Transforming Medicaid Data into the Sentinel Common Data Model

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Agenda

1. Project Overview

2. What is the FDA's Sentinel Initiative?
   - Sentinel Common Data Model

3. Transformation of Medicaid data into the SCDM
   - Mother-infant linkage

4. How can this data source can be used to answer scientific questions?

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Project Overview:
Making Medicaid Data More Accessible Through Common Data Models and FHIR APIs

FDA

- The growth of Common Data Models supports rapid evidence generation across multiple databases simultaneously

    - Enables use of large sample sizes to study rare exposures, risk factors and outcomes

- The Transformed Medicaid Statistical Information System (T-MSIS) Analytic Files (TAF) Research Identifiable Files (RIFs) are a research-optimized national Medicaid dataset

- Our project is creating freely available code to format T-MSIS data into the FDA Sentinel and Observational Medical Outcomes Partnership (OMOP) CDMs to improve data access, accelerate analyses, and enable multi-database studies

- A mother-infant linkage will be created to support several analyses on maternal health

Project Overview:
Making Medicaid Data More Accessible Through Common Data Models and FHIR APIs

Task 1. FDA transforms TAF data into Sentinel CDM

Task 2. NLM transforms TAF data into OMOP CDM

Task 3. FDA and NLM runs Data Quality Metrics

Task 4. FDA creates a Mother-Infant Linkage

Task 5. FDA conducts PCOR study with HRSA, NCBDDD, NCHHSTP, NICHD

Task 6. FDA writes white paper on FHIR API linkage with ONC, NLM

Task 7. FDA and NLM stakeholder engagement, sustainability

Blue: FDA-led   *Purple*: NLM/NIH-led   *Green*: FDA/NLM joint activities

Project Team

Food and Drug Administration

- Sarah Dutcher
- David Moeny
- Lucia Menegussi
- Denise Jones

National Library of Medicine/NIH

- James Mork
- Nick Williams

Sentinel Operations Center (Harvard Pilgrim Health Care Institute)

- Judy Maro
- Christine Halbig
- Robert Rosofsky
- Dan Kiernan
- Alex Mai
- Lauren Zichittella
- Justin Vigeant
- Katie Shapiro
- Laura Shockro

Duke Clinical Research Institute

- Brad Hammill
- Michael Stagner
- Jessica Pritchard
- Steve Lippmann
- Pratap Adhikari

Specific project tasks also receive input from our technical expert panel and/or experts at CDC/NCHHSTP, CDC/NCBDDD, NIH/NICHD, HRSA, and ONC

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2. **What is the FDA's Sentinel Initiative?**
   - **Sentinel Common Data Model**
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What is Sentinel?

The Sentinel Initiative and Real World Data

The FDA has two big jobs. One—are the medical products we use SAFE? Two—are the medical products we use EFFECTIVE? In other words, are medical products doing the job they are supposed to do?

FDA is looking into how real world data like that in Sentinel might help FDA answer these important questions. Much of this real world data comes from health insurance companies and patients themselves.

How does Sentinel Work?

- Sentinel gets information from insurance claims, electronic health records, and patient reports.
- Sentinel uses computer programs to see how groups of patients are doing.
- This real world evidence can show if patients are getting bad side effects and maybe also if products are working.

What kinds of questions?

- What medicines are patients taking and why?
- Are medicines helping or hurting some patients more than others?
- Do side effects interfere with patients' lives?
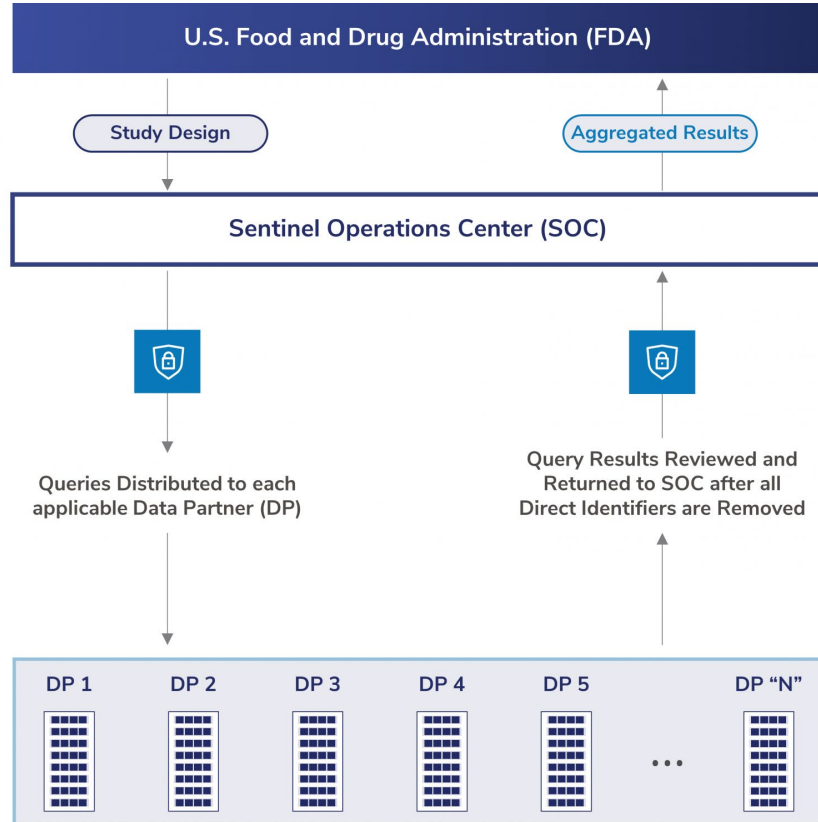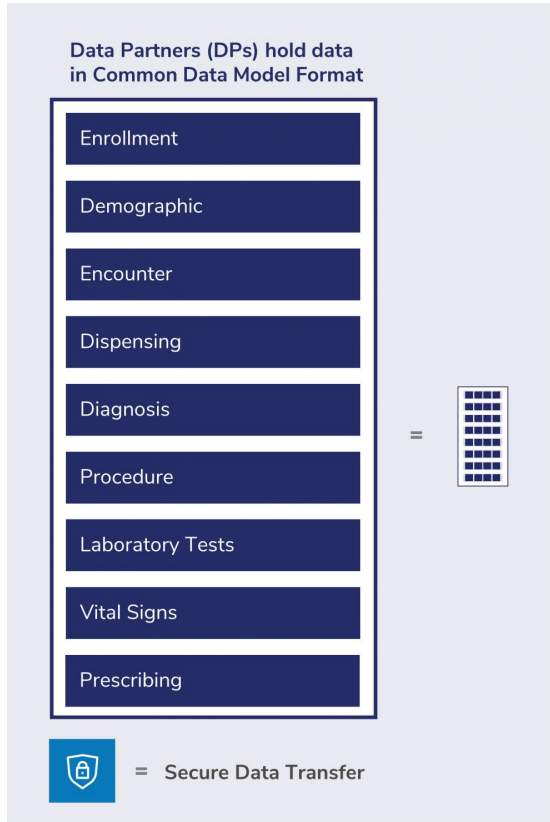- Are patients taking medicines the way their doctors prescribed?

What about privacy?

- No one looks at patients' names, addresses, phone numbers, or other identifying information.
- For more information please visit: https://www.sentinelinitiative.org/about/how-sentinel-protects-privacy-security

What happens next?

- FDA may use information from Sentinel to help determine whether medical products are safe and working.
- FDA warns patients and their doctors about bad side effects.
- If a patient has concerns about their medical products, they should contact their doctor.

https://sentinelinitiative.org/about/engaging-sentinels-stakeholders

Sentinel is a Distributed Data Network

Data Partners (DPs) hold data in Common Data Model Format

- Enrollment
- Demographic
- Encounter
- Dispensing
- Diagnosis
- Procedure
- Laboratory Tests
- Vital Signs
- Prescribing

= Secure Data Transfer

U.S. Food and Drug Administration (FDA)

Study Design

Aggregated Results

Sentinel Operations Center (SOC)

Queries Distributed to each applicable Data Partner (DP)

Query Results Reviewed and Returned to SOC after all Direct Identifiers are Removed

DP 1   DP 2   DP 3   DP 4   DP 5   DP "N"

Sentinel Data Partners

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Sentinel Operations Center: Harvard Pilgrim Health Care Institute

SDD Data Partners:

1. Aetna, a CVS Health company
2. Duke University School of Medicine: Department of Population Health Sciences
3. HealthCore/Elevance Health
4. HealthPartners Institute
5. Humana, Inc.
6. Kaiser Permanente Colorado Institute for Health Research
7. Kaiser Permanente Hawai'i, Center for Integrated Health Care Research
8. Kaiser Foundation Health Plan of the Mid-Atlantic States, Inc.
9. Kaiser Permanente Northwest Center for Health Research
10. Kaiser Permanente Washington Health Research Institute
11. Marshfield Clinic Research Institute
12. Optum (OptumInsight Life Sciences Inc. and Optum Labs®)
13. Vanderbilt University Medical Center, Department of Health Policy (Tennessee Medicaid data)

Medicare Fee-for-Service and Medicaid data

Sentinel's Data Philosophy

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- Sentinel predominantly includes administrative claims and a subset of electronic health record (EHR) and registry data

- Data are transformed into the Sentinel Common Data Model (SCDM)
  - Data are stored at most granular/raw level possible with minimal mapping
  - Distinct data types are kept separate (e.g., prescriptions, dispensings)
  - Construction of medical concepts (e.g., outcome algorithms) from these elemental data is a project-specific design choice
  - SCDM is flexible enough to accommodate new data domains (e.g., free text)

- Appropriate use and interpretation of local data requires the Data Partners' local knowledge and data expertise
  - Not all tables are populated by all Data Partners ➔ site-specificity is allowed

- SCDM was designed to meet FDA needs for analytic flexibility, transparency, and control

Sentinel Common Data Model

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Administrative Data

Enrollment	Demographic	Dispensing	Encounter	Diagnosis	Procedure	Prescribing
Patient ID	Patient ID	Patient ID	Patient ID	Patient ID	Patient ID	Patient ID
Enrollment Start & End Dates	Birth Date	Provider ID	Encounter ID & Type	Encounter ID & Type	Encounter ID & Type	Encounter ID
Medical Coverage	Sex	Dispensing Date	Service Date(s)	Provider ID	Provider ID	Provider ID
Drug Coverage	Postal Code	Rx	Facility ID	Service Date(s)	Service Date(s)	Order Date
Medical Record Availability	Race	Rx Code Type	Etc.	Diagnosis Code & Type	Procedure Code & Type	Rx
	Etc.	Days Supply		Principal Discharge Diagnosis	Etc.	Days Supply
		Amount Dispensed				Rx Route of Delivery
						Etc.

Mother-Infant Linkage Data

Mother-Infant Linkage

Mother ID
Mother Birth Date
Encounter ID & Type
Mother Admission & Discharge Date
Child ID
Childbirth Date
Mother-Infant Match Method
Etc.

Auxiliary Data

Facility	Provider
Facility ID	Provider ID
Facility Location	Provider Specialty & Specialty Code Type

Registry Data

Death	Cause of Death	State Vaccine*
Patient ID	Patient ID	Patient ID
Death Date	Cause of Death	Vaccination Date
Date Imputed Flag	Source	Admission Date
Source	Confidence	Vaccine Code & Type
Confidence	Etc.	Provider
Etc.		Etc.

Inpatient Data

Inpatient Pharmacy	Inpatient Transfusion
Patient ID	Patient ID
Encounter ID	Encounter ID
Rx Administration Date & Time	Transfusion Administration ID
National Drug Code (NDC)	Administration Start & End Date & Time
Rx ID	Transfusion Product Code
Route	Blood Type
Dose	Etc.
Etc.	

Clinical Data

Lab Result	Vital Signs
Patient ID	Patient ID
Result & Specimen Collection Dates	Measurement Date & Time
Test Type, Immediacy & Location	Height & Weight
Logical Observation Identifiers Names and Codes (LOINC®)	Diastolic & Systolic BP
Etc.	Tobacco Use & Type
	Etc.

Patient-Reported Measures (PRM) Data

PRM Survey	PRM Survey Response
Measure ID	Patient ID
Survey ID	Encounter ID
Question ID	Measure ID
Etc.	Survey ID
	Question ID
	Response Text
	Etc.

*The State Vaccine table has not been in use since SCDM v6.0.

Single Patient Example Data in SCDM

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DEMOGRAPHIC

PATID	BIRTH_DATE	SEX	HISPANIC	RACE	zip
PatID1	2/2/1984	F	N	5	32818

ENROLLMENT

PATID	ENR_START	ENR_END	MEDCOV	DRUGCOV
PatID1	7/1/2004	12/31/2006	Y	Y
PatID1	9/1/2007	6/30/2009	Y	Y

DISPENSING

PATID	RXDATE	NDC	RXSUP	RXAMT
PatID1	10/14/2005	00006074031	30	30
PatID1	10/14/2005	00185094098	30	30
PatID1	10/17/2005	00378015210	30	45
PatID1	10/17/2005	54092039101	30	30
PatID1	10/21/2005	00173073001	30	30
PatID1	10/21/2005	49884074311	30	30
PatID1	10/21/2005	58177026408	30	60
PatID1	10/22/2005	00093720656	30	30

ENCOUNTER

PATID	ENCOUNTERID	ADATE	DDATE	ENCTYPE
PatID1	EncID1	10/18/2005	10/20/2005	IP

DIAGNOSIS

PATID	ENCOUNTERID	ADATE	PROVIDER	ENCTYPE	DX	DX_CODETYPE	PDX
PatID1	EncID1	10/18/2005	Provider1	IP	296.2	9	P
PatID1	EncID1	10/18/2005	Provider1	IP	300.02	9	S
PatID1	EncID1	10/18/2005	Provider1	IP	311	9	S
PatID1	EncID1	10/18/2005	Provider1	IP	401.9	9	S
PatID1	EncID1	10/18/2005	Provider1	IP	493.9	9	S
PatID1	EncID1	10/18/2005	Provider1	IP	715.9	9	S

PROCEDURE

PATID	ENCOUNTERID	ADATE	PROVIDER	ENCTYPE	PX	PX_CODETYPE
PatID1	EncID1	10/18/2005	Provider1	IP	84443	C4

MOTHER-INFANT LINKAGE

MPATID	ADATE	DDATE	CPATID	CBIRTH_DATE	CSEX	CENR_START	BIRTH_TYPE	MATCHMETHOD
PatID1	5/3/2006	5/5/2006	PatID2	5/2/2006	M	6/1/2006	1	SI

Data Quality Review and Characterization Process

Preparation

Sentinel Operations Center prepares quality review and characterization package for new dataset

Transformation

Data Partner transforms source data into the Sentinel Common Data Model

Distribution

Sentinel Operations Center distributes quality review and characterization package for new dataset

Quality Assurance Checks & Model Compliance

> 900 different checks

Average: 44 flags

Data Partner runs quality review and characterization package completing the following:

-Level 1 checks: single table checks
-Level 2 checks: cross-table checks

Quality reviews and characterization package outputs lists of errors or anomalies (flags) identified during data checks

Data Partner resolves these flags and sends a detailed response to the Sentinel Operations Center

Data quality review and characterization process may refresh quarterly, semi-annually, or annually, depending on the data partner

Approval

Sentinel Operations Center Quality Assurance Manager approves dataset for use in queries

Completion

Data Partner investigates issues identified in report generated by the Sentinel Operations Center and resolves remaining flags

Quality Assurance Review

Sentinel Operations Center receives output from Data Partner and reviews

Sentinel Operations Center runs additional quality assurance checks:

-Level 3 checks: cross-time checks

> 500 different checks

Average: 10 flags

Sentinel Operations Center evaluates any additional flags and creates issue report for Data Partner to address

https://www.sentinelinitiative.org/about/how-sentinel-gets-its-data

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Data Quality Checks and Examples

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Level 1 Checks:
Single table checks

✓ **Completeness**
Admission date is not missing value

✓ **Validity**
Admission date is in date format

Level 2 Checks:
Cross-table checks

✓ **Accuracy**
Admission date occurs before the patient's discharge

✓ **Integrity**
Admission date occurs within the patient's active enrollment period

Level 3 Checks:
Cross-time checks

✓ **Consistency of Trends**
There is no sizable percent change in admission date record counts by month-year

https://www.sentinelinitiative.org/about/how-sentinel-gets-its-data

Routine Analytic Tools

https://sentinelinitiative.org/methods-data-tools/routine-querying-tools
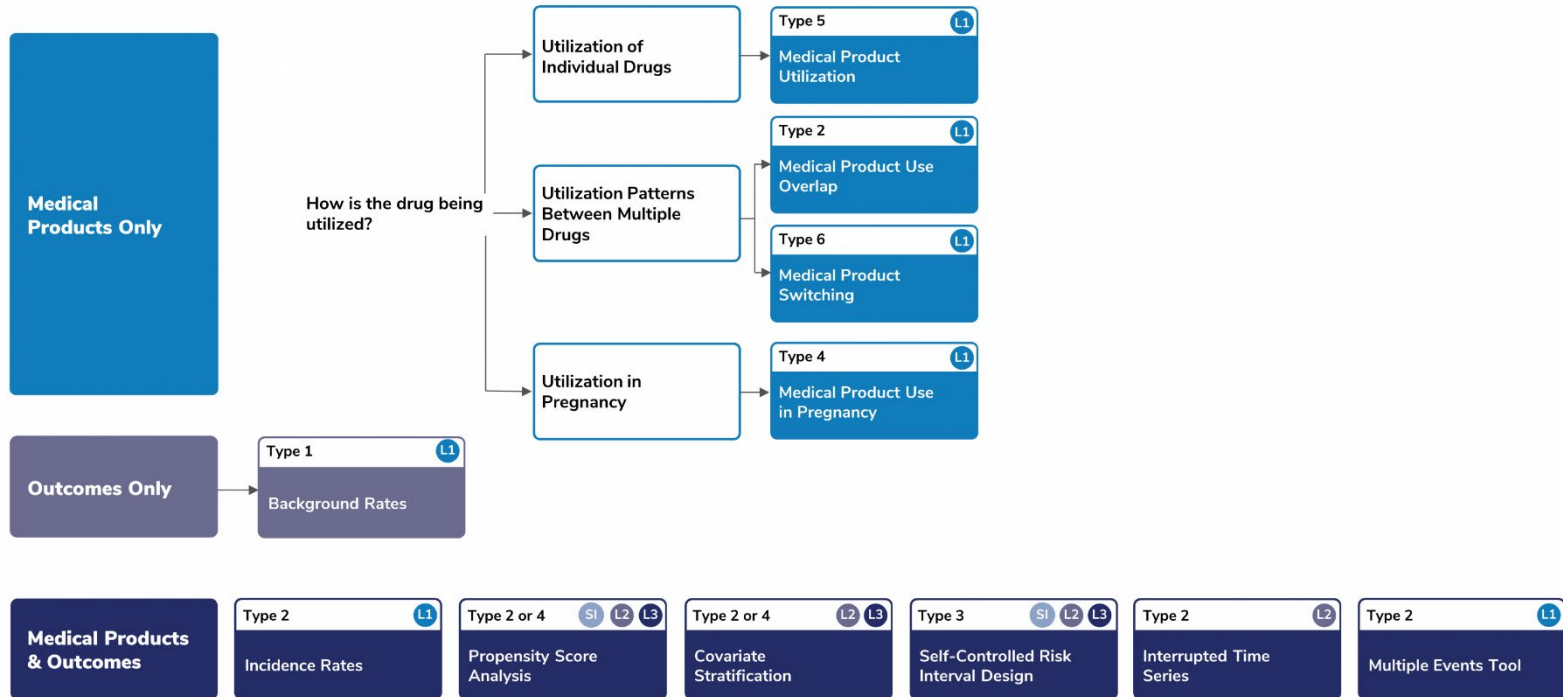
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Medicaid Data – Basic Primer

FDA

What is it?
- Data about beneficiary enrollment and eligibility, utilization and claims, and expenditures for people covered by Medicaid or the Children's Health Insurance Program (CHIP)
- Medicaid and CHIP, combined, provide health coverage to millions of Americans of all ages, including eligible low-income adults, children, pregnant women, elderly adults and people with disabilities.
- In 2010, the Patient Protection and Affordable Care Act (ACA) included a provision to expand Medicaid eligibility to adults up to age 64 with incomes up to 138% of the federal poverty level.
- As of August 2021, 38 states and Washington, DC have adopted the ACA's Medicaid eligibility expansion provision.

How is it available?
- States and territories administer health insurance programs and submit their enrollment and claims data to the federal government in the Transformed Medicaid Statistical Information System (T-MSIS) format starting in 2014, with all states complying by 2016.
- T-MSIS Research Identifiable Files are produced in yearly increments. There is approx. a 2-year lag for "settled" data.
- An earlier submission system known as the Medicaid Statistical Information System (MSIS) was used previous to T-MSIS, from which the Medicaid Analytic eXtract (MAX) files were created. It was retired in place.

DQATLAS

HOW TO USE DQ ATLAS

DQ (Data Quality) Atlas includes data quality information that supports insightful, methodologically sound analyses using the T-MSIS Analytic Files (TAF) Research Identifiable Files (RIF). Select one of the below pathways to explore key Medicaid and Children's Health Insurance Program (CHIP) topics such as enrollment, claims, expenditures, and service use.

EXPLORE BY TOPIC	EXPLORE BY STATE	RESOURCES
View data quality assessments on topics such as enrollment, claims, expenditures, and service use.	View data quality assessments for a selected state for all available topics.	Learn more about DQ Atlas and how it can support your work.

https://www.medicaid.gov/dq-atlas/landing/topics/info

CMS Medicaid Dataset by Jurisdiction
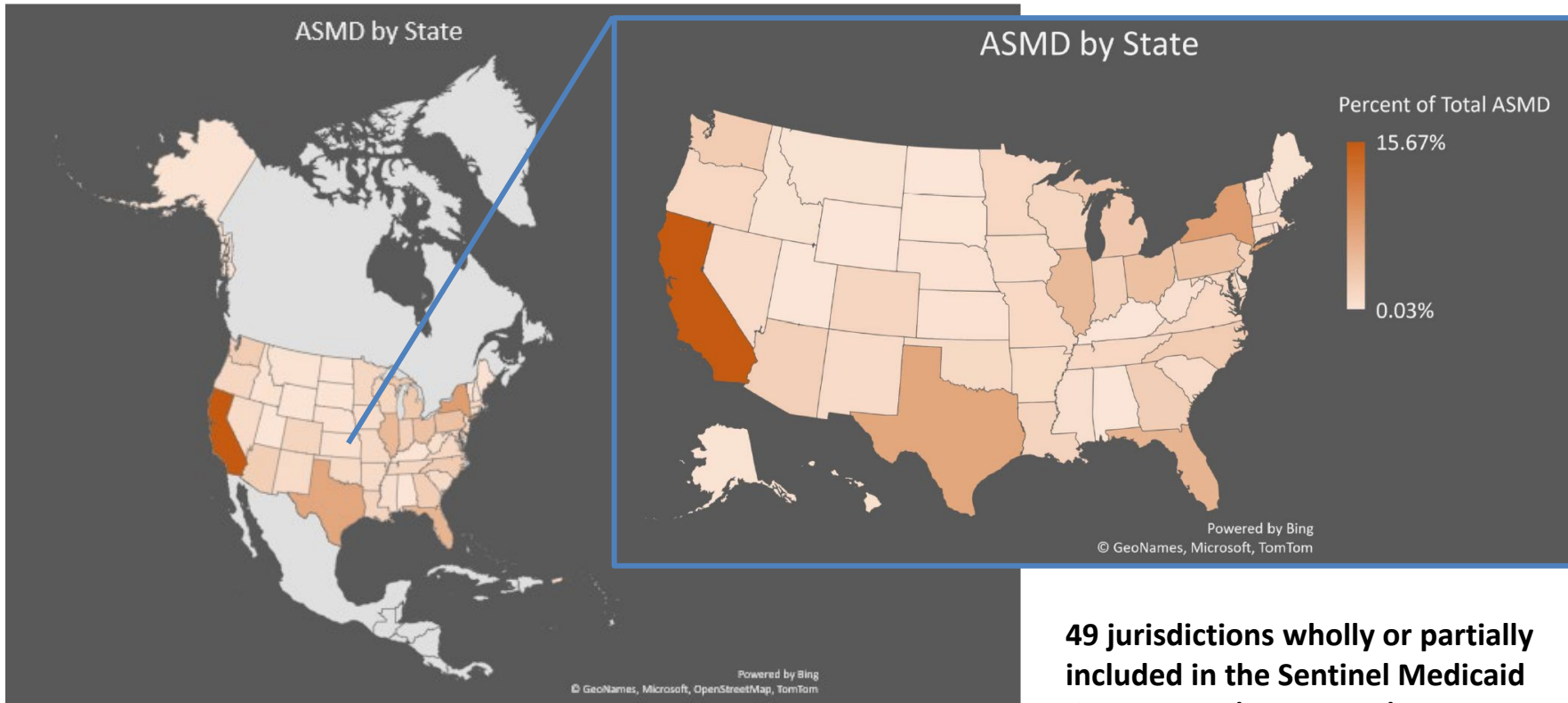
49 jurisdictions wholly or partially included in the Sentinel Medicaid data source (2014-2018)

Adding Medicaid Data to the Sentinel Distributed Database

https://www.medicaid.gov/dq-atlas/landing/topics/info

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Minimum Requirements for Inclusion

- FDA's requirements for pharmacoepidemiology studies are centered around complete capture during enrollment (i.e., absence of event is TRUE absence)

- These fields must not be marked "Unusable" by DQ Atlas:

    a) Dual Eligibility Code

    b) Comprehensive Managed Care Plan Encounters Completeness

    c) Number of Enrollment Spans

    d) Admission Date Completeness

    e) Discharge Date Completeness

    f) Diagnosis Codes Completeness

    g) Procedure Codes Completeness

    h) Claims Volume Completeness

    i) Type of Service (Inpatient v Outpatient v Long Term Care)

Continuity and Completeness of Data

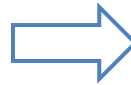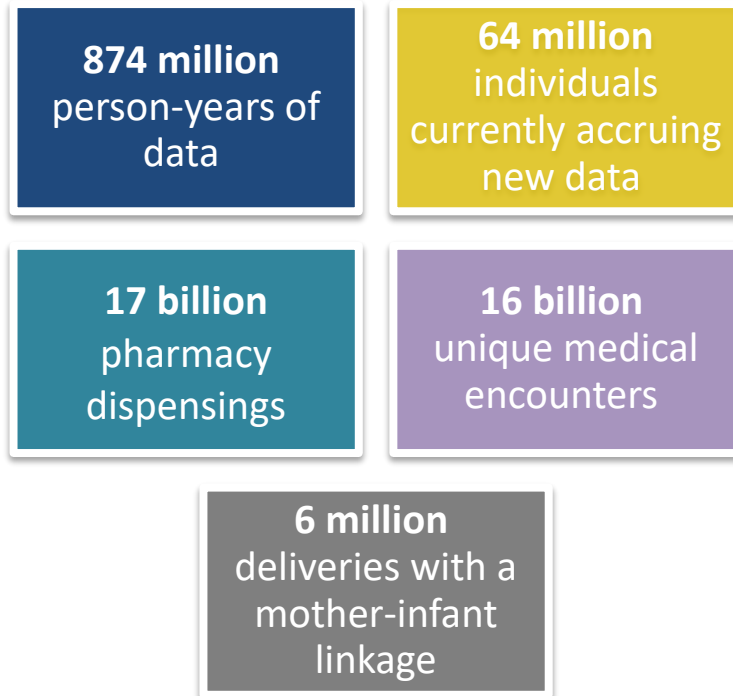| Descriptions	Jurisdictions	Total
Jurisdictions with 5 Years of Continuous Inclusion*	AK, KS, ME, MT, NC, NE, NH, NM, NV	9
Jurisdictions with < 5 Years of Continuous Inclusion	AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IN, LA, MD, MI, MN, MO, MS, ND, NJ, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, VA, VI, VT, WA, WV, WY	36
Jurisdictions with Years of Intervening Exclusions	DC, IL, PR, WI	4
Jurisdictions without Any Inclusion	AL, KY, MA, UT	4

*In this table, an Included Year is counted only when both FFS and CMC are included.

Examples

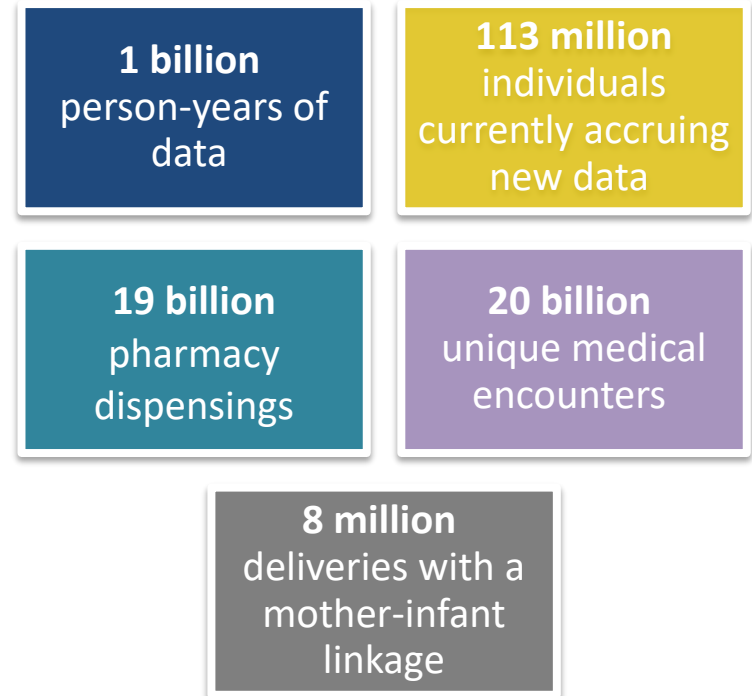| Jur.	Plan	2014	2015	2016	2017	2018
AK	FFS	✓	✓	✓	✓	✓
	CMC	✓	✓	✓	✓	✓
AR	FFS	–	–	✗	✓	✓
	CMC	–	–	✗	✓	✓
DC	FFS	✓	✗	✓	✓	✓
	CMC	✓	✗	✓	✓	✓
AL	FFS	✗	✗	✗	✗	✗
	CMC	✗	✗	✗	✗	✗

Addition of CMS Medicaid Data to the Sentinel Distributed Database

FDA

Sentinel Distributed Database _before_ Adding CMS Medicaid Data

874 million person-years of data	**64 million** individuals currently accruing new data
17 billion pharmacy dispensings	**16 billion** unique medical encounters
6 million deliveries with a mother-infant linkage	

Sentinel Distributed Database _after_ Adding CMS Medicaid Data

1 billion person-years of data	**113 million** individuals currently accruing new data
19 billion pharmacy dispensings	**20 billion** unique medical encounters
8 million deliveries with a mother-infant linkage	

Medicaid ETL 1 Demographics

	N	%
No. of Unique Patient IDs	**90,700,484**	100.0
Age Group		
0-18 years	47,276,540	52.1%
19-44 years	29,874,048	32.9%
45-64 years	12,682,872	14.0%
65+ years	849,855	0.9%
Missing	17,169	0.0%
Sex		
Female	48,337,141	53.3%
Male	42,344,286	46.7%
Unknown	19,057	0.0%
Race		
American Indian or Alaska Native	1,286,624	1.4%
Asian	3,942,643	4.3%
Black or African American	15,266,630	16.8%
Native Hawaiian or Other Pacific Islander	475,510	0.5%
White	30,856,508	34.0%
Unknown	38,872,569	42.9%
Hispanic Origin		
Yes	20,223,270	22.3%
No	52,027,380	57.4%
Unknown	18,449,834	20.3%

The Medicaid data mart makes up about 21% of the SDD by patient ID and is the largest DP, despite having only 4 years of data

Generally younger population than the general SDD, with a wealth of data on pediatrics

	Medicaid	National DPs	Medicare FFS
<18	47.3M (52.1%)	6.5M (18.5%)	<2000 (0.0%)
65+	0.9M (0.9%)	5.6M (16.0%)	12.9M (60.0%)

Lower % unknown race and ethnicity than national DPs

	Medicaid	National DPs	Medicare FFS
Unknown race	38.9M (42.9%)	154.1M (88.0%)	3.2M (6.8%)
Unknown ethnicity	18.4M (20.3%)	164.6M (94.0%)	1.7M (3.6%)

Medicaid ETL 1 Demographics: Encounters and Dispensings

Year	Encounters	Dispensings
2014	198,302,975	103,567,526
2015	447,642,011	259,389,529
2016	910,500,387	555,203,624
2017	1,024,619,369	617,816,746
2018	960,503,462	543,960,355
Total	3,541,568,204	2,079,937,780

Year	Jurisdictions Fully Included	Jurisdictions Fully Excluded
2014	14	1
2015	23	4
2016	39	10
2017	44	7
2018	41	9

# of encounters and dispensings increase over time due to increase in contributing jurisdictions

	Medicaid	National DPs	Medicare FFS
Total Encounters	3.5 Billion	5.5 Billion	9.1 Billion
Total Dispensings	2.1 Billion	6.2 Billion	9.4 Billion

Medicaid ETL 1 Deliveries

	N	%
Identified Deliveries	**2,925,646**	100.0
Age Group		
10-19 years	287,176	9.8%
20-24 years	886,594	30.3%
25-29 years	899,556	30.7%
30-34 years	547,361	18.7%
35-39 years	246,682	8.4%
40-44 years	54,213	1.9%
45-54 years	4,064	0.1%

	N	%
Year		
2015	394,063	13.5%
2016	696,699	23.8%
2017	989,905	33.8%
2018	844,979	28.9%
Encounter Type		
Ambulatory Visit	93,939	3.2%
Emergency Department	5,040	0.2%
Inpatient Hospital Stay	2,553,038	87.3%
Non-Acute Institutional Stay	27,236	0.9%
Other Ambulatory Visit	246,393	8.4%

Medicaid ETL 1 MIL Linkage Rates

Jurisdiction	Deliveries	Infants	Linkage Rate[a]
MS	29,351	81,771	95.4%
NH	9,886	22,245	93.7%
IN	99,459	192,399	92.6%
KS	40,721	73,617	92.6%
OH	146,598	244,347	92.2%
LA	86,484	174,620	91.8%
PA	113,730	296,466	91.1%
NY	215,178	617,043	90.3%
WI	47,788	134,392	89.4%
HI	17,948	37,265	89.2%
MT[c]	16,422	29,286	89.1%
AK	14,860	23,808	88.9%
NM	35,308	76,063	88.8%
WY	4,501	12,936	88.3%
IA	35,804	87,420	88.2%
ND	3,275	12,288	88.2%
MI	64,467	198,761	87.9%
VA	84,198	183,665	87.7%
DE	9,767	26,167	87.6%
VT	5,558	13,396	86.7%
ME	16,989	26,528	86.6%
ID	4,600	38,055	84.9%
OK	66,663	147,667	84.9%
RI	6,466	15,562	83.2%
IL	155,597	336,307	83.1%
UT	250	2,383	82.8%
AL[c]	490	3,447	79.7%

Jurisdiction	Deliveries	Infants	Linkage Rate[a]
CO	43,833	106,756	79.3%
DC[c]	8,327	21,204	79.1%
WV	18,895	48,706	78.7%
AZ	112,406	213,176	78.5%
SD	4,288	23,312	78.1%
OR	41,420	106,304	74.8%
GA	77,058	290,861	73.7%
KY	1,120	3,620	72.6%
NV	8,463	90,764	71.6%
VI	483	1,961	71.4%
MA	2,784	81,195	70.0%
MD	27,210	40,926	69.4%
PR[c]	8,246	43,133	68.2%
CA[c]	361,338	842,089	63.8%
MN	53,424	92,715	55.9%
FL	243,103	470,794	42.4%
TN[c]	20,800	103,970	39.4%
MO	64,125	164,344	28.9%
NE[c]	32,148	50,309	20.4%
AR[b,c]	17,441	80,888	10.2%
SC[b]	14,225	42,183	1.0%
TX[b]	131,484	999,096	0.2%
CT[b]	30,490	75,412	0.0%
NC[b]	122,942	295,073	0.0%
NJ[b,c]	42,092	172,098	0.0%
WA[b]	105,143	197,196	0.0%
Total	**2,925,646**	**7,765,989**	**64.0%**

[a] Calculated as (Linked Deliveries) / (Total # of Deliveries)

[b] Noted jurisdictions had case numbers (i.e., family ID variables) that were unique to individuals over 85% of the time

[c] Noted jurisdictions had case numbers (i.e. family ID variables) that were missing over 10% of the time

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4. **How can this data source can be used to answer scientific questions?**

What Kinds of Questions Can we Answer?

1. How does FDA use these data?

    – Use in pregnancy

    – Risk of negative infant outcomes following maternal exposure during pregnancy

2. How can the scientific community use these data?

    – Publicly-available resources

    – Examples: maternal mortality, adherence to prenatal screening

Assessment of Heart Failure in Pregnancy to Support Pre-Market Review of Vericiguat

FDA

Background

FDA U.S. FOOD & DRUG ADMINISTRATION

Vericiguat–Under Review

Indicated for heart failure (HF)

Embryo-fetal malformations in animal studies

? **Should a Risk Evaluation and Mitigation Strategy (REMS) program be required for vericiguat?**

Analysis and Findings

Sentinel Distributed Database

- Estimated prevalence of HF among reproductive age women
- Characterized medication use among pregnancies with HF

Jan. 2010 – Feb. 2020

Jan. 2010 – Mar. 2021

HF rare (0.5%) among women of reproductive age

Potential embryo-toxic HF medication use during pregnancy was rare

Chart categories: ACE inhibitors, ARBs, ARNI, Aldosterone antagonists, Beta blockers, Digoxin, Diuretics, Hydralazine and nitrates, Ivabradine

Legend: Any use before pregnancy, Any use in 1st trimester, Any use in 2nd trimester, Any use in 3rd trimester, Any use after pregnancy
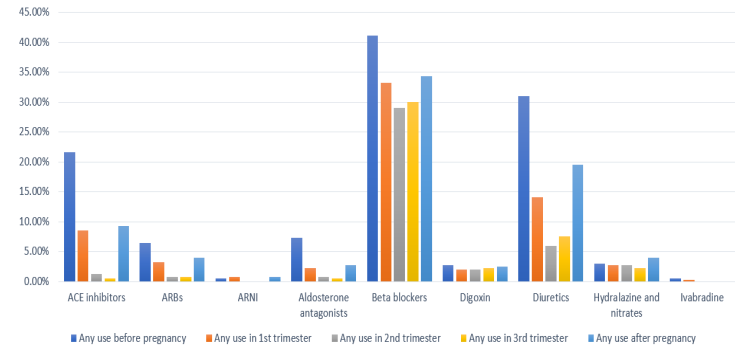
Regulatory Recommendation: This information contributed to the FDA's determination that labeling would provide sufficient information to ensure the benefits of vericiguat outweigh its risks.

What is the risk of cardiac malformations after in-utero exposure to modafinil/armodafinil?

Comparing incidence of cardiac malformations in the infant after first trimester dispensings of modafinil or armodafinil compared to (a) no exposure, (b) methylphenidate, or (c) amphetamines

1. Live births matched to singleton infant

~1.5M eligible linked deliveries

2. Assess exposure

modafinil/armodafinil   comparator

Main analysis: any exposure
Sensitivity: 1 or 2+ dispensings

3. Match on propensity score (1:1)

Age   Dx
Rx
PS

	Any	1	2+
Unexposed	496	222	254
Methylphenidate	519	237	266
Amphetamines	533	238	268
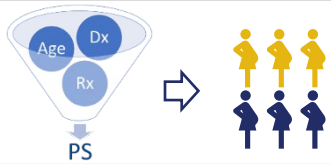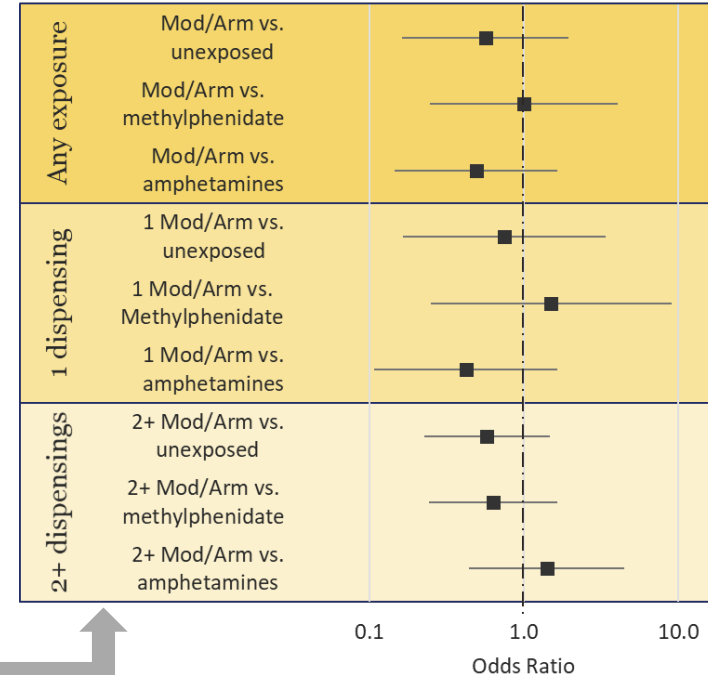
4. Generate estimates

Any exposure
- Mod/Arm vs. unexposed
- Mod/Arm vs. methylphenidate
- Mod/Arm vs. amphetamines

1 dispensing
- 1 Mod/Arm vs. unexposed
- 1 Mod/Arm vs. Methylphenidate
- 1 Mod/Arm vs. amphetamines

2+ dispensings
- 2+ Mod/Arm vs. unexposed
- 2+ Mod/Arm vs. methylphenidate
- 2+ Mod/Arm vs. amphetamines

Odds Ratio
0.1   1.0   10.0

What Kinds of Questions Can we Answer?

1. How does FDA use these data?

   – Use in pregnancy

   – Risk of negative infant outcomes following maternal exposure during pregnancy

2. **How can the scientific community use these data?**

   – Publicly-available resources

   – Examples: maternal mortality, adherence to prenatal screening

Publicly-Available Resources

Provigil (Modafinil) and Nuvigil (Armodafinil) & Congenital Cardiac Malformations

Details

Status: Ongoing

Last Updated: Tuesday, November 17, 2020

Original Posting Date: Thursday, July 30, 2020

Health Outcome(s):

congenital cardiac malformations

Purpose: Drug and Outcome Analysis

Meets requirements of FD&C Act Sec 505(o) prior to requiring a PMR: No

Analytic Code Link(s) (1)

Risk of Congenital Cardiac Malformations Following Armodafinil or Modafinil Use: A Propensity Score Matched Analysis
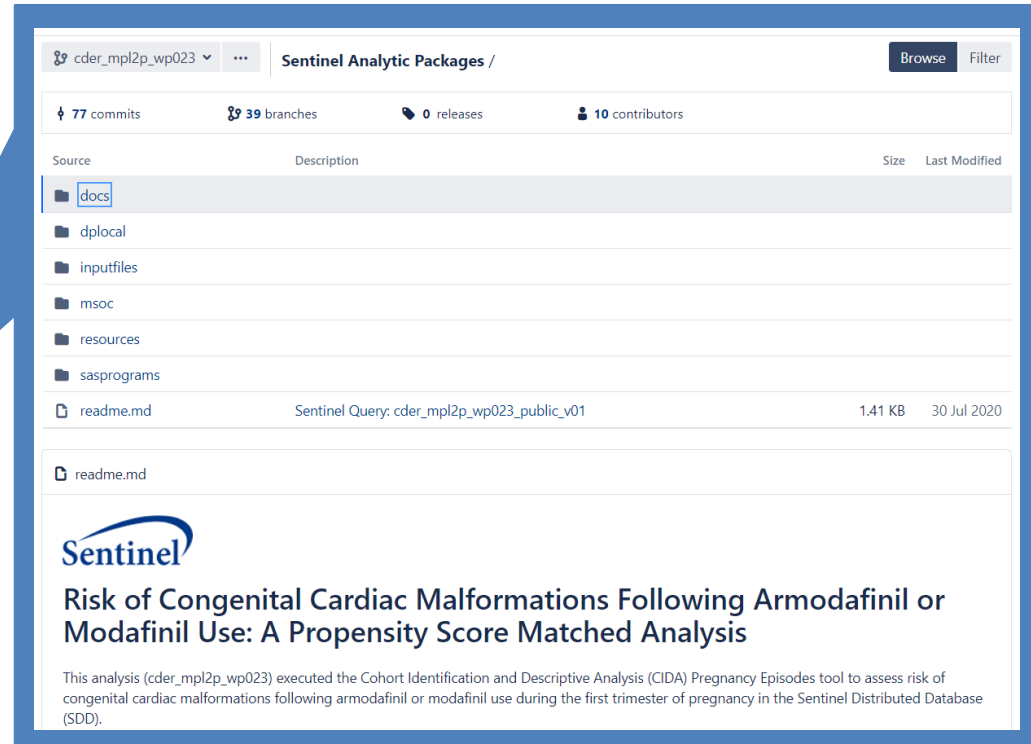
Result(s) (2)

Risk of Congenital Cardiac Malformations Following Armodafinil or Modafinil Use: A Descriptive Analysis

Risk of Congenital Cardiac Malformations Following Armodafinil or Modafinil Use: A Propensity Score Matched Analysis

cder_mpl2p_wp023 ··· **Sentinel Analytic Packages /** Browse Filter

77 commits   39 branches   0 releases   10 contributors

Source	Description	Size	Last Modified
docs			
dplocal			
inputfiles			
msoc			
resources			
sasprograms			
readme.md	Sentinel Query: cder_mpl2p_wp023_public_v01	1.41 KB	30 Jul 2020

readme.md
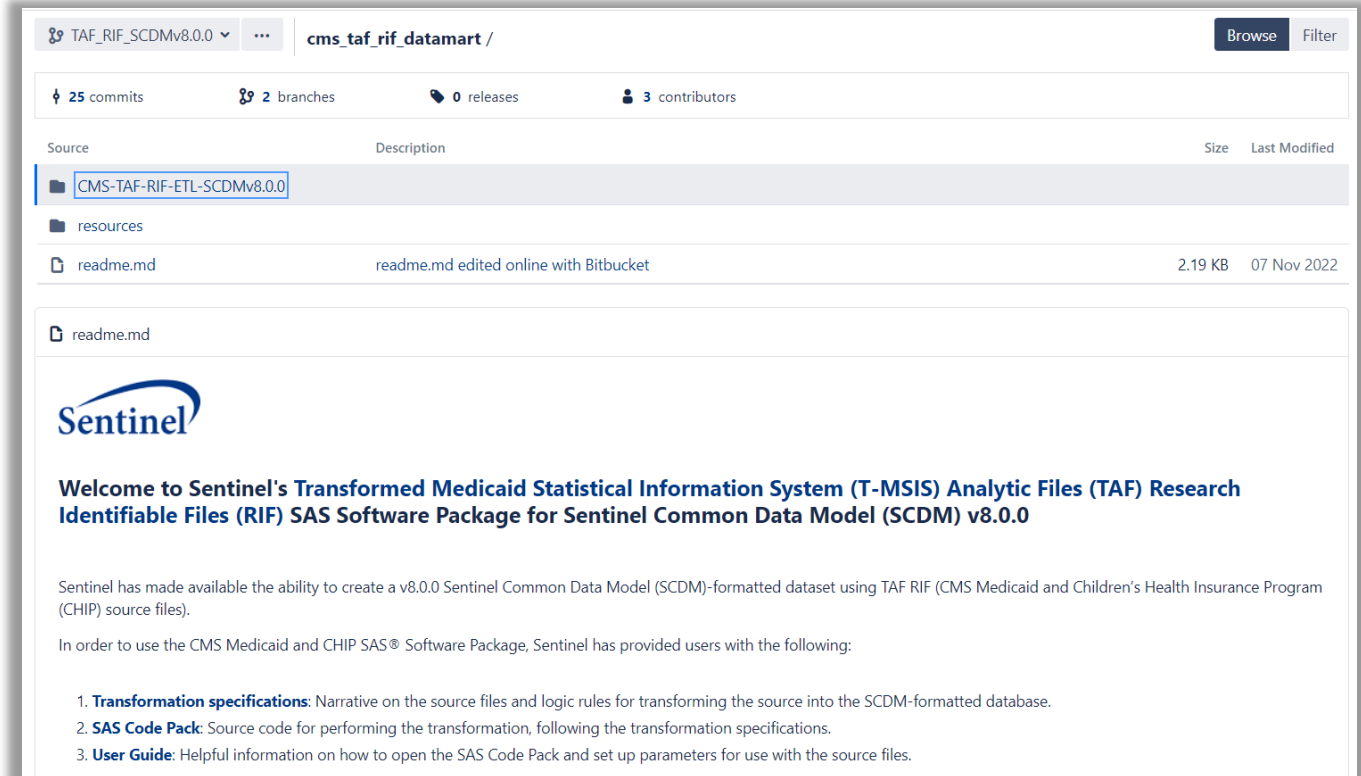
Sentinel

Risk of Congenital Cardiac Malformations Following Armodafinil or Modafinil Use: A Propensity Score Matched Analysis

This analysis (cder_mpl2p_wp023) executed the Cohort Identification and Descriptive Analysis (CIDA) Pregnancy Episodes tool to assess risk of congenital cardiac malformations following armodafinil or modafinil use during the first trimester of pregnancy in the Sentinel Distributed Database (SDD).

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https://sentinelinitiative.org/studies/drugs/individual-drug-analyses/risk-congenital-cardiac-malformations-following-armodafinil

Publicly-Available Resources

T-MSIS-to-SCDM Transformation Materials:

https://dev.sentinelsystem.org/projects/DCMS/repos/cms_taf_rif_datamart/browse/CMS-TAF-RIF-ETL-SCDMv8.0.0?at=TAF_RIF_SCDMv8.0.0

Sentinel Has Tools That Can Address…

1. **Longitudinal Maternal & Infant Health Information for Research Use Cases**

   - Pregnancy and subsequent death within a specific time frame: Cohort includes women who died within a year (365 days) of a pregnancy regardless of cause of death or pregnancy outcome

     - Limited by death data available in T-MSIS, which is generally believed to well-capture inpatient death but not out-of-hospital death

   - Hypertensive disorders of pregnancy: Cohort focuses on individuals with a diagnosis of pregnancy-induced hypertension, gestational hypertension, and/or post-partum hypertension diagnoses within 6 weeks of delivery

2. **Other Proposed Use Cases**

   - Prevalence of prenatal tests among pregnant women

     - We have done extensive work in this area in the Sentinel Distributed Database prior to the inclusion of Medicaid (https://pubmed.ncbi.nlm.nih.gov/35122354/

   - Prevalence of prenatal screening for HIV in women and their newborn infants

Next Steps

Task 3. FDA and NLM run Data Quality Metrics

- Develop 30 data quality metrics to characterize data once transformed into a CDM format and compare across the two CDMs

Task 5. FDA conducts PCOR study with HRSA, NCBDDD, NCHHSTP, NICHD

- Conduct a demonstration study using the transformed T-MSIS dataset and Sentinel analytic tools
  - Leveraging a freely available analytic tool designed to monitor healthcare utilization (e.g., drug exposures, screening procedures) among pregnant women
- Study will address one or more important public health questions in maternal health, with objective(s) selected by the workgroup and the Technical Expert Panel

Conclusions

- The CMS T-MSIS dataset is a valuable data source capturing key populations of public health interest, especially pregnant women and infants

- Sentinel's existing data infrastructure enables us to integrate Medicaid data with commercial claims data
  - Very large distributed database of linked mother-infant pairs
  - Necessary for studying rare drug-related adverse events to support FDAs mission to promote drug safety

- Commitment to transparency
  - All analytic tools and study materials are made publicly available
  - External researchers can leverage analytic code, transform their data into the SCDM, and replicate analyses or conduct new analyses