



# Identification of Opioid Involved Health Outcomes Using Linked Hospital Care and Mortality Data

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# Presentation

- Overview of the National Hospital Care Survey
- Initial work on identifying opioid-involved encounters
- Subsequent methods being developed through Patient Centered Outcomes Research Trust Fund (PCORTF) Projects

# National Hospital Care Survey (NHCS)

# Goal and Objectives

- Goal:
  - Provide reliable and timely healthcare utilization data for hospital-based settings.
- Objectives:
  - Move toward electronic data collection, particularly electronic health records.
  - Provide benchmark data for comparison to national data.
  - Link episodes of care across hospital units as well as link to other data sources such as the National Death Index (NDI) and Medicare data.

# NHCS Sample Design, Data Coverage, and Sources

- Hospitals are randomly selected to provide nationally representative data on hospital utilization. The sampled hospitals represent facilities of similar size, service type, and/or geographic location and cannot be replaced.
- The 2019 NHCS sample consists of 598 non-institutional, non-federal hospitals with six or more staffed inpatient beds.
- Participating hospitals are asked to submit all inpatient discharges and emergency department (ED) visits for up to a 12-month period.
- Data sources are UB-04 administrative claims, electronic health records (EHR), and Vizient.

# 2016 Data Elements by Source

## UB-04:

- Personally identifiable information (PII)
- Patient's age and sex
- Encounter dates
- Diagnoses and procedures
- Revenue codes
- Insurance information

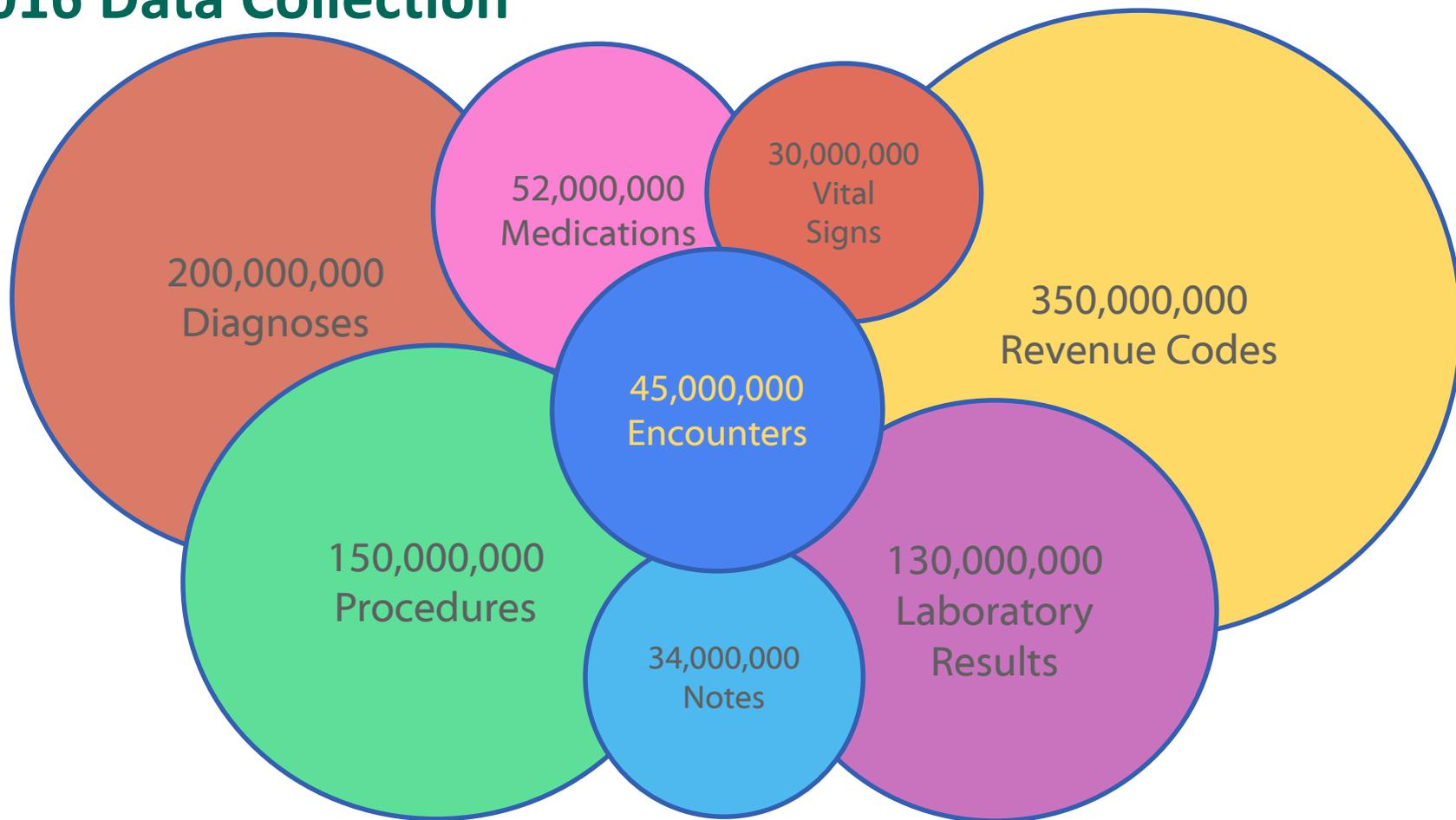
## EHR:

- Personally identifiable information (PII)
- Patient's age and sex
- Encounter dates
- Diagnoses and procedures
- Procedure outcomes
- Lab tests and results
- Medications and vital signs
- Clinical notes (for ED visits only)
- Race and Hispanic origin

## Vizient:

- Patient's age and sex
- Diagnoses and procedures
- Revenue codes
- Lab tests and results

# 2016 Data Collection



# NHCS Data Can Be Used to Study...

- Rare diagnoses and experimental procedures
- Stays in the Intensive Care Unit
- Inpatient admissions from the ED
- 30-, 60-, and 90-day mortality after a hospital visit
- Tracking patient's hospital visits over time
- Opioid-involved emergency department (ED) visits and overdoses

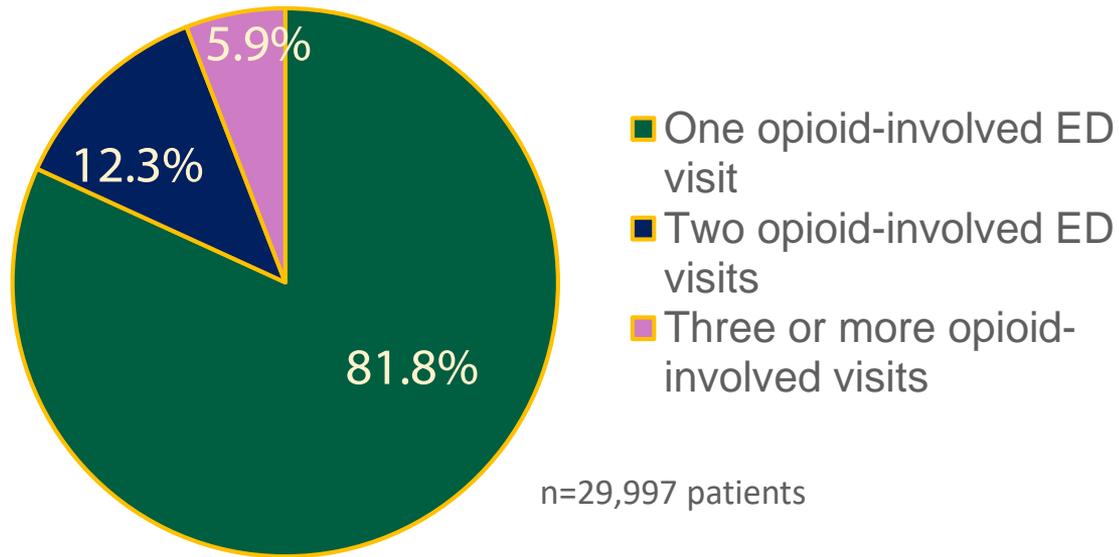
# Initial Work on Identifying Opioid-Involved Encounters

# Identification of Substance-Involved Hospital Visits

In partnership with the Substance Abuse and Mental Health Services Administration (SAMHSA), an algorithm was developed to identify 10 priority substances involved with hospital visits from clinical information collected on UB-04 claims records. The algorithm uses ICD-9-CM and ICD-10-CM diagnosis codes.

1. Alcohol (under age 21)
2. Antidepressants
3. Antipsychotics
4. Benzodiazepines/Sedatives
5. Cannabinoids
6. Cocaine
7. Hallucinogens
8. Heroin
9. Other Opiates/Opioids
10. Pharmaceutical central nervous system (CNS) stimulants

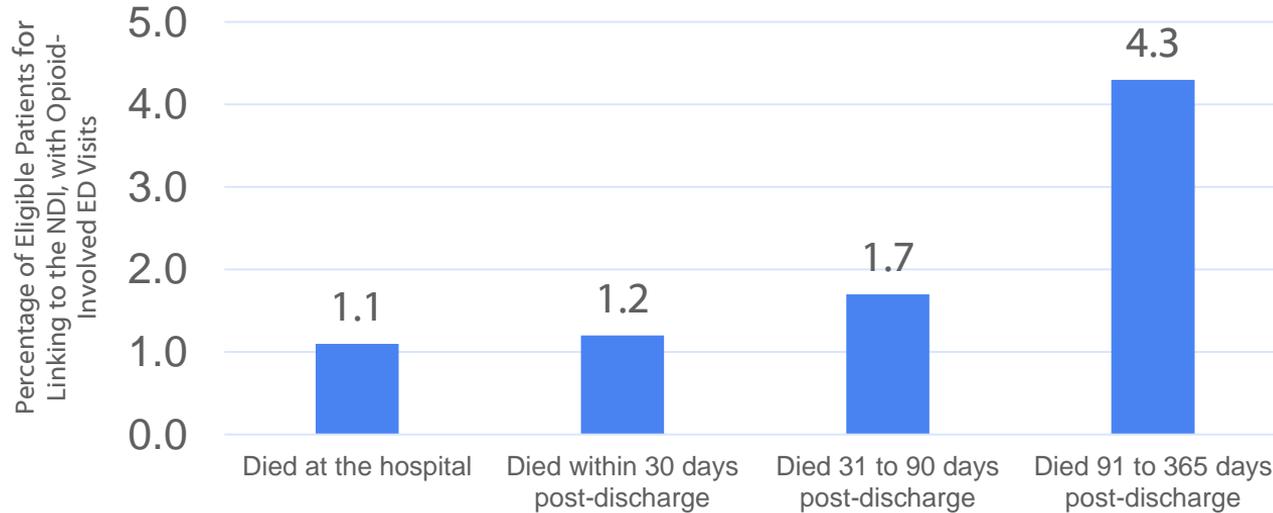
# Repeat Opioid-Involved ED Visits\*



Data source: NCHS, National Hospital Care Survey, 2014.

\*Note: Unweighted estimates, not nationally representative.

# Mortality for Opioid-Involved ED Visits\*



Data source: NCHS, 2014 National Hospital Care Survey Data Linked to the 2014–2015 National Death Index.

\*Note: Unweighted estimates, not nationally representative.

# Limitations of Algorithms

- Some diagnosis/E-codes only specify drug categories (e.g., opioid), rather than specific drug names (e.g., fentanyl).
- Algorithms have not yet been validated to enumerate false positives and false negatives, but this is forthcoming.
- Algorithms only used on claims data to date, which is designed for billing purposes, not research.

# Enhancing Opioid Identification

- Starting in 2015, the NHCS started collecting EHR data from hospitals.
- EHR data contain additional data elements: clinical notes, labs and medications, that can improve the identification of substance-involved ED visits.
- Additional fields may identify substances related to the ED visit that were not captured in diagnosis or procedure codes.
- Clinical notes may provide the context that is not available in medical codes.

# Patient-Centered Outcome Research Trust Fund (PCORTF) Projects

# FY18 Project: Enhancing Identification of Opioid-Involved Health Outcomes Using Linked Hospital Care and Mortality Data

**GOAL:** To improve public health surveillance and expand researchers' access to data on opioid-involved health outcomes by developing enhanced methods that make use of available structured and unstructured data from:

- the National Hospital Care Survey (NHCS),
- the National Death Index (NDI), and
- Drug Involved in Mortality (DIM)

to identify specific opioids (e.g., fentanyl and heroin) involved in outcomes such as drug-related hospital visits and drug poisoning deaths.

# Opioid-Involvement Case Definitions

## Eligible Opioids

### Prescription opioids, such as:

- Morphine
- Oxycodone
- Meperidine

### Illicit opioids, such as:

- Heroin
- Illicitly manufactured fentanyl/fentanyl analogs

### Medication-Assisted Treatment (MAT), such as:

- Methadone
- Buprenorphine
- Naltrexone

### Substances with Opioid-Like Effects, such as:

- Kratom
- Loperamide
- Tianeptine

## Opioid Use

**OVERALL USE:** Pt used an opioid at any time prior to presenting at the hospital

**OVERDOSE:** Pt used an opioid recently and presented with acute opioid poisoning

# FY19: Identifying Co-Occurring Disorders among Opioid Users Using Linked Hospital Care and Mortality Data: Capstone to an Existing FY18 PCORTF Project

## GOAL:

- Serve as a capstone to PCORTF FY18 project to improve public health surveillance and expand researchers' access to data on health outcomes of opioid users with **co-occurring substance use disorders and mental health issues**.
- Will be followed by a study to validate algorithms from both the FY18 and FY19 PCORTF projects to identify the use of opioids and the existence of co-occurring disorders.

# Co-Occurring Disorders Case Definitions

## Substance Use Disorders

Alcohol Use Disorder

Cannabis Use Disorder

Cocaine Use Disorder

Opioid Use Disorder

Hallucinogen Use Disorder

Inhalant Use Disorder

Amphetamine Use Disorder

Sedative, Hypnotic or Anxiolytic Use Disorder

Tobacco Use Disorder

Psychoactive Use Disorder

## Selected Mental Health Issues

### **Depressive Disorders**, including:

- Major depression (single and current episodes)
- Premenstrual dysphoric disorder
- All other depressive disorders
- Suicidal ideation

### **Anxiety Disorders**, including:

- Acute stress reaction
- Generalized anxiety disorders
- Obsessive compulsive disorders
- Panic disorders
- Posttraumatic stress disorder (PTSD)
- Social anxiety disorders/social phobias

# Structured Data: Enhancing Medical Code-Based Algorithms

- Exploring Use of Additional Codes including:
  - Non-billable codes
  - Remission codes
  - Sequela codes
  - Underdosing categories
- Exploring Use of Other Standard Code Systems, including:
  - Procedure codes (CPT, HCPCS, ICD-10-PCS)
  - Medication codes (RxNORM, SNOMED, NDC)
  - Laboratory test codes (LOINC)

# Unstructured Data: Develop an NLP Approach

- The two major natural language processing (NLP) methods, rule-based systems and machine learning, provide a complimentary and efficient way to query both direct and indirect mentions of desired concepts.
- These methods also make it easier to:
  - Capture relevant data despite misspellings, abbreviations, colloquialisms, etc.
  - Add flexibility to queries by adding/modifying new rules as needed.
  - “Teach” the computer to discover new terms and patterns in the data.
  - Examine the context surrounding key terms to help weed out false positives.

# Sample Machine Learning Classifier Application: Opioid Terms

"Patient PCP: Date: CHIEF COMPLAINT: Unresponsive (Patient Found in XXXX bath room on the floor not responding.) HPI: is a 47 year old male with history of depression and chronic back pain/chronic **opioid** use who presents to the ED via EMS with a chief complaint of substance abuse/loss of consciousness. Per EMS was found down in a XXXX bathroom after ""snorting something"". He was unconscious with diminished respiratory rate and pinpoint pupils. He was given intranasal **Narcan** x 2 and IV **Narcan** x 1 with arousal. He is currently awake, alert and appropriately responding to questions. SHx: IVDA, Tob, denies ETOH.

Note: Data are synthetic and only used for demonstrative purposes.

# Sample Machine Learning Classifier Application: Overdose Terms

"Patient PCP: Date: CHIEF COMPLAINT: Unresponsive (Patient Found in XXXX bath room on the floor not responding) HPI: is a 47 year old male with history of depression and chronic back pain/chronic opioid use who presents to the ED via EMS with a chief complaint of substance abuse/loss of consciousness. Per EMS was found down in a XXXX bathroom after "snorting something". He was unconscious with diminished respiratory rate and pinpoint pupils. He was given intranasal Narcan x 2 and IV Narcan x 1 with arousal. He is currently awake, alert and appropriately responding to questions. SHx: IVDA, Tob, denies ETOH.

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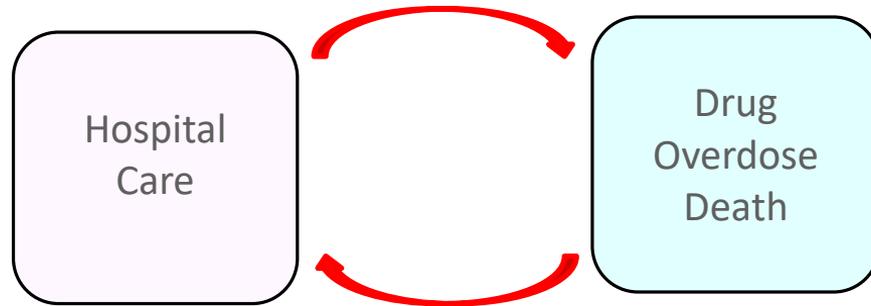
# Sample Machine Learning Classifier Application: SUD & MHI Terms

"Patient PCP: Date: CHIEF COMPLAINT: Unresponsive (Patient Found in XXXX bath room on the floor not responding.) HPI: is a 47 year old male with history of depression and chronic back pain/chronic opioid use who presents to the ED via EMS with a chief complaint of substance abuse/loss of consciousness. Per EMS was found down in a XXXX bathroom after "snorting something". He was unconscious with diminished respiratory rate and pinpoint pupils. He was given intranasal Narcan x 2 and IV Narcan x 1 with arousal. He is currently awake, alert and appropriately responding to questions. SHx: IVDA, Tobacco, denies ETOH.

Note: Data are synthetic and only used for demonstrative purposes.

# Types of Health Outcomes Research Possible with Linked Hospital and Death Data

- Look Forward: What happens after hospitalization?



- Look Back: What patterns of service are seen with patients who die from drug overdose?

# Example Research Questions Using Enhanced Data

- What are characteristics of patients who had at least one opioid-involved hospital encounter?
- What are the most frequent types of opioids taken by patients with opioid-involved hospital encounters?
- What are common patterns of hospital use in the months prior to a opioid-involved overdose death?
- How do patients with a history of repeated opioid-involved hospital encounters that die from an opioid overdose compare to those who did not die from an opioid overdose?

# Accessing NHCS in the NCHS Research Data Center

- Through the NCHS Research Data Center (RDC), researchers can access:

Individual years: 2013-2016 NHCS data

Linked files:        2014 NHCS Data Linked to 2014/2015 NDI  
                          2014 NHCS Data Linked to 2014/2015 NDI and the 2014/2015 DIM  
                          2016 NHCS Data Linked to 2016/2017 NDI  
                          2014 NHCS Data Linked to 2014/2015 Master Beneficiary Summary File

- For information on preparing an RDC proposal, please visit:  
<https://www.cdc.gov/rdc/index.htm>
- For more information on the NHCS data available in the RDC:  
<https://www.cdc.gov/rdc/b1datatype/Dt1224h.htm>  
<https://www.cdc.gov/nchs/data-linkage/nhcs-ndi.htm>

# Thank you!

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