Measuring an epidemic: using EHR data to track trends in opioid prescribing

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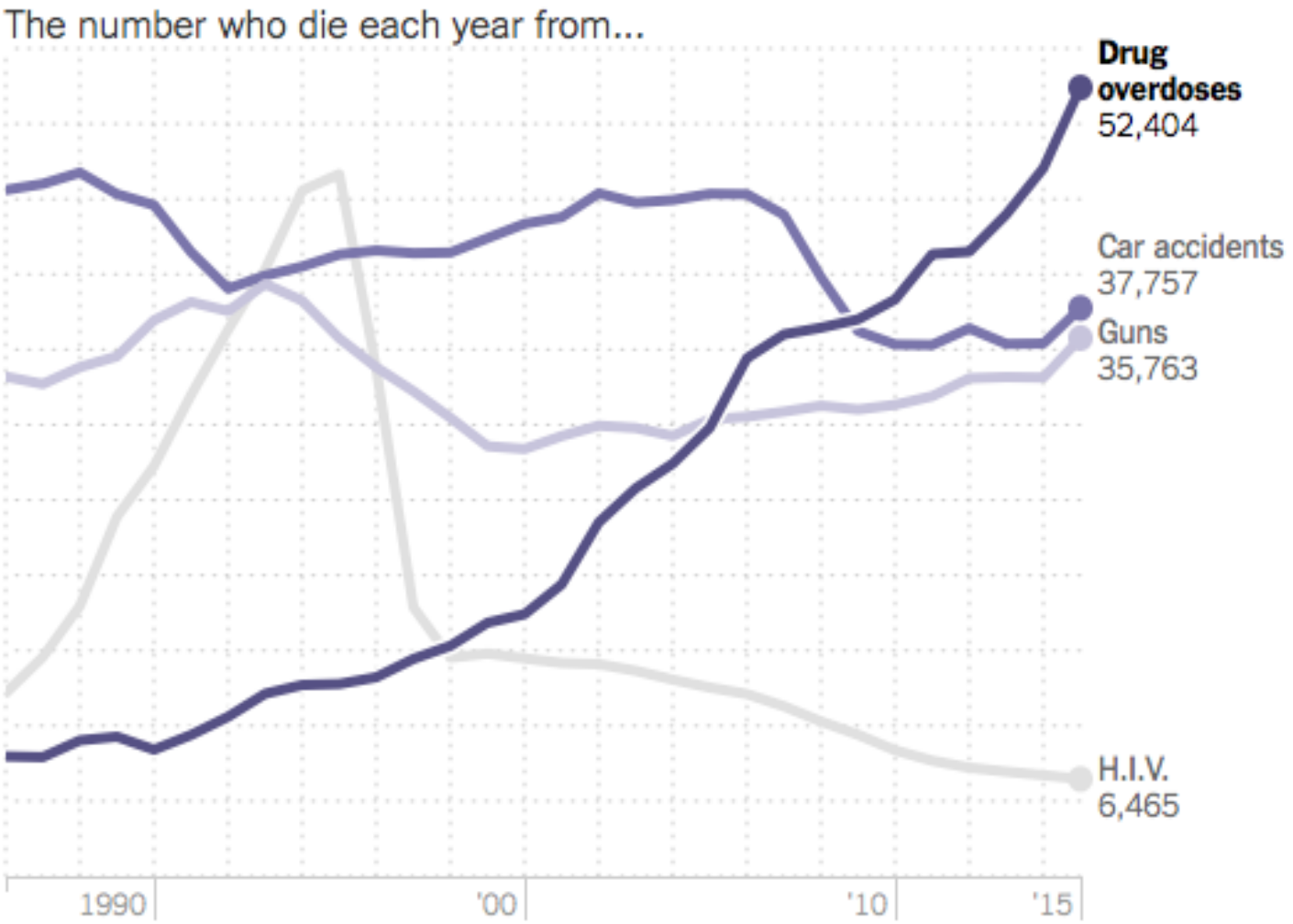
You Draw It: Just How Bad Is the Drug Overdose Epidemic?

By **JOSH KATZ** APRIL 14, 2017



An influential report of a small case series of atypical chronic pain patients using opioids long-term

Pain, 25 (1986) 171–186
Elsevier

Chronic Use of Opioid Analgesics in Non-Malignant Pain: Report of 38 Cases

Russell K. Portenoy and Kathleen M. Foley

Pain Service, Department of Neurology, Memorial Sloan-Kettering Cancer Center, and Department of Neurology, Cornell University Medical College, New York, NY 10021 (U.S.A.)

(Received 10 June 1985, accepted 28 October 1985)

American Pain Society (APS) & American Academy of Pain Medicine (AAPM), 1996 Guidelines

Addiction: "Misunderstanding of addiction and mislabeling of patients as addicts result in unnecessary withholding of opioid medications."

Tolerance: "For most opioids, there does not appear to be an arbitrary upper dosage limit."

Diversion: "Efforts to stop diversion should not interfere with prescribing opioids for pain management."

Overdose: "Respiratory depression induced by opioids tends to be a short-lived phenomenon, generally occurs only in the opioid-naive patient, and is antagonized by pain."

Pharma promotion

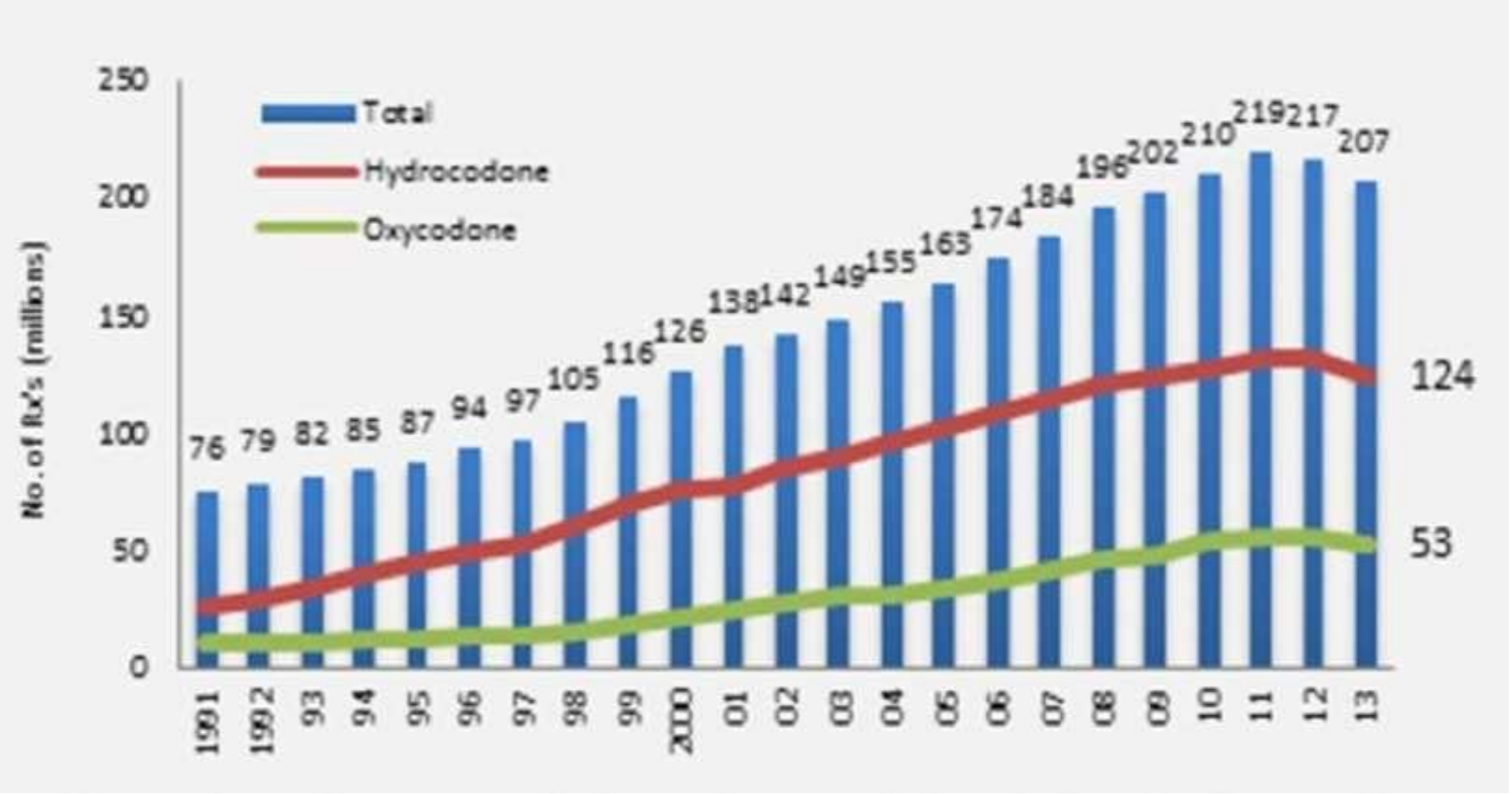
- "There's no question that our best, strongest pain medicines are the opioids, but these are the same drugs that have a reputation for causing addiction and other terrible things."
- "They don't wear out. They go on working."
- "They do not have serious medical side effects…these drugs should be used much more than they are for patients in pain…"

Promotional video, Purdue Pharma, 1999

National, state, local policies

- The Oregon Intractable Pain Act, passed in 1995, allowed physicians to prescribe controlled substances for treatment of chronic pain without sanction from the Oregon Medical Board.
  The Oregon Pain Commission advocated for appropriate patient access to pain management…
  - McCarty, D., R. Bovett, T. Burns, J. Cushing, M. E. Glynn, S. J. Kruse, L. M. Millet, and J. Shames. "Oregon's Strategy to Confront Prescription Opioid Misuse: A Case Study." *J Subst Abuse Treat* 48, no. 1 (Jan 2015): 91-5.
- Joint Commission on Accreditation of Healthcare Organizations (JCAHO) – 2001. All patients assessed for pain (5^{th} vital sign)

Opioid Prescriptions Dispensed by US Retail Pharmacies IMS Health, Vector One



Nora Volkow report to congress May 14, 2014 (NIDA website)

Hints of problems: NY Times July 29, 2001

Magazine

The Alchemy of OxyContin

By PAUL TOUGH JULY 29, 2001

Paula is taking me on a driving tour of Man, the tiny West Virginia town where she has spent her entire life. Because I don't know my way around the hollows and gullies and creeks that carve through these hills, Paula is at the wheel. And because Paula isn't a morning person, we've set out on our tour at midnight. It's dark; the only illumination comes from our headlights cutting through the mist that rolls down from the hills.

The tour Paula is leading isn't sanctioned by the local chamber of

USA Today 2/13/2007

USA TODAY Home News Travel Money Sports Life Tech Weat

Nation Inside News ▼ Cars Ev

Deadly abuse of methadone tops other prescription drugs

Updated 2/13/2007 9:04 AM ET

E-mail | Print |

Enlarge By Chuck Branham, The Evening News via AP

By Donna Leinwand, USA TODAY

Methadone, a painkiller that has been used to treat heroin addicts for decades, has emerged as an increasingly popular and deadly street drug, joining narcotics such as Vicodin and OxyContin as frequently abused prescription drugs.

Fatal overdoses of methadone rose at a higher rate than those involving any other narcotic from 1999 through 2004, according to a recent study by the National Center for Health Statistics (NCHS). The number of deaths from methadone in 2004 (3,849) represented a 390% rise from 1999, the study said.

ON THE STREET: Painkiller becomes more available

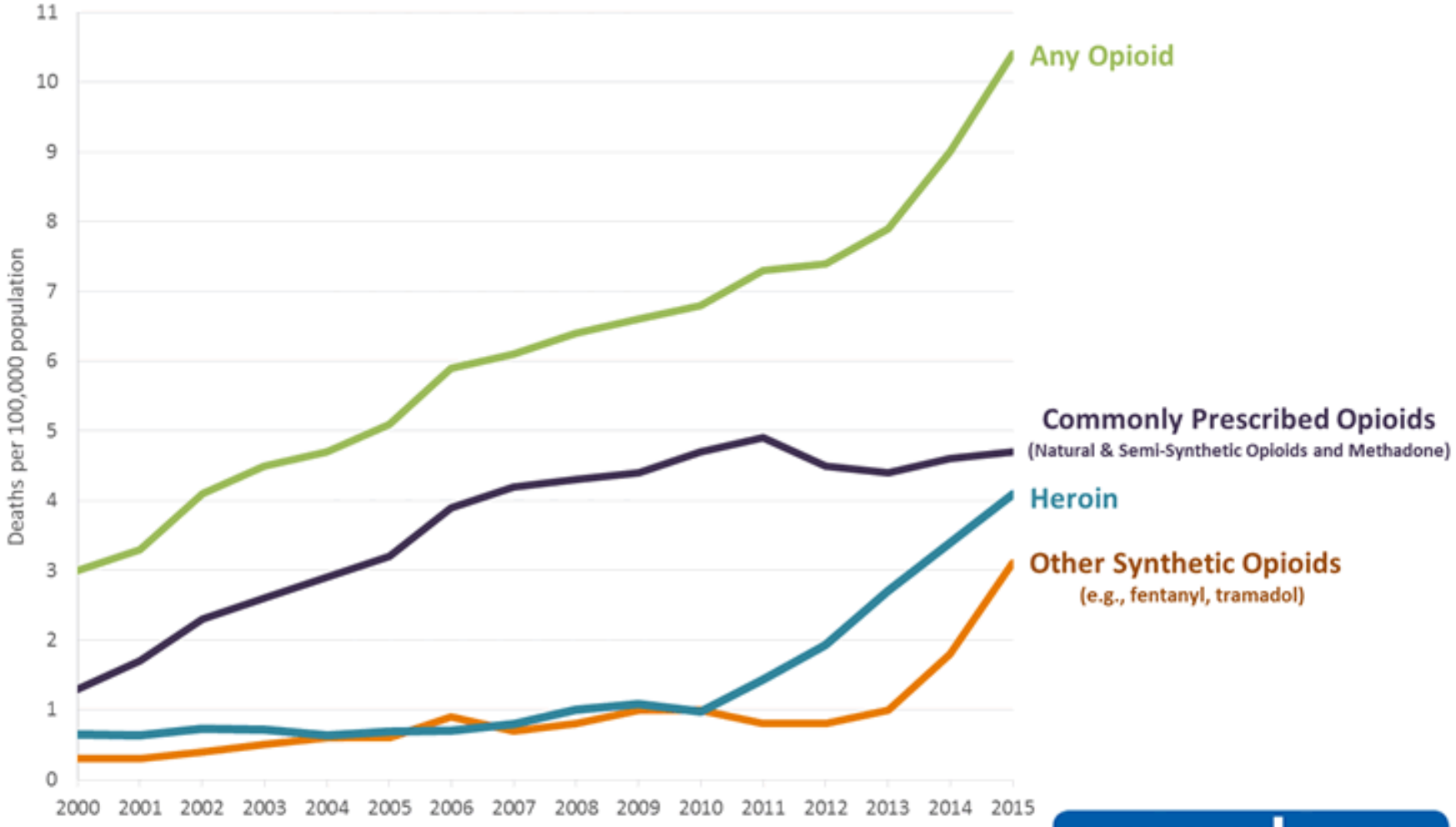
Methadone was cited in nearly 13% of all the overdose deaths reported in the USA in 2004, up from about 4% five years earlier. Among drugs cited in fatal overdoses, only cocaine kills more people than methadone.

The Oregonian, April 12, 2010

Heroin isn't the drug that's killing most Oregonians

- **More people in the 35- to 54-year-old age group die of unintentional overdoses than from motor vehicle accidents.** Methadone is a particularly bad actor…
- More individuals die from overdoses of prescription medications than heroin, cocaine and methamphetamine combined…

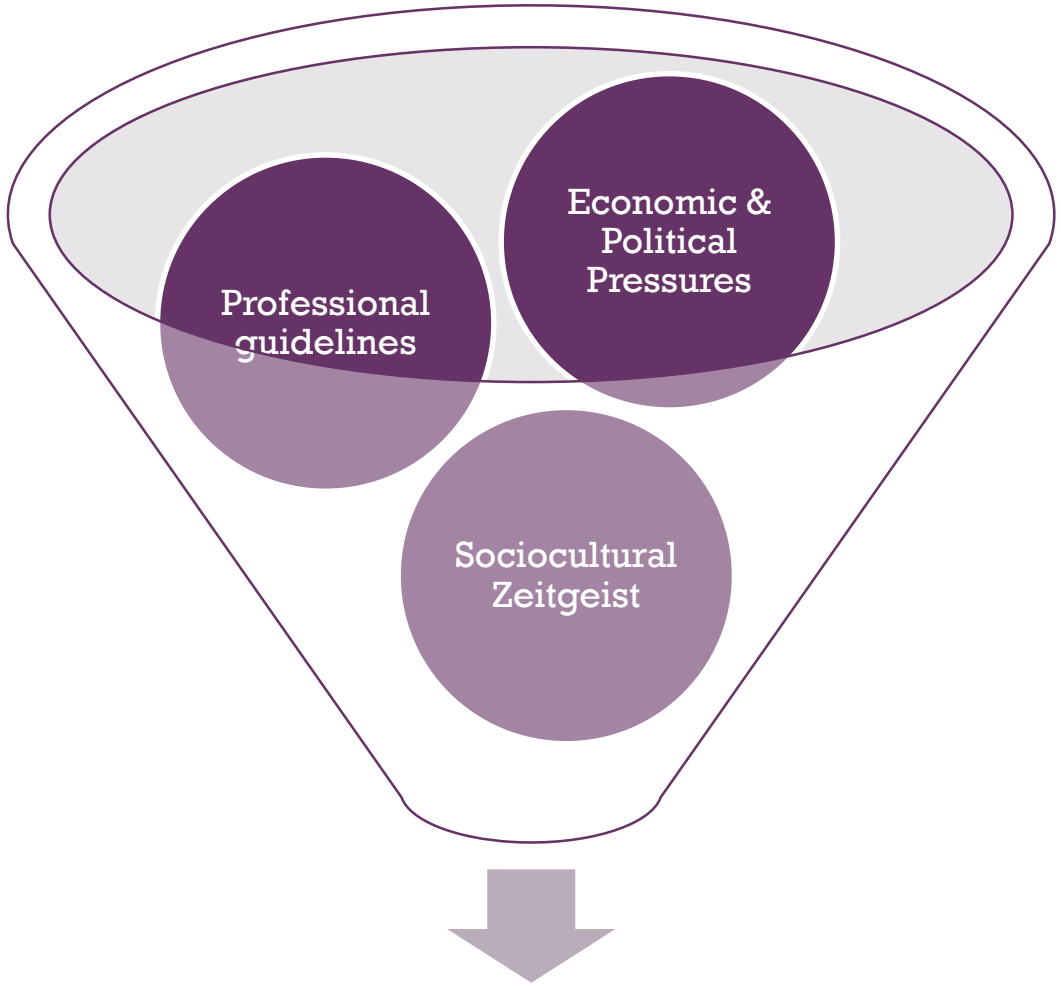
Overdose Deaths Involving Opioids, United States, 2000-2015



SOURCE: CDC/NCHS, National Vital Statistics System, Mortality. CDC WONDER, Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://wonder.cdc.gov/.

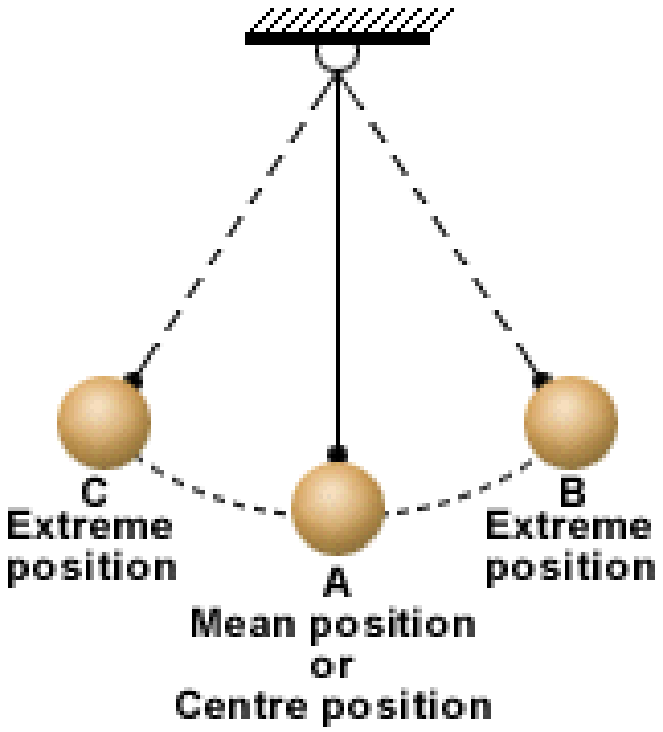
www.cdc.gov
Your Source for Credible Health Information

What happened?



For every action…?

- Beginning 2000 - Anecdotes in the popular press.
- 2007 – Purdue pharmaceutical settlement
- 2010 – Oxycontin reformulated to prevent injection use
- Prescription drug monitoring programs (PDMPs) – 25 in 2005. 46 in 2011
- 2011 – ONDCP report – **Epidemic**: Responding to America's Prescription Drug Abuse Crisis
- 2011 – Portland, OR local FQHC policies
- 2012 – National Governors Association State Policy Academy on Reducing Prescription Drug Abuse.
- 2014 opioid/acetaminophen combinations rescheduled from category 3 to 2
- 2016 CDC safe prescribing guideline published
- 2016 Surgeon general communication to all prescribers



(b) Motion of a simple pendulum

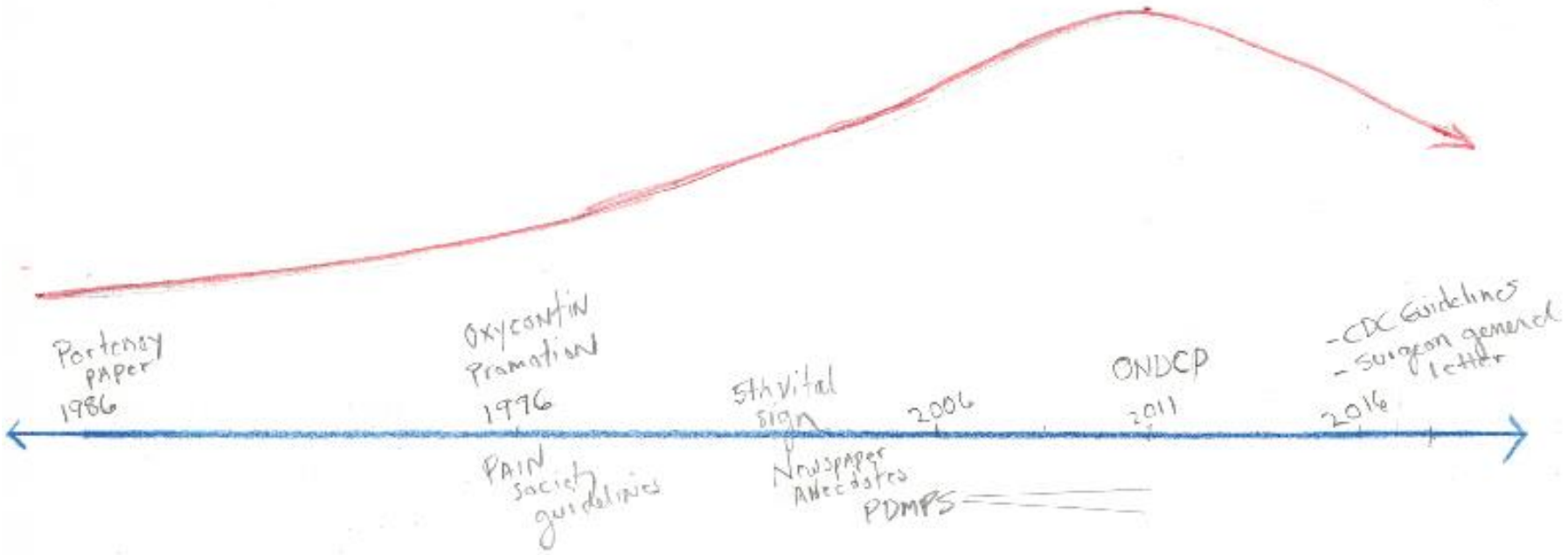
OREGON LEGISLATURE

Oregon House passes bill seeking to stem opioid epidemic

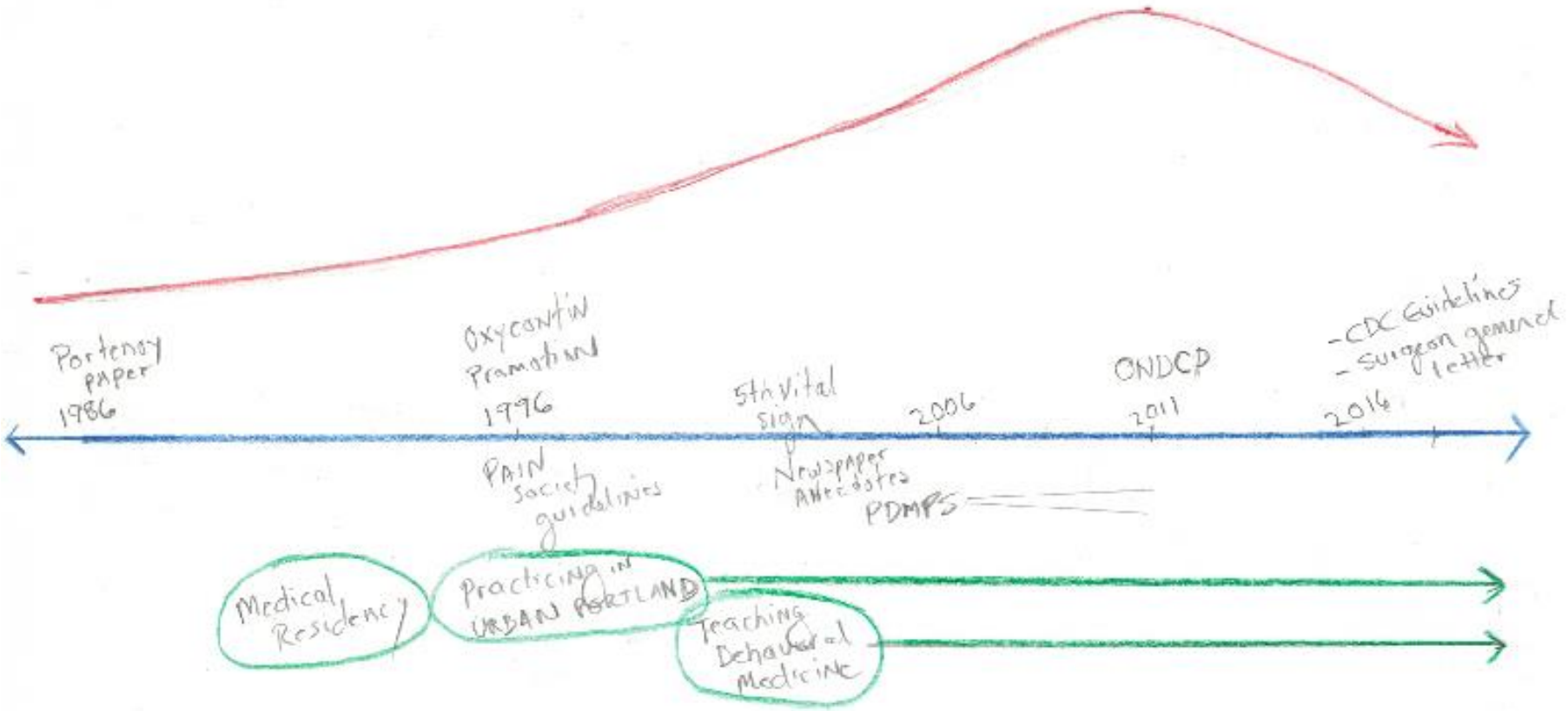
BY ANDREW SELSKY
The Associated Press
6:50 P.M., APRIL 10, 2017

SALEM — Seeking to stem the opioid epidemic in Oregon and prevent overdose deaths, the state House of Representatives unanimously approved a proposed law on Monday that would provide safe-use recommendations to those who prescribe such pain-killing drugs.

However, provisions in the bill that would have limited health-care practitioners to prescribing a maximum seven-day supply


Portenoy paper
1986
Oxycontin Promotion
1996
PAIN Society guidelines
5th Vital sign
Newspaper ANecdotes
2006
PDMPS
ONDCP
2011
-CDC Guidelines
-Surgeon general letter
2016

Timeline2


Portenoy paper 1986
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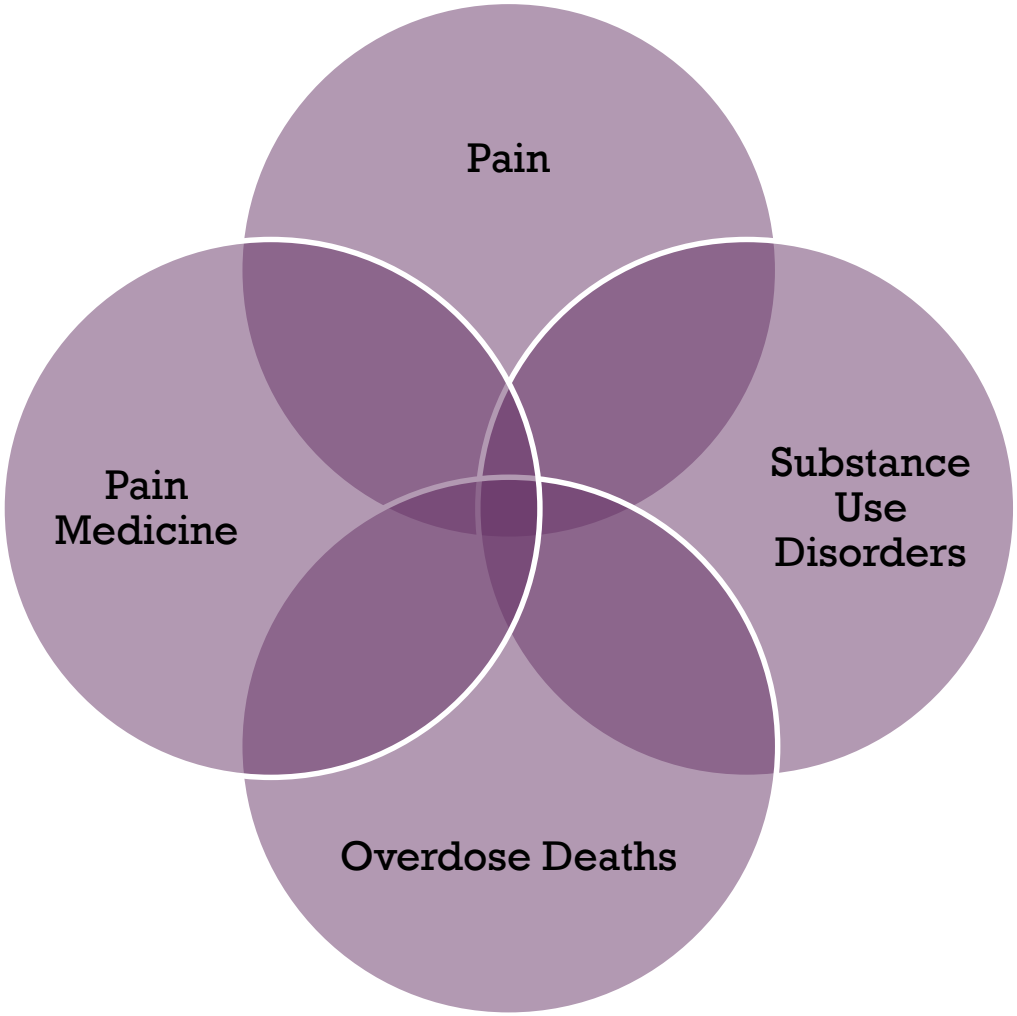
2016
PAIN Society guidelines
Newspaper Anecdotes
PDMPS
Medical Residency
Practicing in URBAN PORTLAND
Teaching Behavioral Medicine

It's complicated



Lack of evidence

- "In the United States guideline [2009], 21 of 25 recommendations were viewed as supported by only low-quality evidence."
- "In other words, the developers of the guidelines found that what we know about opioids is dwarfed by what we don't know."
  - Chou, R. "What We Still Don't Know About Treating Chronic Noncancer Pain with Opioids." *CMAJ* 182, no. 9 (Jun 15 2010): 881-2.

What do we want to know?

- What policies led to over-prescribing of opioids?
- What policies will lead to more appropriate prescribing?
- What pain conditions most commonly lead to opioid use?
- What other patient characteristics are associated with opioid use for pain? With overdose?
- Are some opioids better than others? Are some delivery methods better? LA vs SA? Benefits/Harms?
- What are the best ways to monitor patient opioid use risk?
- How can we identify overdoses in ambulatory records? In ED records?
- How can we better treat pain if not with opioids?
- How can we better treat substance use disorders and overdose to which overprescribing has contributed?

Chou, R. "What We Still Don't Know About Treating Chronic Noncancer Pain with Opioids." *CMAJ* 182, no. 9 (Jun 15 2010): 881-2.

- The principles of research into comparative effectiveness are well suited for addressing these and other research gaps. Rather than evaluating whether yet another opioid is more effective than nothing in low-risk patients, such research focuses on the benefits and harms of interventions in populations similar to those encountered in clinical practice, emphasizing the need to understand the trade-offs between different interventions (e.g., different opioids).

- These principles can be applied to the evaluation of different strategies for risk assessment, patient selection, dosing, management and monitoring, using a broad range of study designs, including observational studies of large databases or registries

How have we studied opioids in populations up to now?

- NSDUH - National Survey on Drug Use and Health
  - Paulozzi, L., C. M. Jones, K. Mack, and R. A. Rudd. "Vital Signs: Overdoses of Prescription Opioid Pain Relievers - United States, 1999-2008." *MMWR Morb Mortal Wkly Rep* 60, no. 43 (2011): 1487-92.
- NHANES – National Health and Nutrition Examination Survey
  - Frenk, S.M., K.S. Porter, and L. Paulozzi. "Prescription Opioid Analgesic Use among Adults: United States, 1999-2012." In *NCHS data brief*, edited by National Center for Health Statistics. Hyattsville, MD, 2015.
- NAMCS – National Ambulatory Medical Care Survey
  - Olsen, Y., G. L. Daumit, and D. E. Ford. "Opioid Prescriptions by U.S. Primary Care Physicians from 1992 to 2001." *J Pain* 7, no. 4 (Apr 2006): 225-35.
  - Daubresse, M., H. Y. Chang, Y. Yu, S. Viswanathan, N. D. Shah, R. S. Stafford, S. P. Kruszewski, and G. C. Alexander. "Ambulatory Diagnosis and Treatment of Nonmalignant Pain in the United States, 2000-2010." *Med Care* 51, no. 10 (Oct 2013): 870-8.
  - Olfson, M., S. Wang, M. Iza, S. Crystal, and C. Blanco. "National Trends in the Office-Based Prescription of Schedule Ii Opioids." *J Clin Psychiatry* 74, no. 9 (Sep 2013): 932-9.
  - Prunuske, J. P., C. A. St Hill, K. D. Hager, A. M. Lemieux, M. T. Swanoski, G. W. Anderson, and M. N. Lutfiyya. "Opioid Prescribing Patterns for Non-Malignant Chronic Pain for Rural Versus Non-Rural Us Adults: A Population-Based Study Using 2010 Namcs Data." *BMC Health Serv Res* 14 (Nov 19 2014): 563.

Pharmacy Claims Databases

- Sullivan, M. D., M. J. Edlund, M. Y. Fan, A. Devries, J. Brennan Braden, and B. C. Martin. "Trends in Use of Opioids for Non-Cancer Pain Conditions 2000-2005 in Commercial and Medicaid Insurance Plans: The Troup Study." *Pain* 138, no. 2 (Aug 31 2008): 440-9.
- Morden, N. E., J. C. Munson, C. H. Colla, J. S. Skinner, J. P. Bynum, W. Zhou, and E. Meara. "Prescription Opioid Use among Disabled Medicare Beneficiaries: Intensity, Trends, and Regional Variation." *Med Care* 52, no. 9 (Sep 2014): 852-9.– Medicare <65yo.
- Edlund, M. J., M. A. Austen, M. D. Sullivan, B. C. Martin, J. S. Williams, J. C. Fortney, and T. J. Hudson. "Patterns of Opioid Use for Chronic Noncancer Pain in the Veterans Health Administration from 2009 to 2011." *Pain* 155, no. 11 (Nov 2014): 2337-43.
- Paulozzi, L. J., K. A. Mack, and J. M. Hockenberry. "Variation among States in Prescribing of Opioid Pain Relievers and Benzodiazepines--United States, 2012." *J Safety Res* 51 (Dec 2014): 125-9.
- Mack, K. A., K. Zhang, L. Paulozzi, and C. Jones. "Prescription Practices Involving Opioid Analgesics among Americans with Medicaid, 2010." *J Health Care Poor Underserved* 26, no. 1 (Feb 2015): 182-98.
- Kuo, Y. F., M. A. Raji, N. W. Chen, H. Hasan, and J. S. Goodwin. "Trends in Opioid Prescriptions among Part D Medicare Recipients from 2007 to 2012." *Am J Med* 129, no. 2 (Feb 2016): 221 e21-30.(Medicare >65yo)

Johnson, H., L. Paulozzi, C. Porucznik, K. Mack, B. Herter. "Decline in Drug Overdose Deaths after State Policy Changes - Florida, 2010-2012." *MMWR Morb Mortal Wkly Rep* 63, no. 26 (Jul 04 2014)

- In 2010 Florida was home to 98 of the 100 U.S. physicians who dispensed the highest quantities of oxycodone.
- Several legislative measures enacted in 2010/2011 –February 2011; statewide raids of problem clinics.
- Opioid prescription rates for selected drugs calculated from IMS Health National Prescription Audit (NPA) decreased significantly 2010 to 2012, and especially oxycodone (24%)
- Florida Medical Examiners Commission (FMEC) data from 200102012 showed opioid overdose deaths declined 27%, again, especially those attributable to oxycodone (52%)

Prescription Drug Monitoring Programs (PDMPs)

- Paulozzi, L. J., G. K. Strickler, P. W. Kreiner, C. M. Koris, Control Centers for Disease, and Prevention. "Controlled Substance Prescribing Patterns--Prescription Behavior Surveillance System, Eight States, 2013." *MMWR Surveill Summ* 64, no. 9 (Oct 16 2015): 1-14.

- Deyo, R. A., S. E. Hallvik, C. Hildebran, M. Marino, E. Dexter, J. M. Irvine, N. O'Kane*, et al.* "Association between Initial Opioid Prescribing Patterns and Subsequent Long-Term Use among Opioid-Naive Patients: A Statewide Retrospective Cohort Study." *J Gen Intern Med* 32, no. 1 (Jan 2017): 21-27.

How can we better leverage clinical data warehouses to track opioid prescribing?

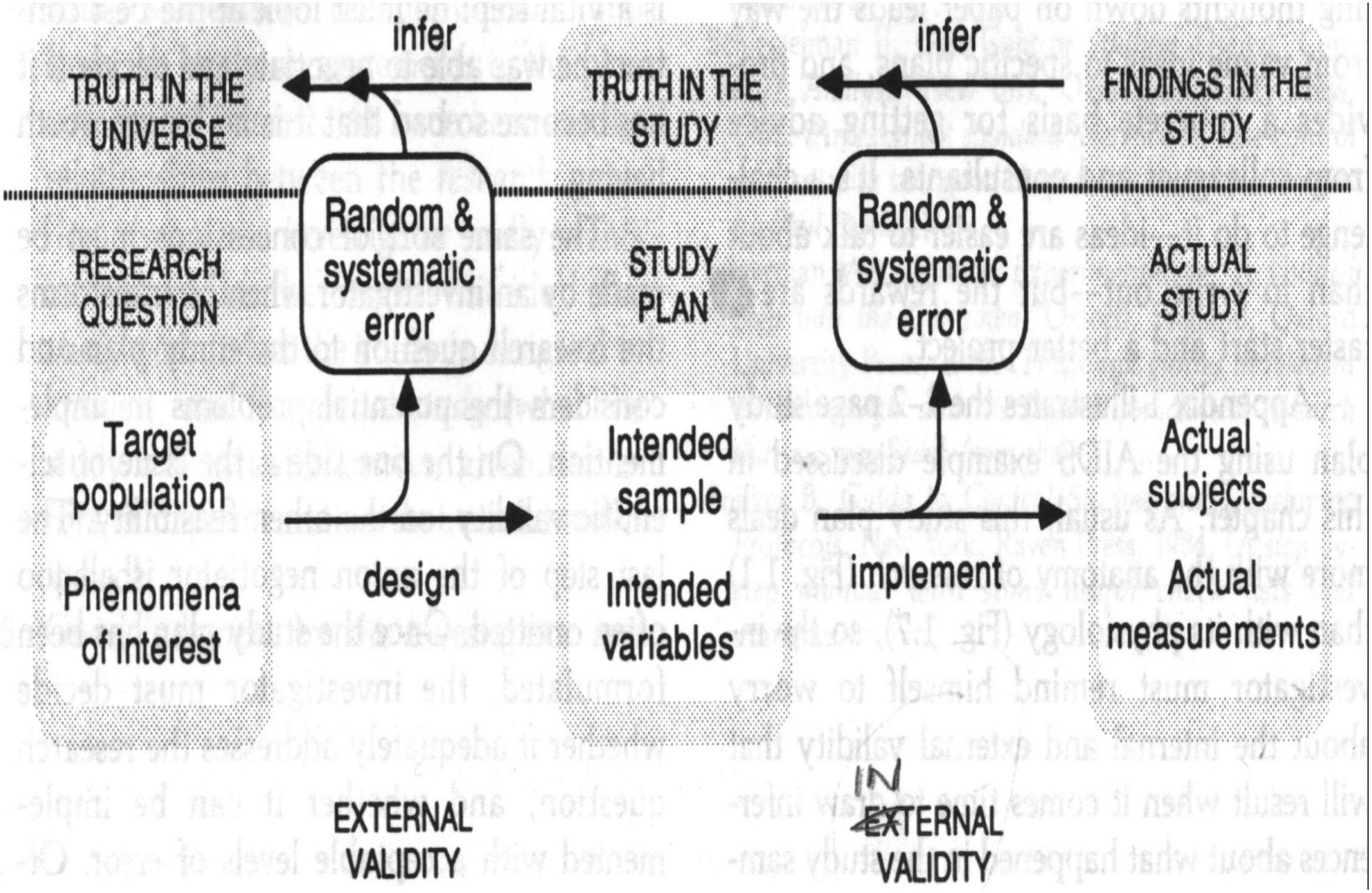
- Most major institutions began implementing EHRs after 2005 – if this tool had been available in 1990, could we have understood the problem better and addressed it earlier?
- Clinical data is a more granular look at details of encounters in which opioids have been prescribed.

Clinical data entry

Data warehouse structure and organization

Extraction into population reports with meaning

Hulley, Stephen B., Steven R. Cummings, and Warren S. Browner. *Designing Clinical Research : An Epidemiologic Approach*. Baltimore: Williams & Wilkins, 1988



Studies using EHR data

- The CONSORT study
  - Von Korff, M., K. Saunders, G. Thomas Ray, D. Boudreau, C. Campbell, J. Merrill, M. D. Sullivan*, et al.* "De Facto Long-Term Opioid Therapy for Noncancer Pain." *Clin J Pain* 24, no. 6 (Jul-Aug 2008): 521-7.
  - Boudreau, D., M. Von Korff, C. M. Rutter, K. Saunders, G. T. Ray, M. D. Sullivan, C. I. Campbell*, et al.* "Trends in Long-Term Opioid Therapy for Chronic Non-Cancer Pain." *Pharmacoepidemiol Drug Saf* 18, no. 12 (Dec 2009): 1166-75.
  - Campbell, C. I., C. Weisner, L. Leresche, G. T. Ray, K. Saunders, M. D. Sullivan, C. J. Banta-Green*, et al.* "Age and Gender Trends in Long-Term Opioid Analgesic Use for Noncancer Pain." *Am J Public Health* 100, no. 12 (Dec 2010): 2541-7.

- Deyo, R. A., D. H. Smith, E. S. Johnson, M. Donovan, C. J. Tillotson, X. Yang, A. F. Petrik, and S. K. Dobscha. "Opioids for Back Pain Patients: Primary Care Prescribing Patterns and Use of Services." *J Am Board Fam Med* 24, no. 6 (Nov-Dec 2011): 717-27.

- Mosher, H. J., E. E. Krebs, M. Carrel, P. J. Kaboli, M. W. Weg, and B. C. Lund. "Trends in Prevalent and Incident Opioid Receipt: An Observational Study in Veterans Health Administration 2004-2012." *J Gen Intern Med* 30, no. 5 (May 2015): 597-604.

Introducing the ADVANCE Clinical Data Research Network

Jon Puro, MPA:HA
Principle Investigator, ADVANCE

The ADVANCE CDRN Partners

OCHIN, Inc.

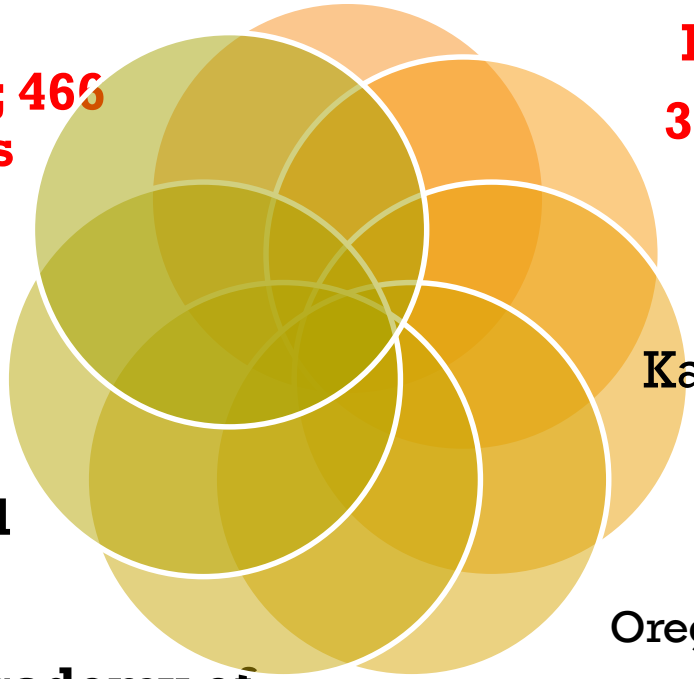
97 health systems; 597 clinics; 17 states

Health Choice Network (HCN)

24 health systems; 466 clinics; 8 states

Fenway Health

3 clinics; 1 state



Legacy Health System

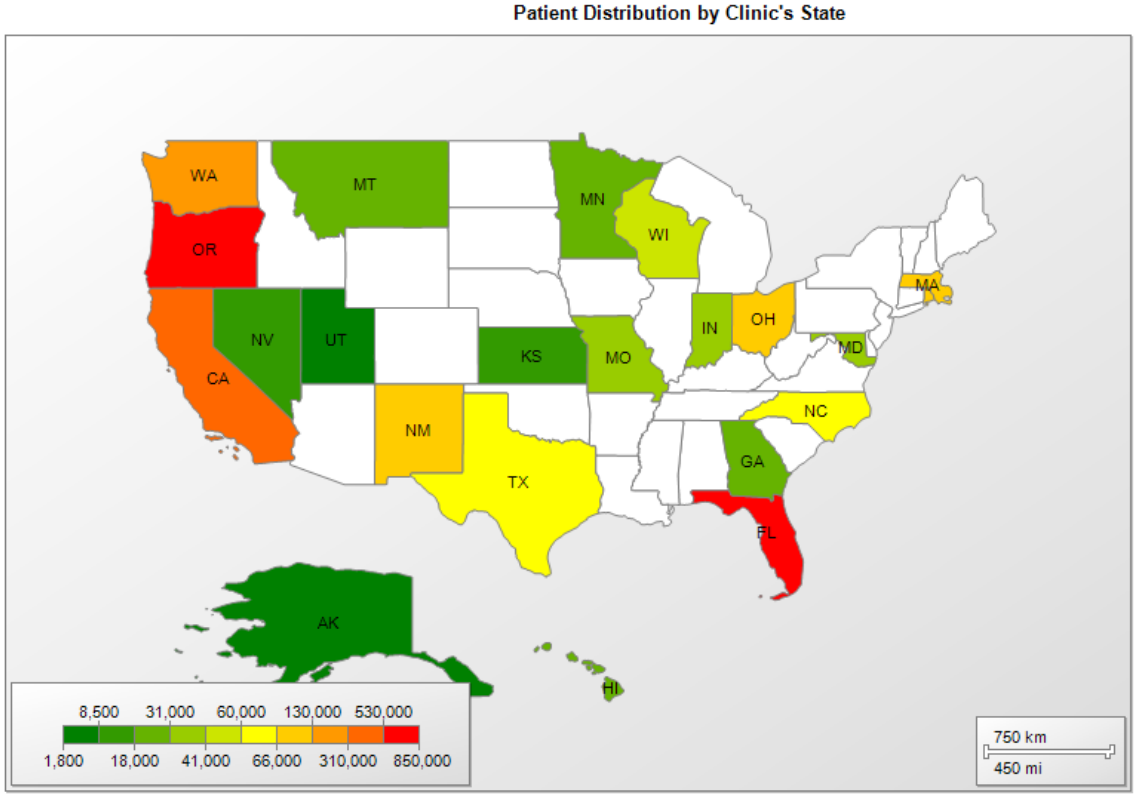
Care Oregon Medicaid Managed Care Plan

American Academy of Family Physicians, Robert Graham Center

Kaiser Permanente NW Center for Health Research

Oregon Health and Sciences University (OHSU)

The ADVANCE CDRN



ADVANCE

Accelerating Data Value Across a National Community Health Center Network

Brought to you in partnership by:

CareOregon | Fenway Health | Health Choice Network
Kaiser Permanente Center for Health Research | Legacy
OCHIN, Inc. | OHSU Department of Family Medicine | The Robert Graham Center

ADVANCE Research Data Warehouse (RDW) includes:

PCORnet CDM

- Demographics (DOB, sex, race, etc.)
- Enrollment
- Encounter
- Diagnosis
- Labs
- Prescribing and Dispensing
- Death date and cause
- Vital Signs (height, weight, tob.)
- Condition (incl. Problem List)
- Patient Reported Outcomes

Plus additional data needed for research on the safety net:

- ***Federal Poverty Level (FPL)***
- ***Household income and size***
- ***Insurance status (incl. uninsured)***
- ***Homeless status***
- ***Migrant/seasonal worker status***
- ***Veteran status***
- ***Community Vital Signs***

OVERVIEW:

- ADVANCE prescribing data
- Methods used in identifying opioid medications
  - Step I: Identify opioid classes using RxClass and RxNav
  - Step II: Identify additional opioid medications with missing RxNorms using text searches; obtain RxNorms using RxMix.
- Preliminary results

Terminology

- **RxNorm**: Standardized terminology for identifying both generic and brand-name drugs.
- **RxCUI**: RxNorm concept unique identifier for a clinical drug.
- **Raw_Rx_Med_Name**: An optional field in the prescribing CDM table.
- **RxClass**: Web based application to look at drug class hierarchies to find RxNorm.
- **RxNav**: Web based application to search for different drug characteristics across different classification systems.
- **RxMix**: Web based application that can be used to create programs to search for RxNorm functions. Allow users to run programs instantly or in batch mode.
- **NDC**: National Drug Code. It is a unique 10-digit, 3-segment number. It is a universal product identifier for human drugs in the US.

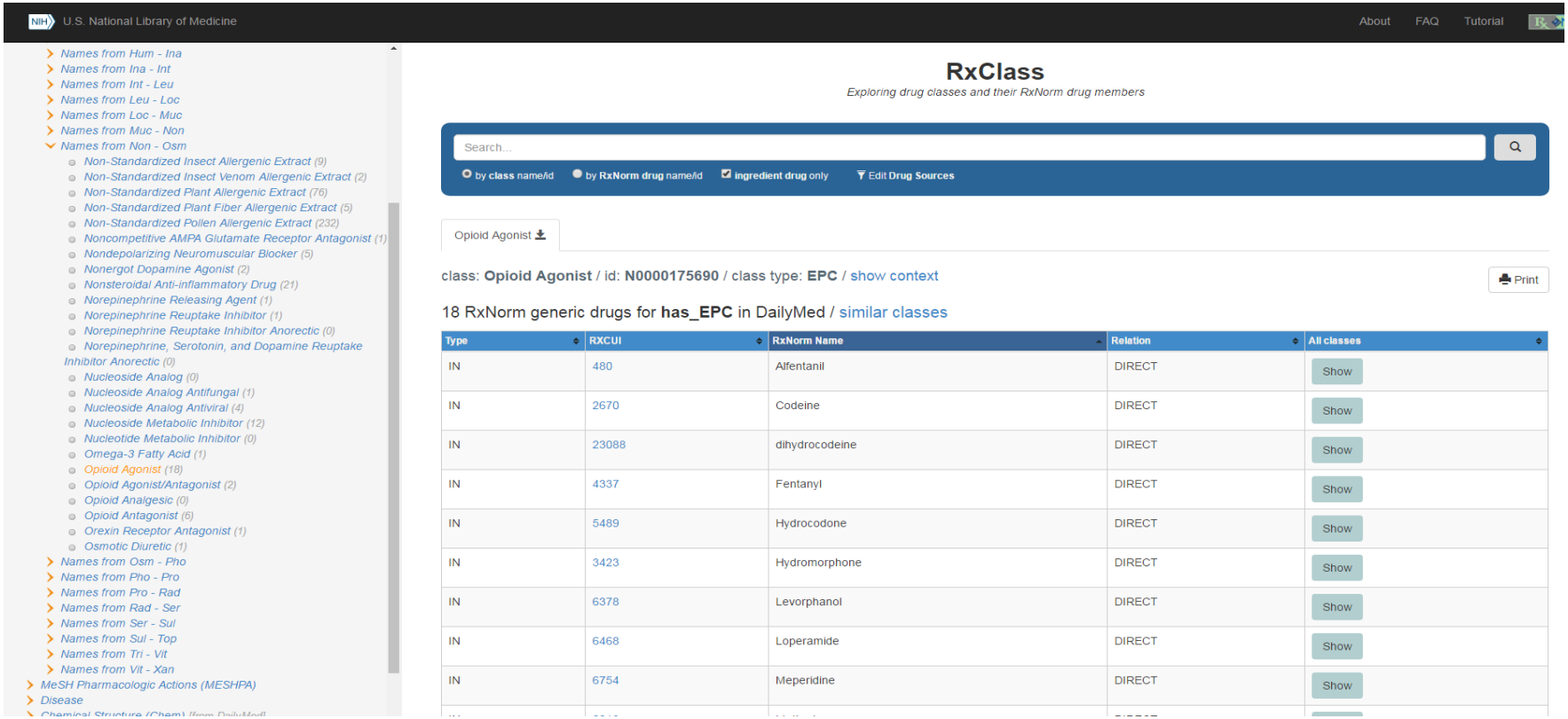
Advance prescribing data

- All prescribed medications are included, even if some cannot be mapped to RxNorm.
  - >95% mapped to RxNormCUI.
- Medication reconciliation/active med list records are not included in the Prescribing table.
- Contain optional fields such as Raw_Rx_Med_Name and Raw_RxNorm_CUI.
  - Raw_Rx_Med_Name may contain both generic and brand named medications

Step I: using RxClass and RxNav

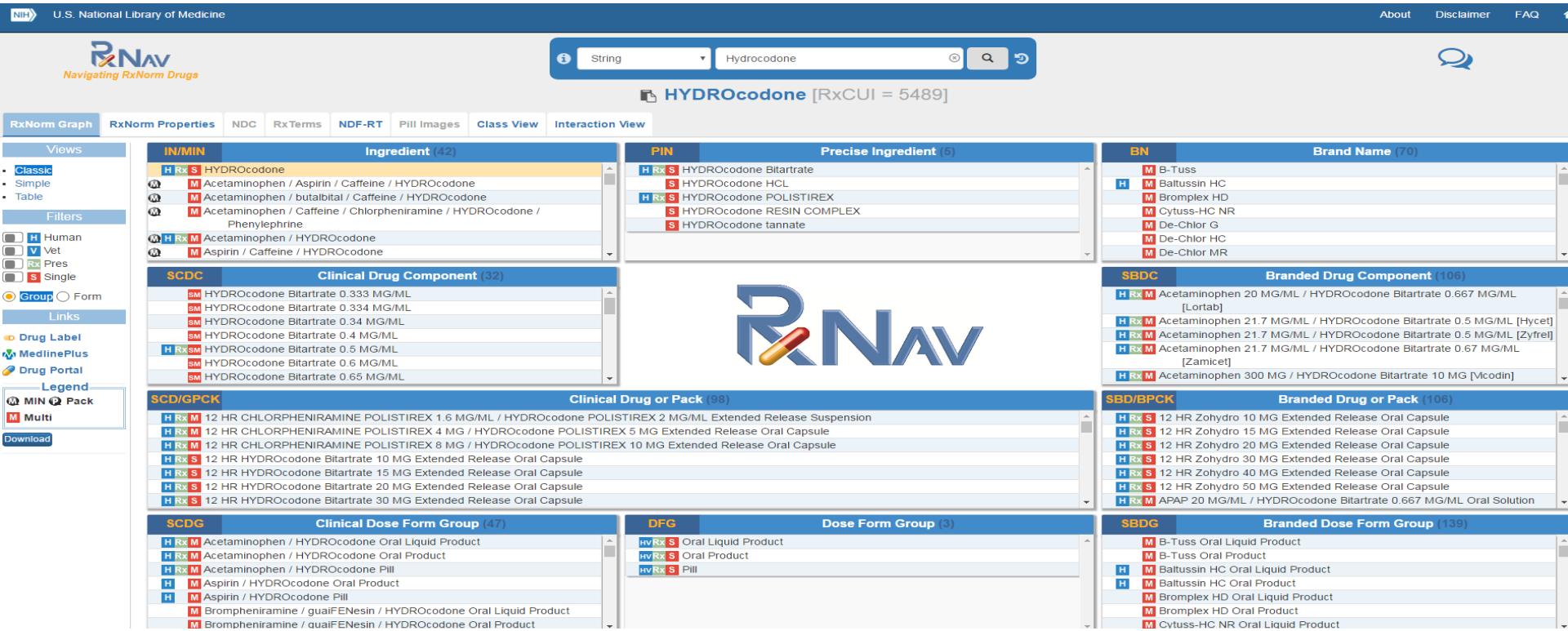
- RxClass
  - Web based application created by NIH to look at drug class hierarchies to find RxNorm.
    - NDC code cannot be used in the search.
    - Shows links to clinical drugs (brand and generic), to their active ingredients, drug components, and related brand names.
  - Contain 9 drug class trees:
    - Anatomical Therapeutic Chemical (ATC1-4)
    - Established Pharmacologic Classes (EPC)
    - MeSH Pharmacologic Actions (MESHPA)
    - Disease
    - Chemical Structure (Chem)
    - Mechanism of Action (MoA)
    - Physiologic Effect (PE)
    - Pharmacokinetics (PK)
    - VA Classes (VA)

Step I: using RxClass and RxNav



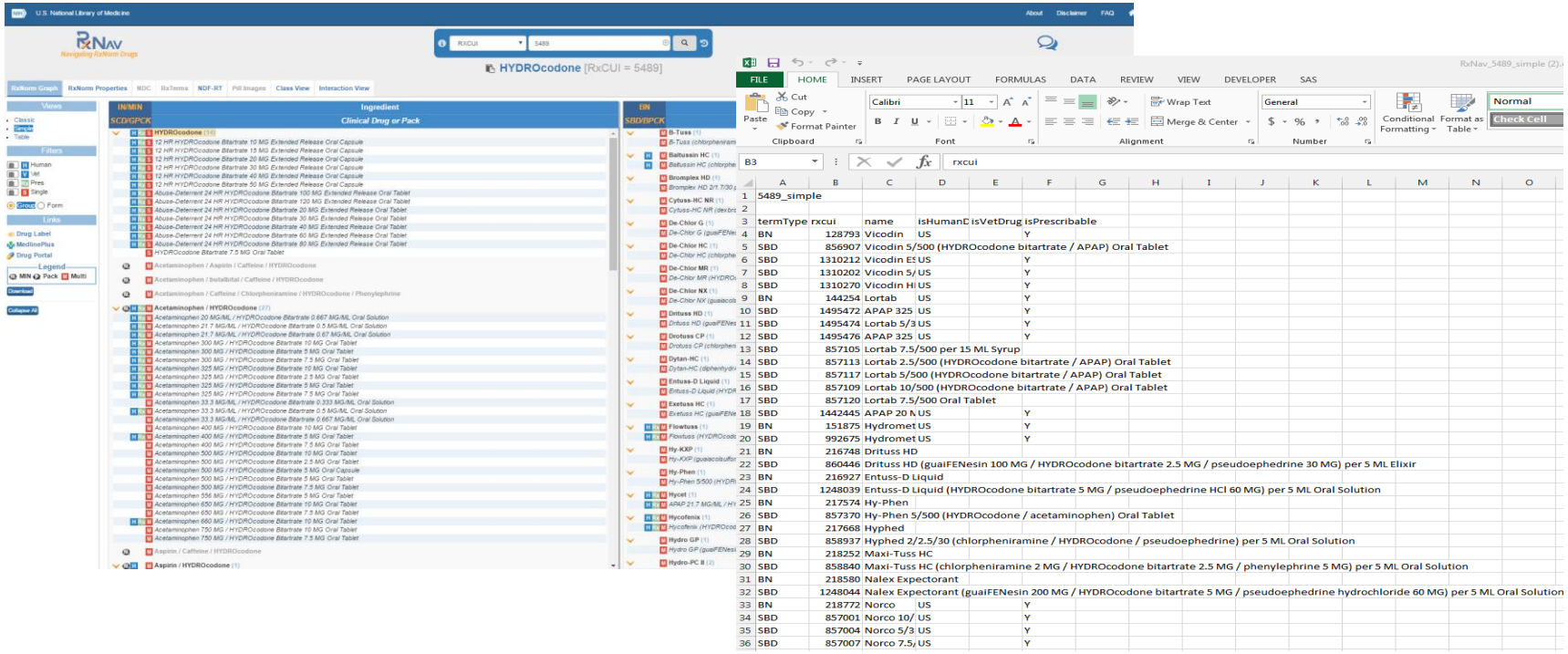
RxClass: https://mor.nlm.nih.gov/RxClass/

Step I: using RxClass and RxNav



RxNav: https://mor.nlm.nih.gov/RxNav/

Step I: using RxClass and RxNav

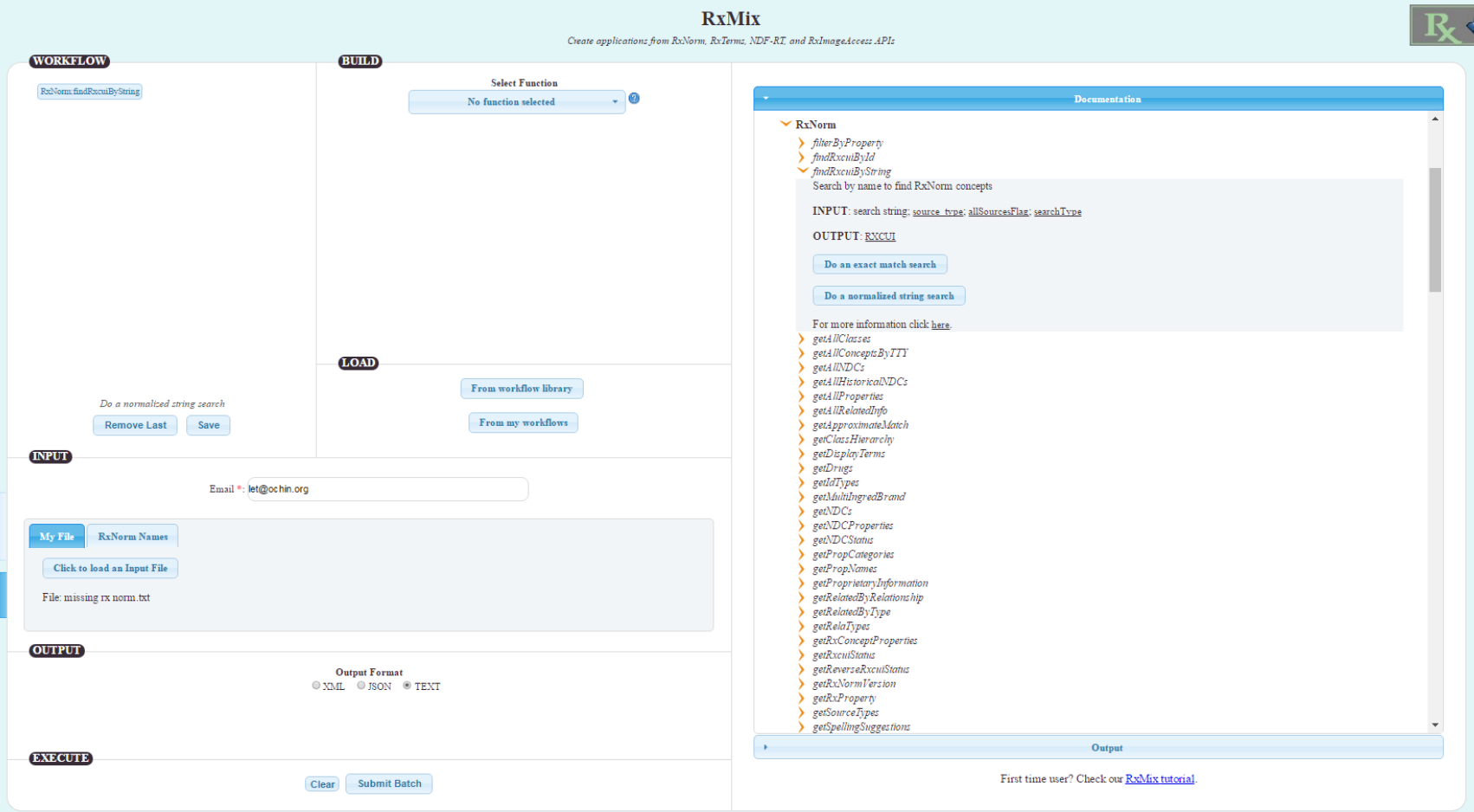


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	5489_simple														
2															
3	termType	rxcui	name	isHumanD	isVetDrug	isPrescribable									
4	BN	128793	Vicodin	US		Y									
5	SBD	856907	Vicodin 5/500 (HYDROcodone bitartrate / APAP) Oral Tablet												
6	SBD	1310212	Vicodin ES	US		Y									
7	SBD	1310202	Vicodin 5/	US		Y									
8	SBD	1310270	Vicodin HI	US		Y									
9	BN	144254	Lortab	US		Y									
10	SBD	1495472	APAP 325	US		Y									
11	SBD	1495474	Lortab 5/3	US		Y									
12	SBD	1495476	APAP 325	US		Y									
13	SBD	857105	Lortab 7.5/500 per 15 ML Syrup												
14	SBD	857113	Lortab 2.5/500 (HYDROcodone bitartrate / APAP) Oral Tablet												
15	SBD	857117	Lortab 5/500 (HYDROcodone bitartrate / APAP) Oral Tablet												
16	SBD	857109	Lortab 10/500 (HYDROcodone bitartrate / APAP) Oral Tablet												
17	SBD	857120	Lortab 7.5/500 Oral Tablet												
18	SBD	1442445	APAP 20 M	US		Y									
19	BN	151875	Hydromet	US		Y									
20	SBD	992675	Hydromet	US		Y									
21	BN	216748	Drituss HD												
22	SBD	860446	Drituss HD (guaiFENesin 100 MG / HYDROcodone bitartrate 2.5 MG / pseudoephedrine 30 MG) per 5 ML Elixir												
23	BN	216927	Entuss-D Liquid												
24	SBD	1248039	Entuss-D Liquid (HYDROcodone bitartrate 5 MG / pseudoephedrine HCl 60 MG) per 5 ML Oral Solution												
25	BN	217574	Hy-Phen												
26	SBD	857370	Hy-Phen 5/500 (HYDROcodone / acetaminophen) Oral Tablet												
27	BN	217668	Hyphed												
28	SBD	858937	Hyphed 2/2.5/30 (chlorpheniramine / HYDROcodone / pseudoephedrine) per 5 ML Oral Solution												
29	BN	218252	Maxi-Tuss HC												
30	SBD	858840	Maxi-Tuss HC (chlorpheniramine 2 MG / HYDROcodone bitartrate 2.5 MG / phenylephrine 5 MG) per 5 ML Oral Solution												
31	BN	218580	Nalex Expectorant												
32	SBD	1248044	Nalex Expectorant (guaiFENesin 200 MG / HYDROcodone bitartrate 5 MG / pseudoephedrine hydrochloride 60 MG) per 5 ML Oral Solution												
33	BN	218772	Norco	US		Y									
34	SBD	857001	Norco 10/	US		Y									
35	SBD	857004	Norco 5/3	US		Y									
36	SBD	857007	Norco 7.5/	US		Y									

Step II: Pattern SEARCH on GENERIC Names of opioid drugs

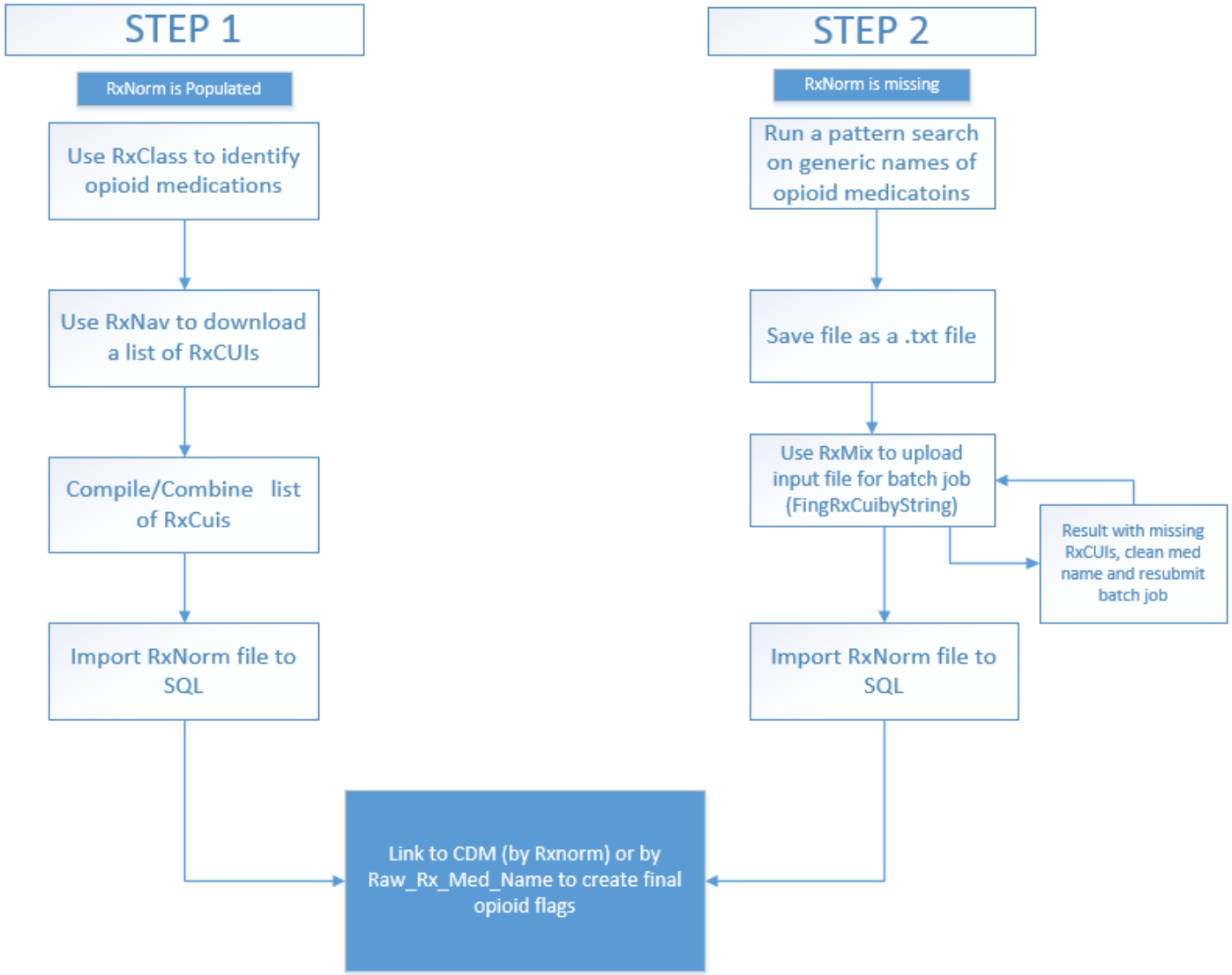
- Missing RxNormCUI information
- Pattern search on generic opioid medications
  - Hydrocodone
  - Oxycodone
  - Tramadol
  - Codeine
  - Morphine
  - Methadone
  - Fentanyl
  - Hydromorphone
  - Oxymorphone
  - Meperidine
  - Tapentadol
- Use RxMix to identify the RxCUIs

Step II: Pattern SEARCH on GENERIC Names of opioid drugs

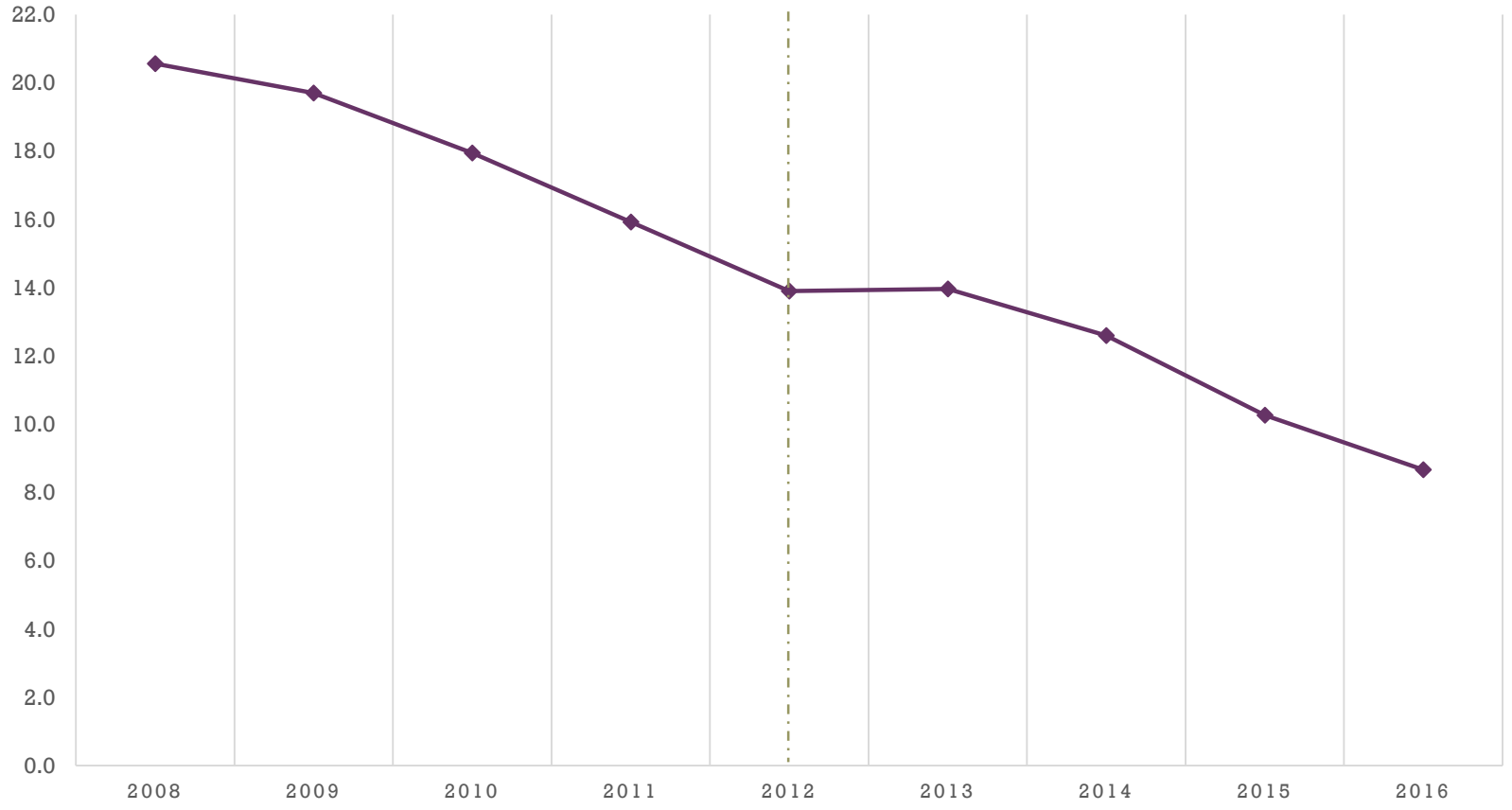


https://mor.nlm.nih.gov/RxMix/

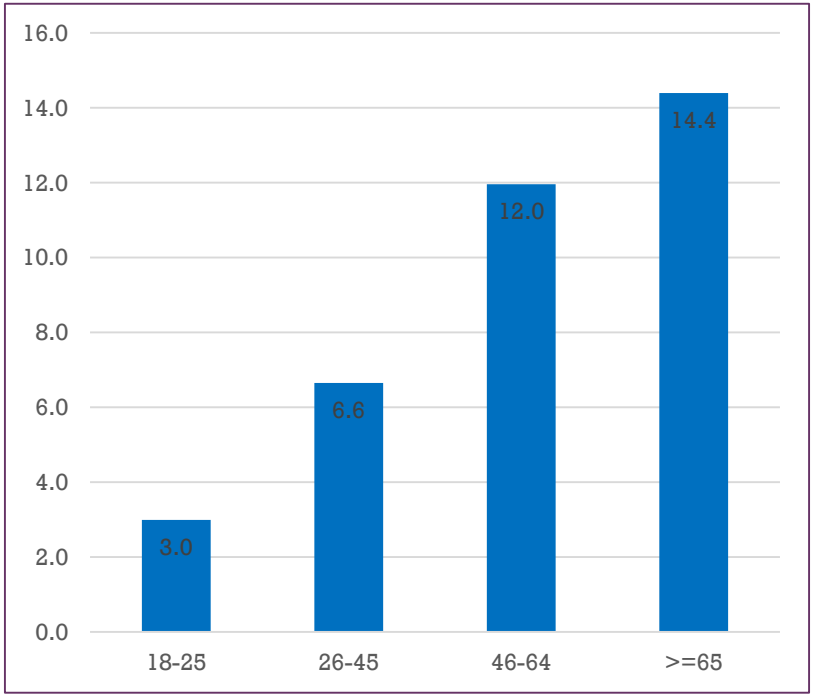
Methods

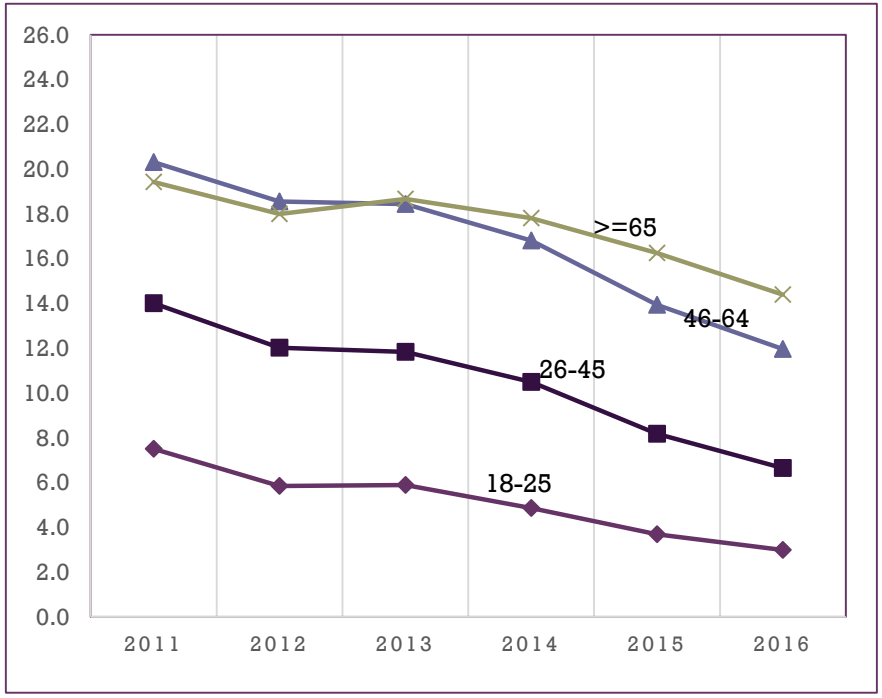

STEP 1
RxNorm is Populated
Use RxClass to identify opioid medications
Use RxNav to download a list of RxCUIs
Compile/Combine list of RxCuis
Import RxNorm file to SQL
STEP 2
RxNorm is missing
Run a pattern search on generic names of opioid medicatoins
Save file as a .txt file
Use RxMix to upload input file for batch job (FingRxCuibyString)
Result with missing RxCUIs, clean med name and resubmit batch job
Import RxNorm file to SQL
Link to CDM (by Rxnorm) or by Raw_Rx_Med_Name to create final opioid flags

Percentage of adults with >= 1 opioid prescription by year

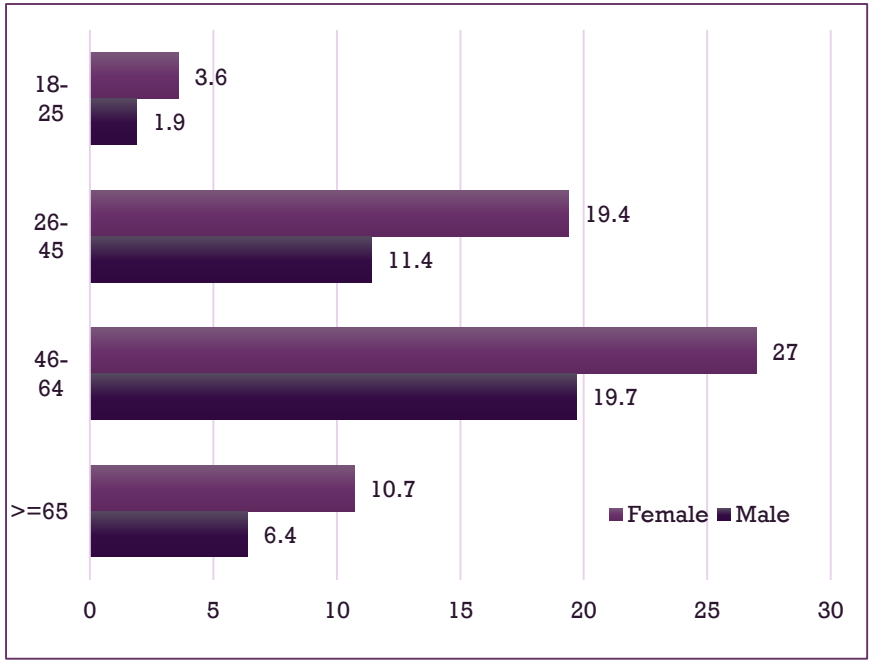


Percentage of adults with >=1 opioid prescription by age group

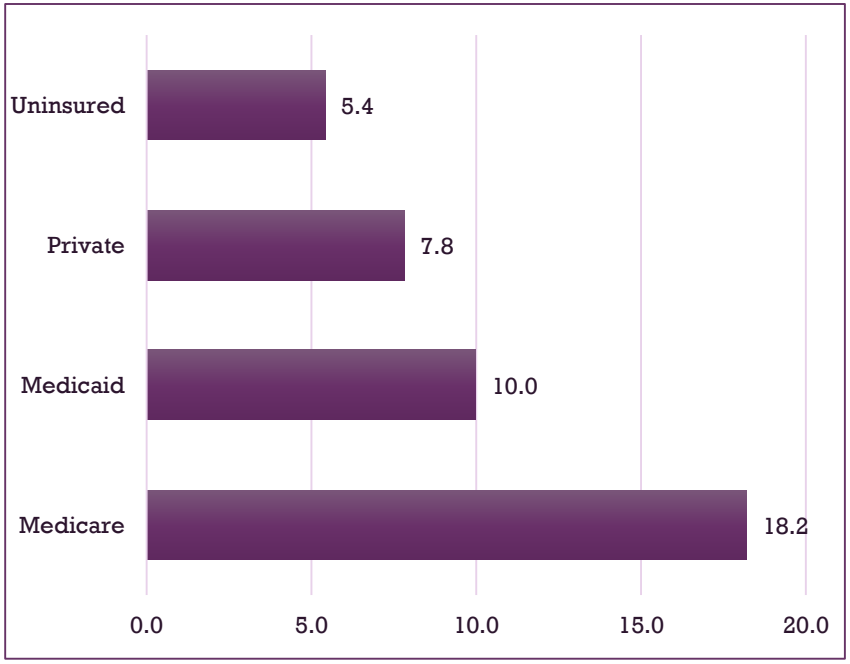




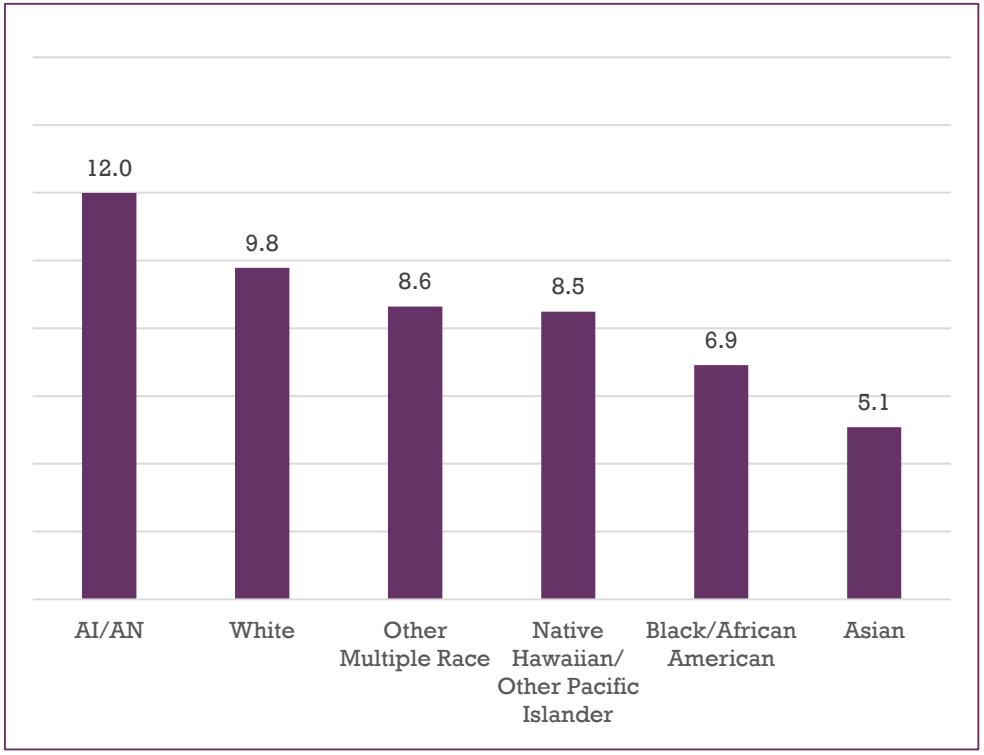
4. Percentage of adults with >=1 opioid prescription in 2016 by sex and age group



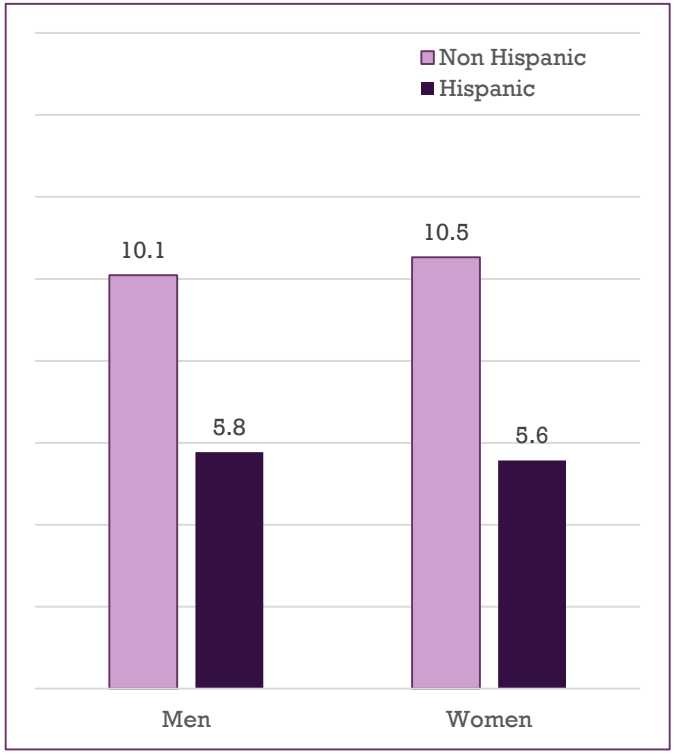
5. Percentage of adults with >=1 opioid prescription in 2016 by payor type



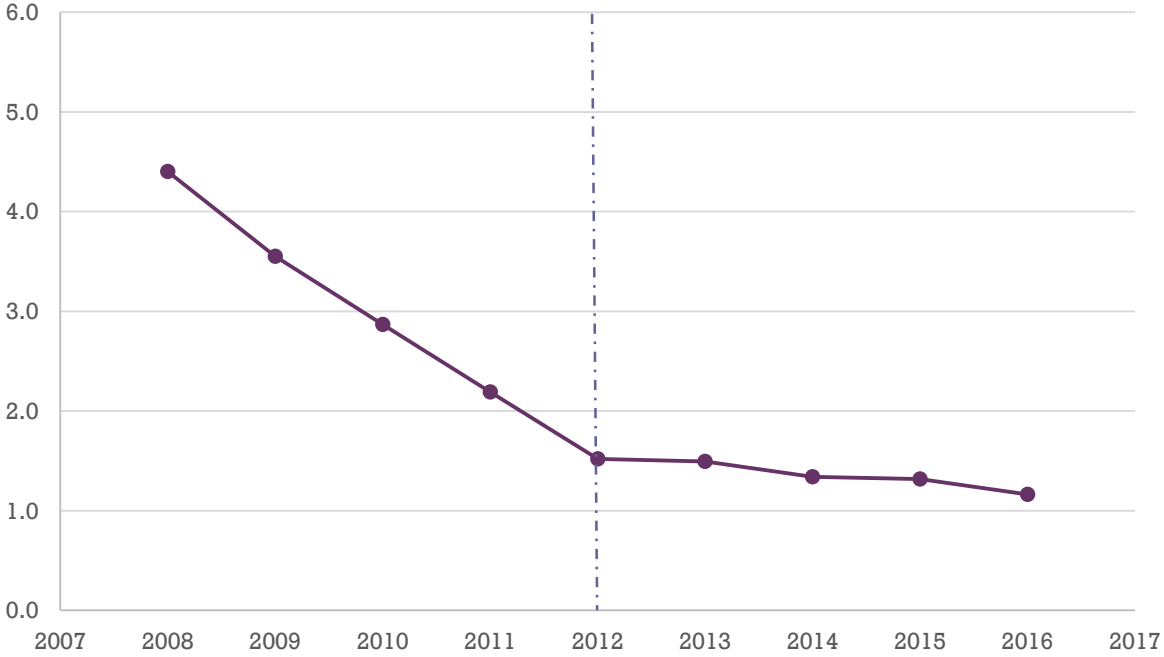
6. Percentage of adults with >=1 opioid prescription in 2016 by Race



7. Percentage of adults with >=1 opioid prescription by sex and ethnicity



8. Percentage of all adults with >=10 opioid prescription by year.



Most prescribed opioid medication by generic name

Generic Name	Orders
Hydrocodone	160,766
Oxycodone	106,238
Tramadol	61,523
Codeine	35,743
Morphine	23,770
Methadone	12,287
Fentanyl	8,797
Hydromorphone	3,471
Oxymorphone	380
Meperidine	254
Tapentadol	222

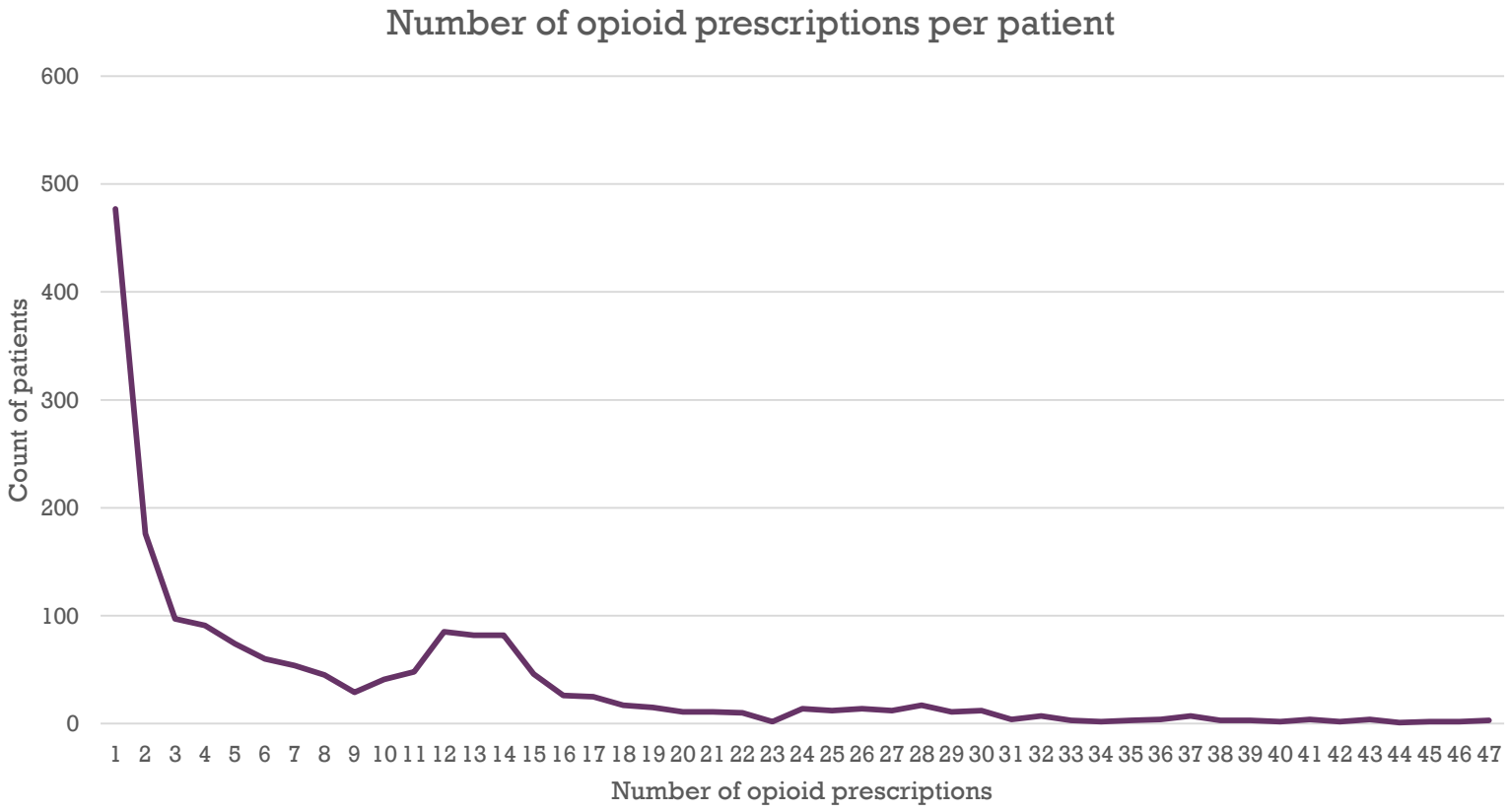
Defining chronic opioid use using population data - Annual number of prescriptions vs. a predefined MME

- EHR Order Data
  - Unique Med Order ID
  - Unique Patient ID
  - Date of prescription order
  - Name of medication
  - Unit of medication (MG, MG/ML, MCG/HR)
  - Strength of ordered medication per unit
  - Number of units ordered
  - Frequency at which it should be taken
  - Example: Order20010111, MRN1002010, 1/25/2015, Oxycontin, Mg, 10, 90, Take one three times daily.
- And extrapolate:
  - Number of morphine milliequivalents per prescription (from name, strength, unit, number of units
  - Long acting vs. short acting medicine (from name)
  - Initiation date

One Urban FQHC in Portland

- 8080 adults with at least one ambulatory visit in 2015
- Followed forward for one year after index visit and opioid prescriptions assessed.
- 1757 with at least one prescription for an opioid (22%)
- 15160 distinct opioid prescription orders (avg 8.6)
  - 81% did not have a discrete "sig", so expected frequency wasn't clear.
- The clinic keeps a list of "chronic opioid users"= 540 patients (in 2015)

Count of opioid prescriptions for each patient



FQHC 2015

8080 adults, 1757 with at least 1 opioid prescription

Opioid number	Number of patients	Percentage
1	477	27%
>8	683	39%
>10	613	35% (7.6% of clinic adults)

Opioid type	Number of patients	Percentage
Long acting	46	3%
Short acting	227	13%
Both LA and SA	1479	84%

Milligram Morphine Equivalents (MMEs)

Major Group	Type of Opioid	Morphine equivalent conversion factor per mg of opioid
Short-acting Non-Schedule II	Propoxyphene (with or without aspirin/acetaminophen/ibuprofen)	0.23
	Codeine + (acetaminophen, ibuprofen or aspirin)	0.15
	Hydrocodone + (acetaminophen, ibuprofen, or aspirin) Hydrocodone and homatropine	1.0
	Tramadol with or without aspirin	0.10
	Butalbital and codeine (with or without aspirin, ibuprofen, acetaminophen)	0.15
	Dihydrocodeine (with or without aspirin, ibuprofen, acetaminophen)	0.25
	Pentazocine (with or without aspirin, ibuprofen, acetaminophen)	0.37
Short-acting, Schedule II	Morphine sulfate	1.0
	Codeine sulfate	0.15
	Oxycodone (with or without aspirin, acetaminophen, ibuprofen)	1.5
	Hydromorphone	4.0
	Meperidine hydrochloride	0.1
	Fentanyl citrate transmucosal[2]	0.125
	Oxymorphone	3.0
Long-acting (Schedule II)	Morphine sulfate sustained release	1.0
	Fentanyl transdermal[3]	2.4
	Levorphanol tartrate	11.0
	Oxycodone HCL controlled release	1.5
	Methadone	3.0

Sullivan, M. D., M. J. Edlund, M. Y. Fan, A. Devries, J. Brennan Braden, and B. C. Martin. "Trends in Use of Opioids for Non-Cancer Pain Conditions 2000-2005 in Commercial and Medicaid Insurance Plans: The Troup Study." *Pain* 138, no. 2 (Aug 31 2008): 440-9.

Milligram morphine equivalents prescribed for the year

Total MME	Total/365	No. Patients (% of 1757)
<1825	<5	949 (54)
1826-5474	5-14.9	262 (14.9)
5475-18249	15-49.9	296 (16.8)
18250-32849	50-89.9	97 (5.5)
>32850	>=90	153 (8.7)

Opportunities

- Medication orders are mostly defined vocabulary from that clinicians select from lists, and therefore reliably accurate.
- There is a great deal of unexplored data in the clinical records concerning visits and patient characteristics that have yet to be explored and tracked.
- Thus far, studies have been retrospective analyses. Do they need to be?
  - Once opioid prescriptions are appropriately identified, there is opportunity for regular surveillance on a nearly real time basis.

Challenges

- The larger the study population, the more generalizable. Combining data from different EHRs is complicated.
- The data is only as good as the entry. Example: clinicians free-text the patient instructions, or "sig", it becomes difficult to calculate a daily MME.
- Electronic health records count prescription orders, not fills. But perhaps we can assume excellent medication adherence when it comes to opioids.

Next steps:

- Continue organizing and exploring ADVANCE data as infrastructure for further studies
- New CDC Prescribing Guidelines – can we tease out the effect?
- Benzodiazepines
- Funding

Future directions

- Linking to other data sets
  - Social determinants of health data
  - Prescription drug monitoring program data
  - State vital statistic registries
- Patient reported data (adverse childhood experiences)
- Identifying overdoses in EHRs?
  - Green, C. A., N. A. Perrin, S. L. Janoff, C. I. Campbell, H. D. Chilcoat, and P. M. Coplan. "Assessing the Accuracy of Opioid Overdose and Poisoning Codes in Diagnostic Information from Electronic Health Records, Claims Data, and Death Records." *Pharmacoepidemiol Drug Saf* (Jan 10 2017).
- Pain!
  - Von Korff, M., A. I. Scher, C. Helmick, O. Carter-Pokras, D. W. Dodick, J. Goulet, R. Hamill-Ruth*, et al.* "United States National Pain Strategy for Population Research: Concepts, Definitions, and Pilot Data." *J Pain* 17, no. 10 (Oct 2016): 1068-80.

Questions, Answers, and Discussion

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