGROUND: POPMEDNET
Federated Model for Secure Data Sharing

[Diagram showing the flow of secure federated queries to standard/virtual data warehouses through a query service.]

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PopMedNet

• Open-source application to facilitate data sharing among multi-site health data networks

• HIPAA-compliant distributed infrastructure

PopMedNet Portal

• Web-based app for query distribution

DataMart Client

• Windows application for query execution and response installed at each site

Web Service API

• Implements application logic to process requests against network(s)
PopMedNet

- Scalable; used by several regional and national networks:
The Query Process

**Data Requester Seeking Information**
Includes public health agencies, researchers, others.

**CHORDS PopMedNet Query Portal**
Authorized requesters access the portal through a web browser and submit their data query.

**Each CHORDS Data Partner Site: Health Care and Mental Health Providers**
- PopMedNet Client and Administrator
  - Site receives new query. PopMedNet administrator reviews the query and decides whether to execute it.

**Firewall**
- Query is run using a DataMart client software application. A site’s DataMart is regularly updated with standardized data from electronic health records.

**Partner DataMart Administrator**
- DataMart administrator decides whether to release results back to portal.

**DataMart (Virtual Data Warehouse)**
- DataMart returns results to DataMart administrator.

**Portal aggregates results from partners and returns data to requester.**
BACKGROUND: CHORDS VIRTUAL DATA WAREHOUSE
### The CHORDS Data Model

#### Colorado Health Observation Regional Data Service

#### Virtual Data Warehouse V3.1 Data Model

**Version Issued:** Summer 2017

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|---------------------|--------------------------|-------------------------|                  |
| PERSON_ID           | PROVIDER                 | ADATE                   |                  |
| PROVIDER            |                          | DDATE                   |                  |
The CHORDS Common Data Model: VDW

- **Encounters**
- **Diagnoses** (ICD-9/-10 codes)
- **Procedures** (ICD-9/-10; CPT, HCPCS)
- **Social History** (e.g., tobacco, alcohol, and/or drug use)
- **Laboratory Results** (e.g., test type, date of test and result)
- **Patient Demographics** (e.g., age, gender, race, ethnicity)
- **Patient Residence and Community Factors** (e.g., census tract of residence, American Community Survey socioeconomic data)
- **Prescribing** (e.g. written prescriptions; rxnorm; prescribing md, quantity, refills)
- **Vital Signs** (e.g. height and weight; diastolic and systolic blood pressure)
- **New for 2019: Benefits, Linkage**
Enhancing Data Reliability

- Many existing data sources rely on self-reported measures
- CHORDS uses EHR data, accessing measurements entered by providers
Maintaining Patient Privacy

- CHORDS provides aggregated data for use by public health agencies.
- Information cannot be traced back to individual patients – limited data set.
- Each data partner retains full control over their patients’ data – opt out model.
CHORDS Network Use

• Public Health
  – Retrospective surveillance
    • Disease prevalence across demographic, geographic strata
    • Adapters standardized for specific case definitions

• Healthcare Research
  – Infrastructure (governance, analytic support) for internal/external research using CHORDS data
Public Health and Research Requests

- **Public Health Topics:**
  - Depression
  - Mental Health and Pregnancy
  - Hypertension
  - Diabetes
  - Adult/Child BMI
  - Tobacco Use
  - Opioid Use Disorder
  - Marijuana

- **Research Topics:**
  - Asthma Exacerbation Index
  - Adolescent Pregnancy and LARCs
  - Spinal Fusion Procedures and Opioids
### Underlying Data

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Public Health Use Case: Depression Among the Latino Age Wave

Prevalence of Diagnosed Depression Among Non-Latino Adults 35 Years and Older in Denver County, by Census Tract, 2015

Data Source: Colorado Health Observation Regional Data Service (CHORDS)

Prevalence of Diagnosed Depression Among Latino Adults 35 Years and Older in Denver County, by Census Tract, 2015

Data Source: Colorado Health Observation Regional Data Service (CHORDS)
Research Use Case: Asthma

Count of asthma related prescriptions, by month

Absolute Eos. vs. % Eos.
INNOVATION: CUSTOMIZING CHORDS
Structured public health requests

• Menu-driven user interface
• Small cell size suppression
• Tailored reports
• Enhancements for large numbers of records
• Coverage
### Observation Date Range

**Start Date:** 06/21/2017  
**End Date:** 06/21/2018

### Gender

- [ ] Male
- [ ] Female
- [ ] Unknown
- [ ] Other

### Race

- [ ] Native Hawaiian or Other Pacific Islander
- [ ] American Indian/Alaska Native
- [ ] Asian
- [ ] Black or African American
- [ ] White
- [ ] More than one race, particular races unknown or not reported
- [ ] Unknown or Not Reported

### Ethnicity

#### Hispanic:

- [ ] Select All Ethnicities
- [ ] Yes
- [ ] No
- [ ] Unknown

### Age of Individuals

- [ ] Age by Fixed Increments
- [ ] Age by Custom Ranges
Structured public health requests

- Menu-driven user interface
- Small cell size suppression
- Tailored reports
- Enhancements for large numbers of records
- Coverage
Small cell size suppression

• Aligned with CMS Guidelines
  – Cell sizes ≤10 are replaced with ≤10
  – This masking can be turned off for QA checks
Structured public health requests

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Structured public health requests

• Menu-driven user interface
• Small cell size suppression
• Tailored reports
• Enhancements for large numbers of records
• Coverage
Enhancements for large numbers of records

- Change in file size of transmissions from DMC to Portal to minimize SQL Server space requirements
- Limiting displayed rows in Portal
Structured public health requests

- Menu-driven user interface
- Small cell size suppression
- Tailored reports
- Enhancements for large numbers of records
- Coverage
Exploring CHORDS Data

The Colorado Health Observation Regional Data Service (CHORDS) is gathering and aggregating electronic medical record data from 11 health care and mental health providers in the seven-county Denver metro area. For the first time, researchers and public health agencies have access to clinical data to help monitor public health trends. CHORDS data can be used alone or in conjunction with survey data sources.

This dashboard compares the population covered by CHORDS — people who received care at one or more of the participating health providers — with the population included in the American Community Survey. Comparisons are based on 2015 data and are available by county, age, gender and race.

Use the demographic filters below to explore CHORDS coverage data

Demographic Filters

**Age**
- Under 18
- 18 and Over
- 65+

**Gender**
- Females
- Males
- Total

**Race**
- AIAN
- Asian
- Black
- HPI
- Hispanic
- Multi
- Race
- White

### Age: Under 18 who are represented in CHORDS

Legend
- 30.1%
- 72.4%

Select a Unit of Measure
- Percentage of Population Represented in CHORDS Compared with the ACS
- Number of People Represented in CHORDS Compared with the ACS

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Customizing CHORDS

• Linking and de-duplicating records across data-contributing sites
CHALLENGES
Data Partners

- Legal/regulatory
- Different technical resources
Legal/Regulatory

- Unique processes at each site
- Agreements required to share data
  - Reciprocal DUA
- IRB approval: site by site considerations
- Research vs. public health
Data Partners

• Legal/regulatory
• Different technical resources
Different Technical Resources

- Full IT team vs. summer interns/part time assistance
- Software licensing considerations
- Previous experience in other data networks
Data Partners

• ETL (Extract, Transform and Load) challenges
• QA efforts
Data Partners: ETL

• Differing experience levels
• Site-specific decisions
• The mystery of the missing heights
Data Partners

• ETL challenges
• QA efforts
Data Partners: QA

Patient Volume Stratified by Age

**do not distribute.**
Data Partners: QA

Pregnancy Lab Test Volume, 2005-2016

**do not distribute.**
WHERE WE ARE NOW AND WHERE WE ARE GOING
Geographic Area

• NOW:
  – Metro Denver area
Geographic Area

• GOING TO:
  – Northern Colorado/Front Range
Data Partners

• NOW:
  – 12 data partners contributing data
Data Partners

• GOING TO:
  – Adding new data partners, including two of the largest state-wide systems.
  – Adding new behavioral health data partners
  – New outreach
VDW

• NOW

  – CHORDS VDW 3.1
  – Assessed data model concordance with:
    • HCSRN VDW CDM: 98%
    • PCORnet CDM: 47%
VDW

• GOING TO:
  – Balance of specialized tables/fields vs. staying in alignment: point of no return?
  – CHORDS VDW 3.2: BENEFITS and LINKAGE tables
  – Next up: Social Determinants, Screening?
Software

• Customization: pros and cons
• Keeping up with the Joneses (aka new releases)
• Help from the Harvard Pilgrim development team
Where Else?

• Linkage and de-duplication
• Expanded Research Agenda
Linkage and De-duplication

• We’ve got an eMPI... now what?
  – Distributed data network design
  – Which record “wins”
Where Else?

- Linkage and de-duplication
- Expanded Research Agenda
Expanded Research Agenda

- Deep dive into newer tables
- New fields, lab tests
- Revisiting regulatory/legal processes at each site
Questions?

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Additional Resources Online

www.coloradohealthinstitute.org/research/colorado-health-observation-regional-data-service