NIH Collaboratory

Health Care Systems Research Collaboratory

Distributed Research Network: A Status Report

March 2, 2018

The Goal

The NIH Collaboratory Distributed Research Network facilitates research partnerships with organizations that participate in the FDA Sentinel Initiative

Sentinel partner organizations

Lead – HPHC Institute

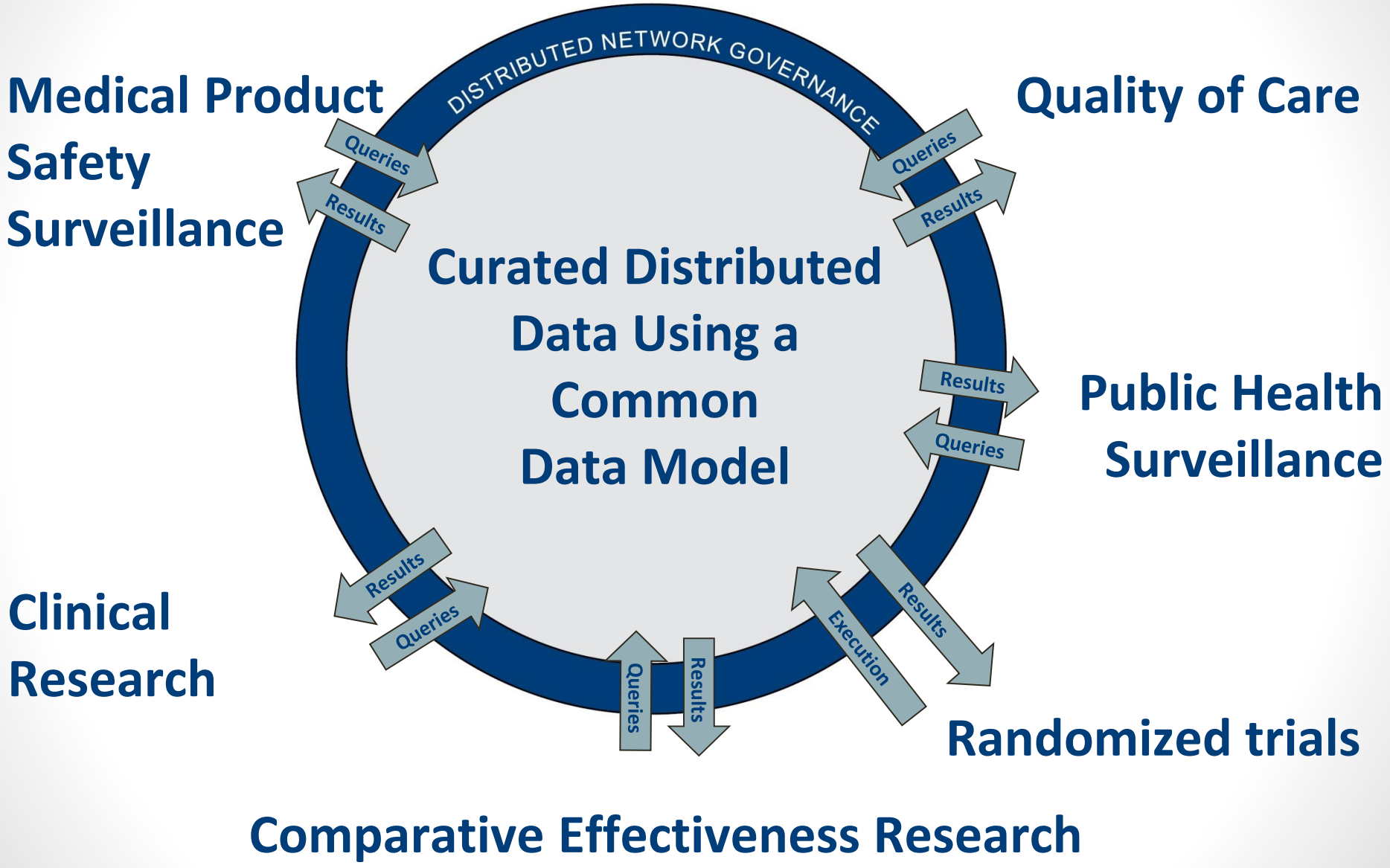
DEPARTMENT OF POPULATION MEDICINE
HARVARD MEDICAL SCHOOL
Harvard Pilgrim Health Care Institute

Data and scientific partners

HealthCore Anthem
VANDERBILT SCHOOL OF MEDICINE
health care systems research network
MASSACHUSETTS
HUMANA
HCA Hospital Corporation of America
DukeMedicine
OPTUM
KAISER PERMANENTE
aetna

Scientific partners

IQVIA
Penn Medicine
UAB
DEPARTMENT OF MEDICINE BRIGHAM AND WOMEN'S HOSPITAL HARVARD MEDICAL SCHOOL
AHIP America's Health Insurance Plans
UNC GILLINGS SCHOOL OF GLOBAL PUBLIC HEALTH
HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH
UF College of Pharmacy UNIVERSITY of FLORIDA
UIC
THE UNIVERSITY OF IOWA COLLEGE OF PUBLIC HEALTH
RUTGERS


Medical Product Safety Surveillance
DISTRIBUTED NETWORK GOVERNANCE
Quality of Care
Queries
Results
Curated Distributed Data Using a Common Data Model
Results
Queries
Public Health Surveillance
Results
Queries
Clinical Research
Queries
Results
Execution
Results
Randomized trials
Comparative Effectiveness Research

Potential Uses of Available Networks

- **Based on Sentinel**
  - DRN Collaboratory: Observational and interventional studies using Sentinel Distributed Dataset funded by NIH and other not-for-profit sponsors
  - FDA-Catalyst: Observational and interventional studies using Sentinel Distributed Dataset funded by FDA or studies specifically approved by FDA
  - IMEDS: Observational and interventional studies using Sentinel Distributed Dataset sponsored by regulated industry
- **Based on PCORnet**
  - PCORnet: Observational and interventional studies anchored in clinical settings, using PCORnet Distributed Dataset

NIH Collaboratory Distributed Research Network Partners

NIH Collaboratory Distributed Research Network

Millions of people. Strong collaborations. Privacy first.

Data Partners

Harvard Pilgrim Health Care

KAISER PERMANENTE®

Kaiser Permanente Washington Health Research Institute

aetna℠

HealthCore® Anthem®

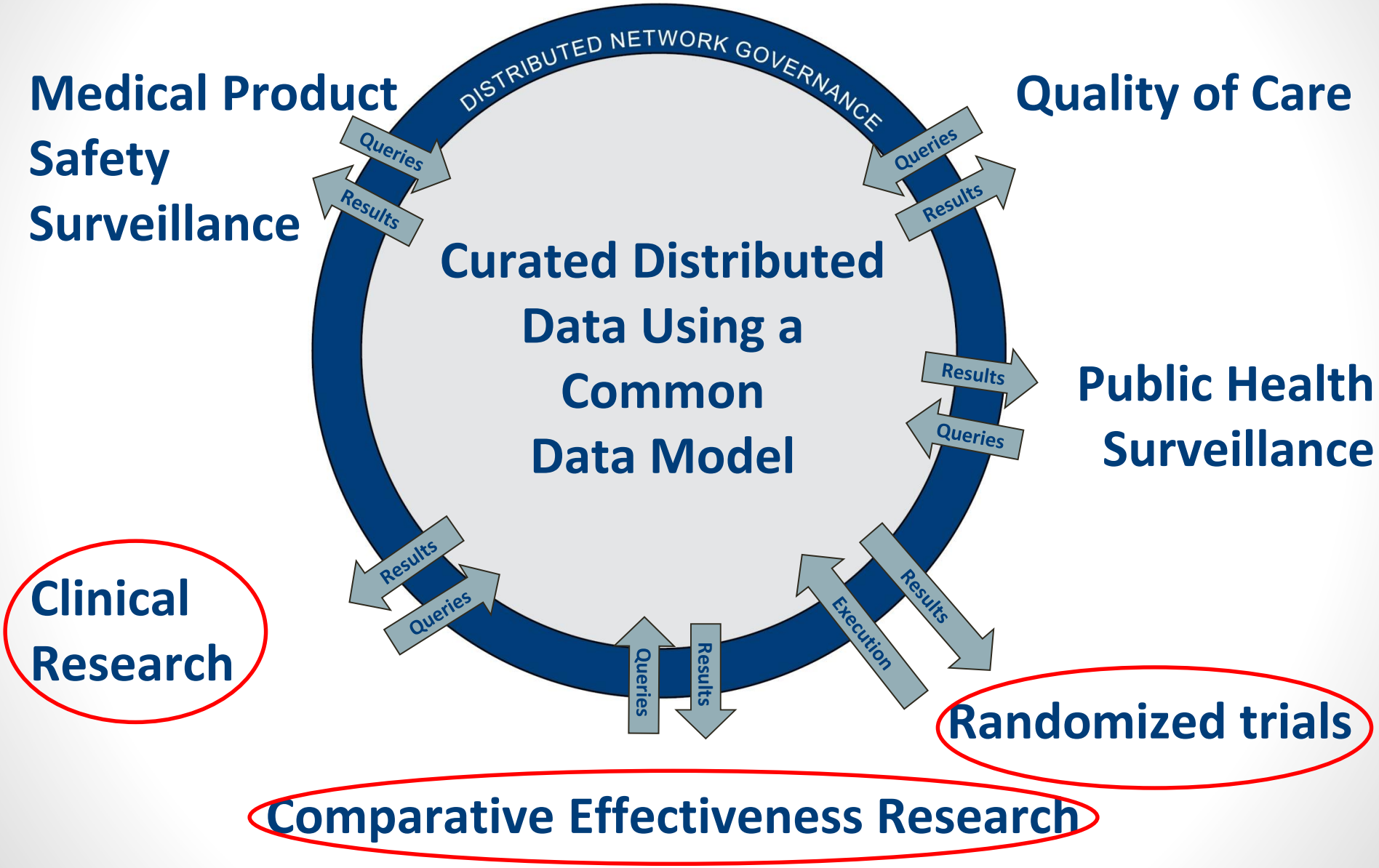
HealthPartners® Institute for Education and Research

OPTUM™

HUMANA®

The **Meyers** Primary Care Institute

All participate in FDA's Sentinel System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FDA Catalyst Randomized Trial

- **IMPACT-AFib**
  - **Primary Aim:** Increase initiation of oral anticoagulants among patients with atrial fibrillation at high risk of stroke
  - **Design:** Individually randomized trial of ~80,000 individuals
  - **Intervention:**
    - For patients – Mailed educational material
      Recommendation to consult their clinician
    - For physicians – Notification of eligible patients
      Recommendation to (re)consider anticoagulation
  - **Population:**
    - Repeated diagnosis of atrial fibrillation
    - No oral anticoagulation in prior year
    - CHA_2DS_2VASc score >2
    - Several exclusions apply
  - **Primary outcome:** Initiation of anticoagulation
  - **Secondary outcomes:** Duration of therapy, stroke & TIA, bleeding

http://rethinkingclinicaltrials.org/news/january-5-2018-impact-afib-an-80000-person-randomized-trial-using-the-sentinel-initiative-platform/

Collaboratory DRN Objective

Goal: Facilitate multisite research collaborations between investigators and data stewards through use of secure networking capabilities and analysis tools.

- Advantages
  - Ability to work with analysis-ready datasets covering many millions
  - Standardized data using a common data model
  - All activities audited and secure
  - Availability of validated analytic tools for simple to complex comparative analyses
  - Enables efficient multisite studies

- Operating model
  - Data Partners keep and analyze their own data
  - Provide results, not data, to the requestor

http://rethinkingclinicaltrials.org/nih-collaboratory-distributed-research-network-1/

Uses of the Network

- Research planning
  - Assess background rates and population impact of conditions / treatments
  - Prioritize research domains
  - Identify sites for participation in interventional or observational studies
- Conduct observational and interventional research

Available Data

- Rapid-response distributed querying available across data partners with over 90 million lives
- The Collaboratory DRN has partnerships with a variety of health plan data sources
- Detailed information for billions of medical encounters and outpatient pharmacy dispensings
- Analysis-ready datasets (i.e., quality checked and formatted) representing >90% of the FDA Sentinel program

Data Elements

- Available / Possible
  - Ambulatory care diagnoses and procedures
  - Outpatient pharmacy dispensing
  - Laboratory test orders and selected test results
  - Inpatient diagnoses, treatments, and procedures itemized in hospital bill
  - Ability to contact providers and members
- Not available
  - Out-of-hospital death
  - OTC medication
  - Community-based immunizations

Prior DRN Queries

- Pilot queries developed by 3 NIH Institutes, which used publicly-available Sentinel querying tools
  - Assess recruitment feasibility of replicating the Trial to Assess Chelation Therapy (TACT)
  - Characterize statin users >75 years of age
  - Assess rates of abnormal cancer screening test results and rates of follow up testing
- DRN Team and NIH staff (led by NHLBI & NCI) used queries as test cases for developing processes, and refining strategies to format queries

http://rethinkingclinicaltrials.org/news/grand-rounds-3-11-16/

Collaboratory DRN: Recent Uses

- 2017 Collaboratory DRN Solicitation
  - 9 applications received, reviewed, and prioritized
  - 5 requests selected and answered via the DRN
    - Incidence and recurrence of hepatocellular carcinoma associated with oral direct acting antivirals
    - Identifying chemotherapy-induced peripheral neuropathy (CIPN) and its treatment
    - Antibiotic dispensing in emergency departments and ambulatory settings
    - Estimating opioid users and diagnoses of opioid use disorder and opioid overdose
    - Estimating prevalent long-term bisphosphonate use
- Discussing 3 requests today

Recent Use Cases: Study Population

Health Plan	Total Enrollees in Research Database*
Aetna	18.8 million
Harvard Pilgrim Health Care	3.7 million
HealthCore	65 million

*Note: Actual eligible populations for each query were smaller due to each query's start and end dates, enrollment requirements, age restrictions, etc.

Hepatitis C Query

Dr. Sonal Singh, University of Massachusetts Medical School

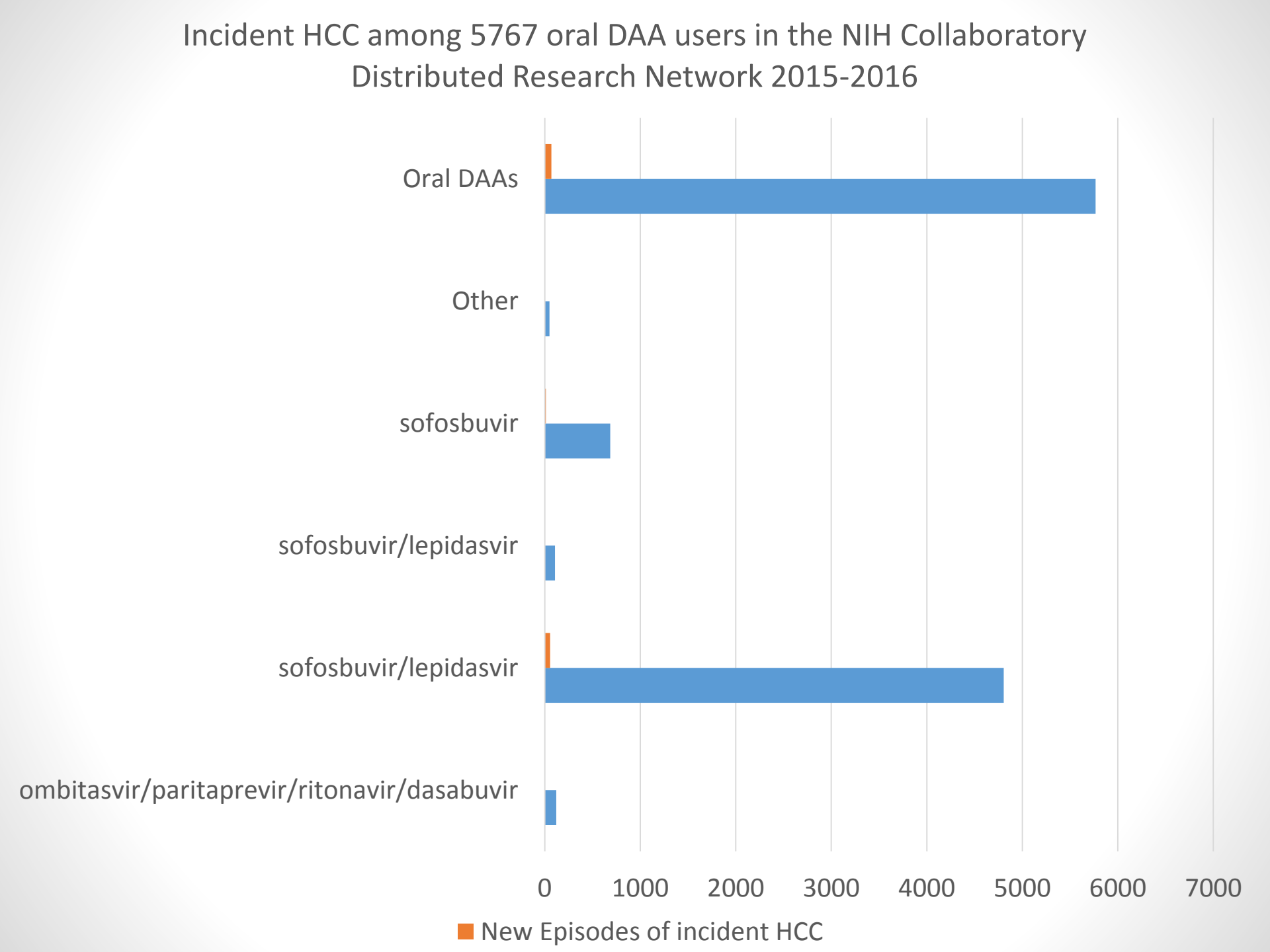
Hep C Query: Background & Objectives

- Oral Direct Acting Antivirals (DAAs) are used to treat chronic hepatitis C and achieve Sustained Virologic Response rates > 90% in RCTs
- The influence of Sustained Virologic Response induced by oral DAAs on the risk of hepatocellular carcinoma (HCC) is unknown
- Some cohort studies have suggested an increased risk of incident or recurrent HCC after treatment
- Alterations in immunosurveillance and removal of a protective effect from inflammation secondary to chronic HCV infection are postulated to increase the risk of HCC
- Objective Query Goal: Estimate the number of incident or recurrent hepatocellular carcinoma (HCC) diagnoses among new users of oral direct-acting antivirals (DAAs) from Jan 1, 2015 to Dec 31, 2016

- Jakobsen et al CDSR 2017;9:CD012143 Reig et Journal of hepatology 2016;65:719-26

Hep C Query: Analysis

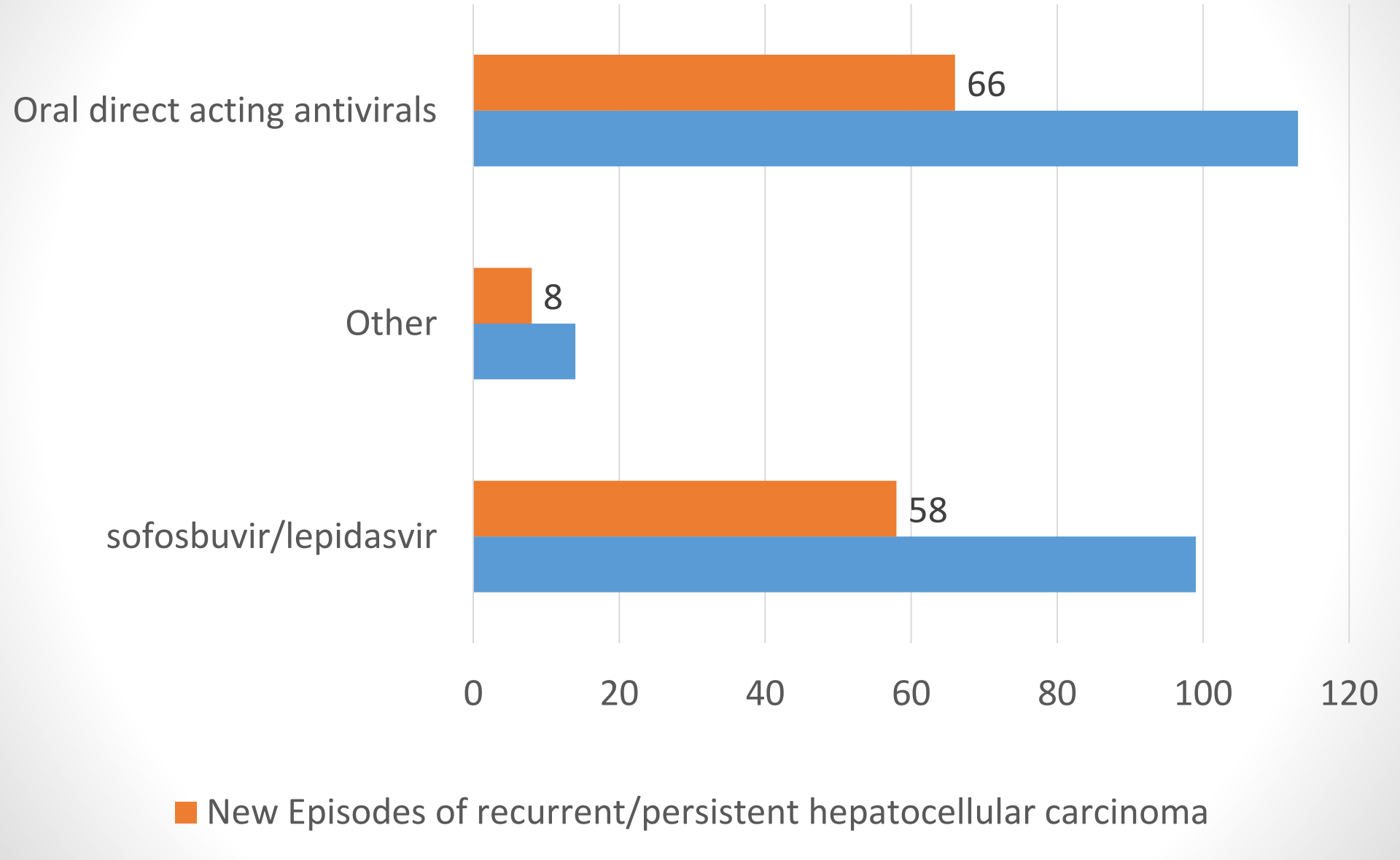
- Retrospective cohort among adults ≥18 years of age who received oral DAAs between January 1, 2015 and December 31, 2016 in 3 of the organizations that participate in the NIH Collaboratory Distributed Research Network
- Continuous coverage for a minimum of 183 days; allowing gaps of up to 45 days
- Incidence use: No exposure to DAA in the 90 days prior to the index date. Allowable gap between dispensing of 30 ds and exposure extension period of 365 days. Minimum of 84 days of drug use.
- NDCs were used to identify exposures for the oral DAAs & ICD- 9 codes for HCC
- **Incident HCC analysis.** No preexisting HCC during the 180 d prior to the index date
- **Recurrent/persistent HCC** included incident oral DAA users with preexisting HCC in the 366 days prior to incident use


Incident HCC among 5767 oral DAA users in the NIH Collaboratory Distributed Research Network 2015-2016
Oral DAAs
Other
sofosbuvir
sofosbuvir/lepidasvir
sofosbuvir/lepidasvir
ombitasvir/paritaprevir/ritonavir/dasabuvir
0
1000
2000
3000
4000
5000
6000
7000
New Episodes of incident HCC

Oral Directing Acting Antiviral Use and Incident Hepatocellular carcinoma in the NIH Collaboratory DRN 2015 –2016

Oral Direct acting antiviral	Total number of New Users for each drug for Incident HCC, N	Person Years at Risk	New Episodes of incident HCC, [%, 95% CI]
ombitasvir/paritaprevir/ritonavir/dasabuvir	120	98.3	2 [1.7, 0.2 to 5.9]
sofosbuvir/lepidasvir	4805	3761	57 [1.1, 0.9to 1.5]
sofosbuvir/lepidasvir	108	23.5	NA
sofosbuvir	685	541	11 [1.6, 0.8 to 2.8]
Other	49	23.9	NA
Total Oral DAAs	5767	4447.7	70 [1.21, CI 0.9 to 1.5]

Oral DAA Use and Recurrent/Persistent HCC in the NIH Collaboratory DRN 2015-2016



Oral Directing Acting Antiviral Use and Recurrent/Persistent HCC in the NIH Collaboratory DRN 2015 –2016

Oral Direct acting antiviral	Total number of New Users for each drug for Recurrent/persistent Hepatocellular carcinoma, N	Person years at risk	New Episodes of recurrent/persistent hepatocellular carcinoma n, [% and 95 % Confidence Interval of %I] #
Sofosbuvir/lepidasvir	99	45.7	58 [58, 48 to 0.68]
Other	14	4.2	8
Total Oral direct acting antivirals	113	49.9	66 [0.58, 0.49 to 0.68]

Conclusions & Next Steps

- Limited follow up; and analysis for recurrence/persistence did not stipulate HCC treatment prior to cohort entry
- Low rate of incident HCC with a high rate of *recurrent/persistent* HCC among new users of oral direct acting antivirals
- Abstract accepted for presentation at Health Care Systems Research Network Meeting 2018; manuscript ready for submission
- Use the underlying data and subsequent academic products to support a grant application to the NIDDK to evaluate long term real world outcomes, including HCC with oral direct acting antiviral drugs

Antibiotic Query

Drs. Kevin Haynes and Abiy Agiro, HealthCore

Antibiotic Query: Goals & Analysis

- **Genesis**: A surprising finding was published in *Pediatrics* reporting "downward trend in pediatric antibiotic use has come to an end" (Vaz LE, Kleinman KP, Raebel MA, et al. 2014)
- **Research question**: 1) is that true, and 2) will the trend be different for emergency department encounters compared to ambulatory visits?
- **Query goal**: measure temporal trends in antibiotic dispensing of pediatric patients (<20 years) stratified by encounter setting (emergency department vs ambulatory), infectious disease diagnosis, year (2006 – 2016), season of diagnosis (winter vs summer), sex, and age at diagnosis
- **Method and Analysis** – Data aggregation through CIDA* Tool
  - Data partners: Anthem via HealthCore-NERI, Aetna and Harvard Pilgrim
  - 4 level classifications of infectious diagnosis
  - Number of visits with fills per 1000 children with infectious diagnosis was outcome
  - No antibiotic dispensing in the 90 days before an infectious diagnosis
  - Poisson regression with population denominators as offsets

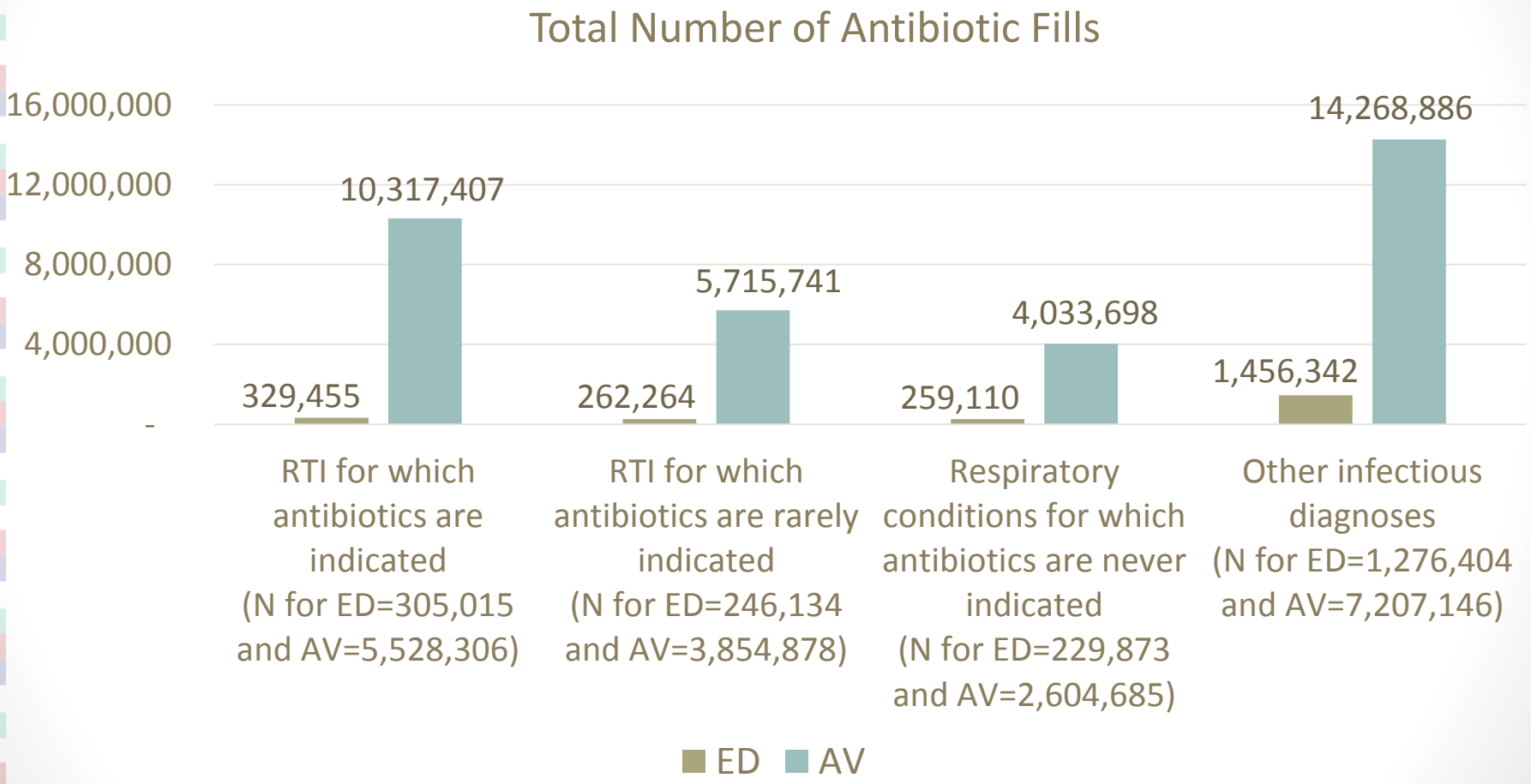
*Cohort Identification and Descriptive Analysis (CIDA) from Sentinel Common Data Model (CDM)

Antibiotic Query: Goals & Analysis

Condition Classification Based on Infectious Diagnosis	Description
RTI* for which antibiotics are **indicated**	Sinusitis, pharyngitis, tonsillitis, otitis media, mastoiditis, streptococcal sore throat, peri-tonsillar abscess, nonspecific pneumonia
RTI* for which antibiotics are **rarely indicated**	Nasopharyngitis, laryngitis, unspecified upper respiratory infections, bronchitis (acute and not otherwise specified), bronchiolitis, viral pneumonia, influenza
Respiratory conditions for which antibiotics are **never indicated**	Chronic sinusitis, chronic bronchitis, asthma, allergy, other respiratory conditions
Other infectious diagnoses	Urinary tract infections (acute pyelonephritis, renal abscess, other pyelonephritis, unspecified kidney infection, acute cystitis, unspecified cystitis), Skin/cutaneous/mucosal infections (open wounds, burns, erysipelas, dermatomycosis, ear diseases other than otitis media and mastoiditis, folliculitis, infective myositis, mastitis, necrotizing fasciitis), Gastrointestinal infections (intestinal infectious diseases, nausea/vomiting, diarrhea), Miscellaneous infections (tuberculosis, zoonotic diseases, pertussis, meningitis, parasitic diseases other than those of the skin and subcutaneous tissue or digestive tract)

*RTI (Respiratory Tract Infection); Source of classification (Hersh AL et al 2011 *Pediatrics*)

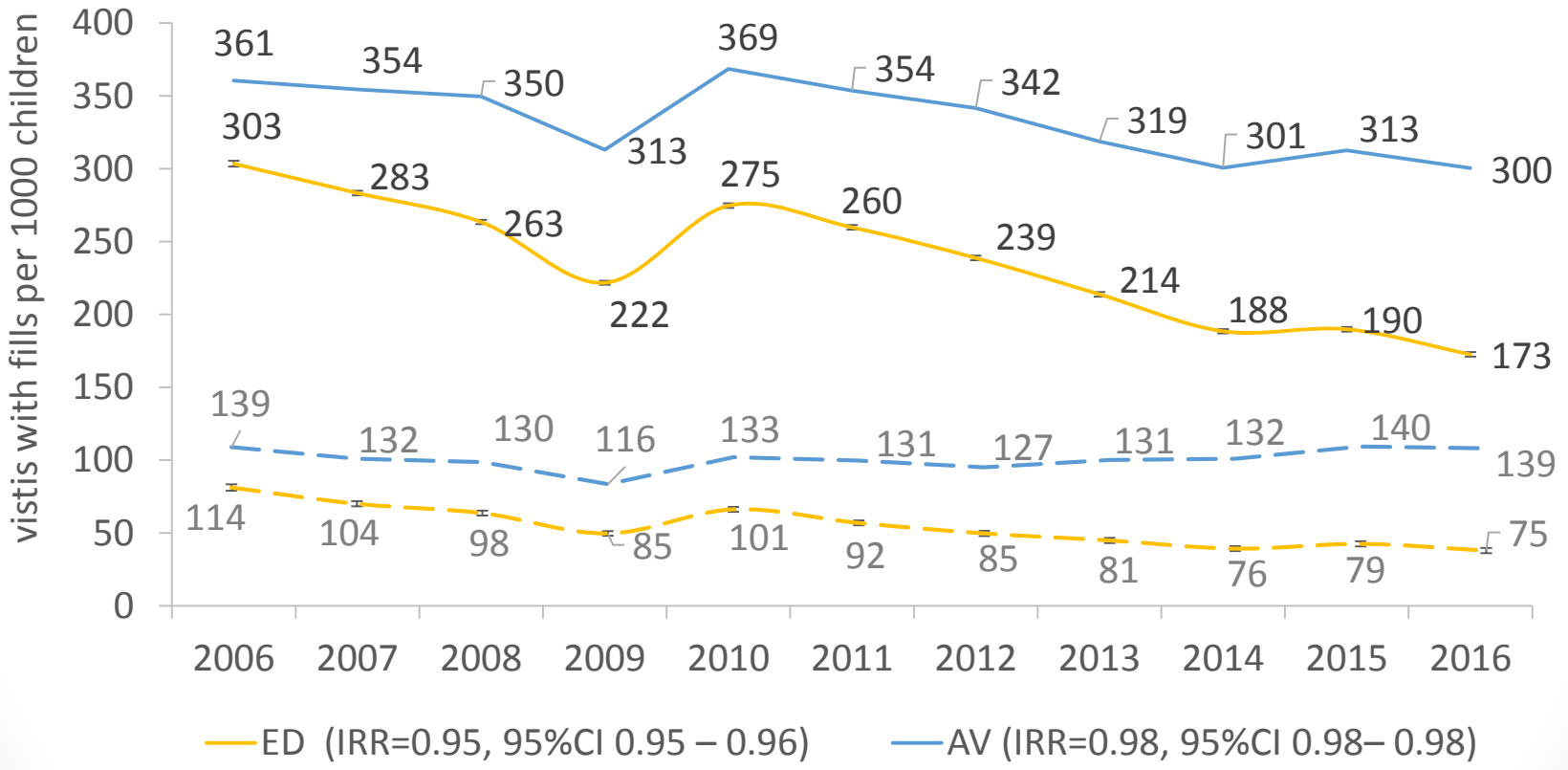
Antibiotic Query: Descriptive Results



RTI (Respiratory Tract Infection); N = Number Children with Infectious Diagnosis;
ED (Emergency Departments); AV (Ambulatory Visits)

Antibiotic Query: Regression Results

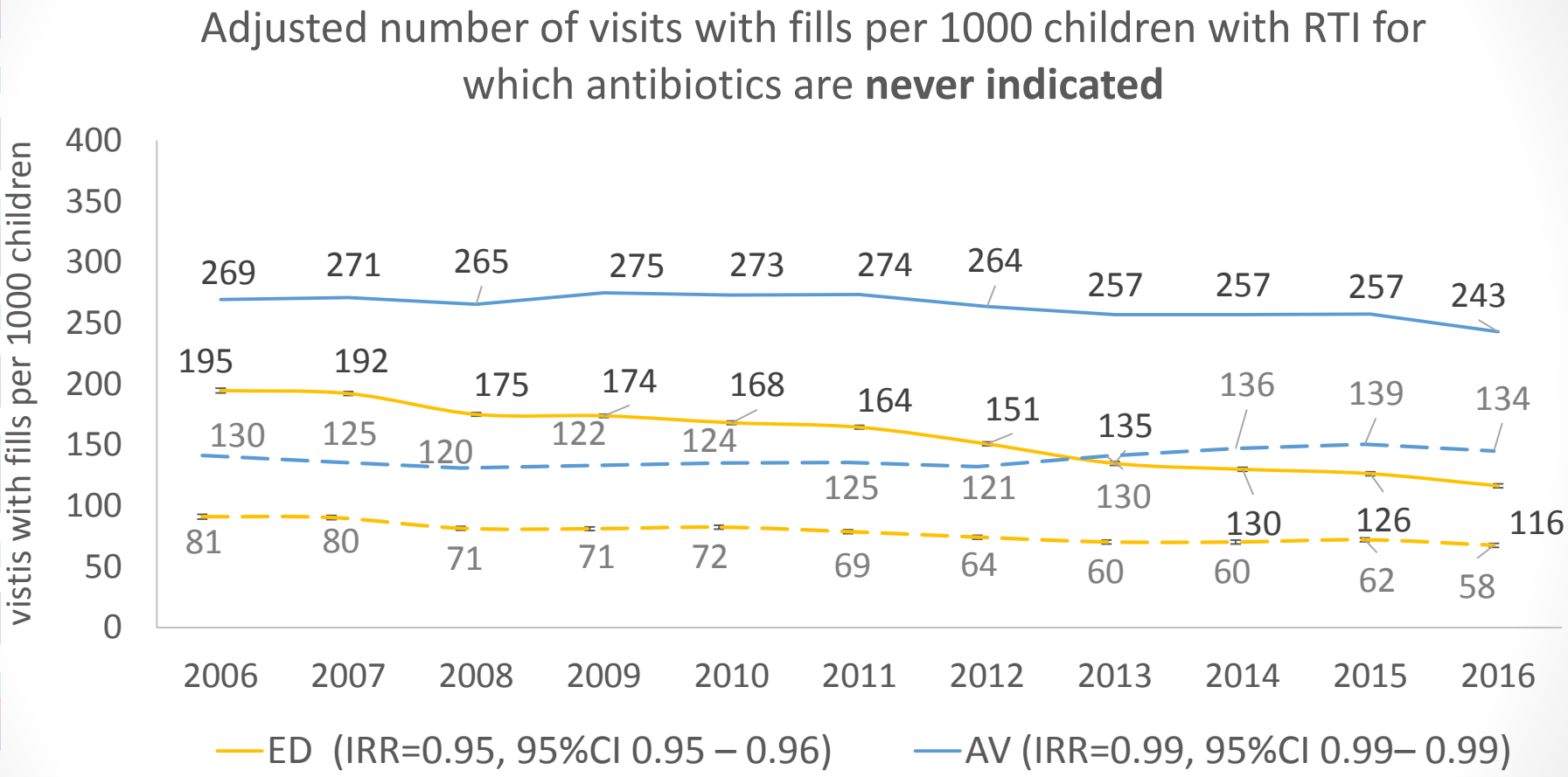
Adjusted number of visits with **any** fills per 1000 children with RTI for which antibiotics are **rarely indicated**



Dotted line is broad-spectrum fills – ED (IRR=0.96, 95%CI 0.96-0.97) and AV (IRR=1.01, 95%CI, 1.01=1.01)

RTI (Respiratory Tract Infection); ED (Emergency Department); AV (Ambulatory Visit); IRR (Incidence Rate Ratio) adjusted for age group, sex and winter season

Antibiotic Query: Regression Results



Dotted line is broad-spectrum fills – ED (IRR=0.97, 95%CI 0.96-0.97) and AV (IRR=1.01, 95%CI, 1.01=1.01

RTI (Respiratory Tract Infection); ED (Emergency Department); AV (Ambulatory Visit); IRR (Incidence Rate Ratio) adjusted for age group, sex and winter season

Antibiotic Query: Conclusions & Next Steps

- This study provides evidence of 5% per year *decrease* in trends of **any** antibiotic dispensing in two of four infectious disease classifications in ED encounters vs. 1% to 2% per year *decrease* in ambulatory encounters

- ED encounters were associated with 3% to 4% per year *decreasing* trends in **broad spectrum** antibiotic dispensing in two of four infectious disease classifications while ambulatory encounters were associated with 1% per year *increasing* trends

- Antibiotic stewardship programs need to focus on ambulatory settings, specifically on the use of broad spectrum agents, to meet the goal of reducing inappropriate antibiotic use by 50% in outpatient settings

- Manuscript submission to JAMA Network Open

Chemotherapy-Induced Peripheral Neuropathy (CIPN) Query

Dr. Jennifer Gewandter, University of Rochester School of Medicine & Dentistry

Chemotherapy-induced Peripheral Neuropathy (CIPN)

- No preventive therapies exist for CIPN
- Claims data could be used to generate hypotheses regarding predictors of CIPN and preventive strategies
- No studies have investigated the feasibility of identifying CIPN cases using claims data
  - Possibly due to a perception of low billing for CIPN by oncologists

Research Questions

- Primary: Is it feasible to identify patients who develop CIPN using ICD-10 codes in regional and national claims data?
- Secondary: Could a new prescription of a neuropathic pain medication (i.e., gabapentin, pregabalin, and duloxetine) serve as a surrogate marker for CIPN cases?

Methods

Data Partners: HealthCore, Aetna, and Harvard Pilgrim Health Care

Primary objective

Inclusion criteria:

- Patients receiving one of the following types of chemotherapy:
  - Neurotoxic - Taxane, Platinum agent, Vinca alkaloid, Bortezomib
  - Non-neurotoxic - Antimetabolies, Anthracyclines, Alkylating agents, Topoisomerase inhibitors
- Did not have a history of any of 20 ICD-9/10 codes and sub-codes associated with peripheral neuropathy (PN-codes) within 6 months prior to chemotherapy start date.

Outcome:

- Incidence of at least 1 PN-code within 6 months after chemotherapy initiation

Analyses:

- The percentage of patients with a New PN-code and new users with new PN - code/10K years at risk were calculated for groups of patients who received neurotoxic and non-neurotoxic chemotherapies.
- The ratio of these estimates between groups of patients who received neurotoxic vs. non-neurotoxic chemotherapies was calculated

Methods, Cont.

Secondary objectives

Inclusion criteria:

- Patients receiving one of the following types of chemotherapy:
  - Neurotoxic - Taxane, Platinum agent, Vinca alkaloid, Bortezomib
  - Non-neurotoxic - Antimetabolies, Anthracyclines, Alkylating agents, Topoisomerase inhibitors
- For duloxetine analyses: Did not fill a prescription for duloxetine within 6 months prior to chemotherapy start date.
- For pregabalin and gabapentin analyses: Did not fill a prescription for pregabalin or gabapentin within 6 months prior to chemotherapy start date.

Outcome:

- Prescription for duloxetine, pregabalin, or gabapentin within 6 months after chemotherapy initiation (each drug analyzed separately)

Analyses:

- The percentage of patients with a new prescription and new users with new prescription/10K years at risk were calculated for groups of patients who received neurotoxic and non-neurotoxic chemotherapies.
- The ratio of these estimates between groups of patients who received neurotoxic vs. non-neurotoxic chemotherapies was calculated

Results

Primary Objective: New PN-code

	New users	Total eligible Members	% of total eligible members	# of new users with new PN diagnosis	% of new users with new with PN diagnosis	New users with new PN diagnosis /10K years at risk
Neurotoxic 6 mos FU	137,559	41,840,828	0.3%	26,872	19.5%	4997
Non-neurotoxic 6 mos FU	214,969	41,711,741	0.5%	14,670	6.8%	2385

	Ratio of neurotoxic to non-neurotoxic
Percent of new uses with PN (6 mos)	2.9
Rate of new users with PN (6 mos)	2.1

Results, Cont.

Secondary objectives

	New Users	Total eligible Members	% of total eligible members	# of new users with new gaba prescription	% of new users with new with new gaba prescription	New users with new gaba prescription /10K years at risk
New Gabapentin						
Neurotoxic 6 mos FU	156,079	41,748,297	0.37%	11,148	7%	1686
Non-neurotoxic 6 mos FU	242,777	41,622,866	0.58%	4,154	1.7%	574
New Pregabalin						
Neurotoxic 6 mos FU	156,079	41,748,297	0.37%	1,080	0.69%	158
Non-neurotoxic 6 mos FU	242,777	41,622,866	0.58%	756	0.31%	103
New Duloxetine						
Neurotoxic 6 mos FU	162,795	41,854,252	0.39%	1,262	0.77%	177
Non-neurotoxic 6 mos FU	251,945	41,726,878	0.6%	1,906	0.76%	252

Percentage of patients with new	Ratio of neurotoxic to non-neurotoxic
Gabapentin prescription	4.1
Pregabalin prescription	2.2
Duloxetine prescription	1.0

Conclusions

- New PN-associated ICD-10 codes appear in claims data more frequently after neurotoxic chemotherapy than after non-neurotoxic chemotherapy
  - These data suggest ICD-10 codes could be used to identify CIPN cases
- Gabapentin, but not pregabalin or duloxetine, is prescribed more frequently after neurotoxic chemotherapy than non-neurotoxic chemotherapy
  - These data suggest that a composite of gabapentin prescription and/or ICD-10 code might be useful for identifying CIPN cases

Next Steps

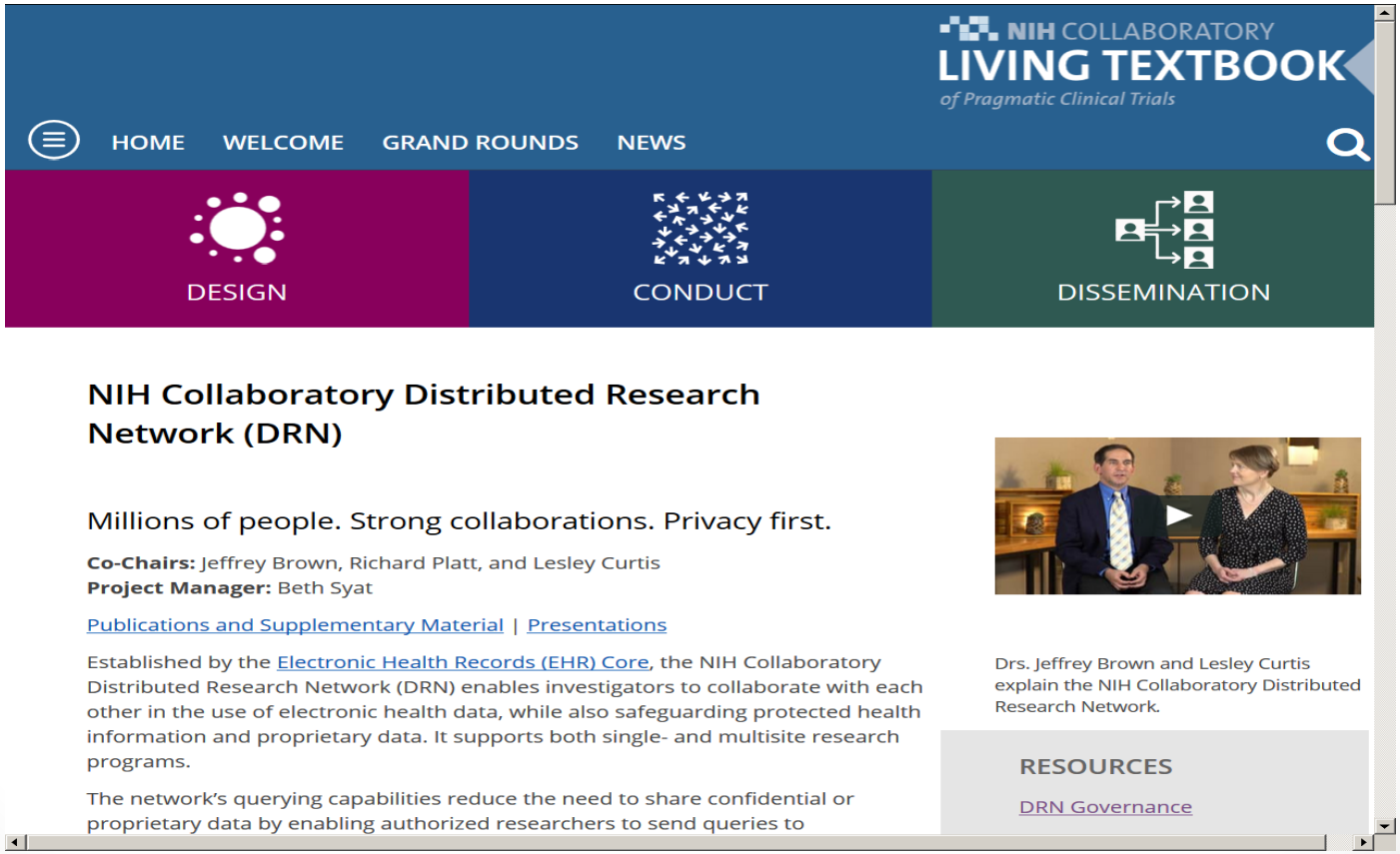
- Submitted abstract to ASCO
- Prepare manuscript
- Prepare a grant application (possible ideas):
  - Investigate specific ICD-10 codes using similar methodology in original study
  - Investigate sensitivity and specificity of ICD-10 code as diagnostic for CIPN by pairing with clinical data from a prospective study performed by my collaborator
  - Pair gabapentin prescription data with ICD-10 code data to identify cases of CIPN in claims data

Cost

- FDA Catalyst randomized trial total cost ~$5.3M
- DRN query costs range from $15k – 200k, depending on query complexity and number of Data Partners
  - Charges may be waived for prep-to-research queries to support a grant proposal that involves the DRN partners
- Funding is available to subsidize 50% of the cost of a small number of queries

Send Us Your Questions!

- Soliciting requests from employees of federal agencies, academic organizations, and not-for-profit organizations
- To apply, go to: http://www.rethinkingclinicaltrials.org/nih-collaboratory-distributed-research-network-1/



Appendix C: List of ICD-9-CM Codes and ICD-10-CM Codes used to Define CIPN in this Request

Code Type	Code	Description
ICD-9-CM	729.2	Neuropathic pain
ICD-9-CM	357.6	Peripheral neuropathy from drugs
ICD-9-CM	357.7	Peripheral neuropathy from drugs
ICD-9-CM	357.9	Peripheral neuropathy from drugs
ICD-9-CM	782*	Numbness / burning
ICD-9-CM	355.71	Pain in the hands or feet
ICD-9-CM	354.4	Pain in the hands or feet
ICD-9-CM	729.82	Cramping in hands or feet
ICD-9-CM	356.9	Peripheral neuropathy
ICD-9-CM	357.3	Polyneuropathy in malignant disease
ICD-9-CM	357.8*	Inflammatory and toxic neuropathy - Other
ICD-10-CM	G62	Other and unspecified polyneuropathies
ICD-10-CM	G62.0	Other and unspecified polyneuropathies
ICD-10-CM	G62.1	Other and unspecified polyneuropathies
ICD-10-CM	G62.2	Other and unspecified polyneuropathies
ICD-10-CM	G62.8	Other and unspecified polyneuropathies
ICD-10-CM	G62.81	Other and unspecified polyneuropathies
ICD-10-CM	G62.82	Other and unspecified polyneuropathies
ICD-10-CM	G62.89	Other and unspecified polyneuropathies
ICD-10-CM	G62.9	Other and unspecified polyneuropathies

* inculdes all subcodes