



# Drug-Involved Mortality (DIM) Project

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FDA/CDER/OSE/OPE/DEPI II

CDC/OPHSS/NCHS/DVS/MSB

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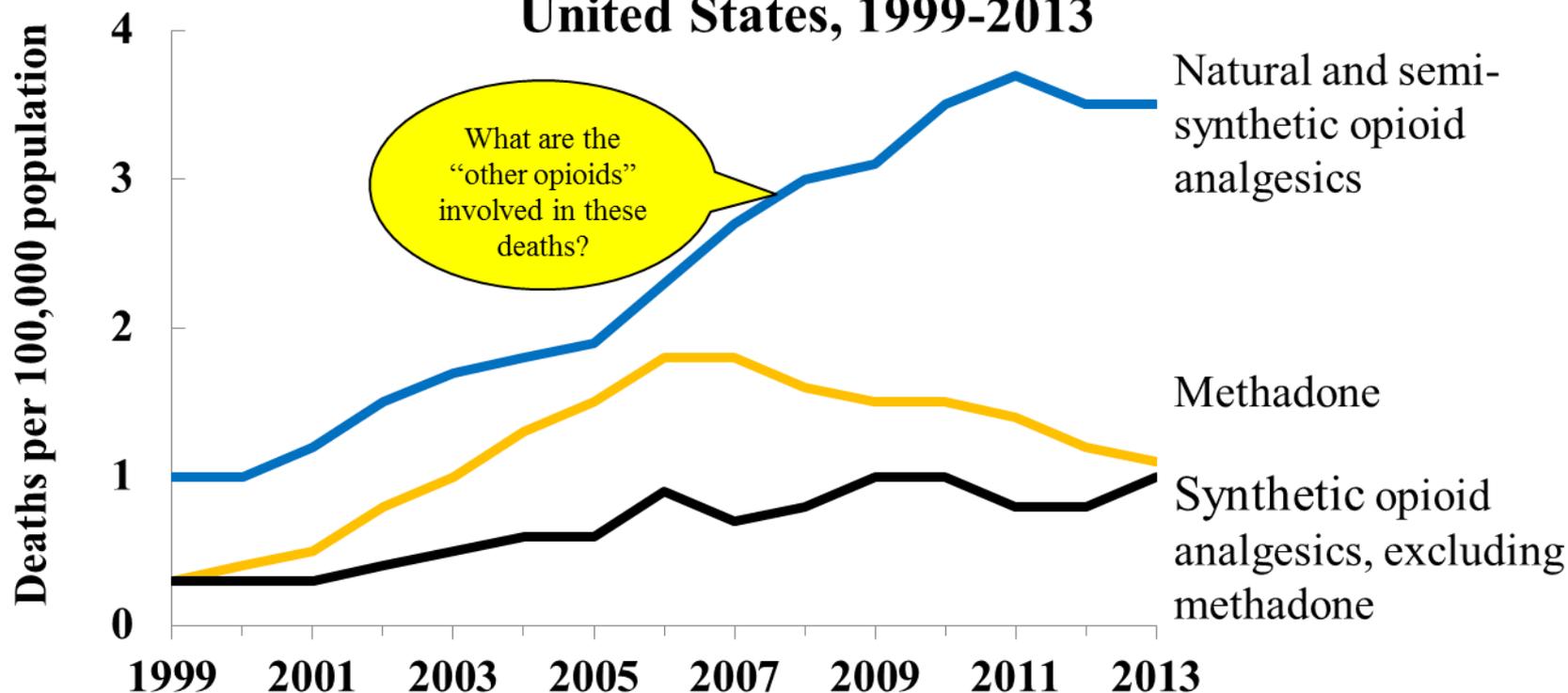
2015 National Conference on Health Statistics

Scientific Session: “From Health to Harm: The Burden  
of Drug Poisoning in the U.S.”



# Increase in drug poisoning deaths due to “other opioid analgesics”

**Age-adjusted drug poisoning death rates, United States, 1999-2013**



NOTES: Decedents’ exposures may not be mutually exclusive (i.e., concomitant exposure).

SOURCE: CDC/NCHS, National Vital Statistics System, Mortality File



## Death certificate text: Better drug specificity than ICD

- Data on drug-specific mortality could enhance understanding of benefit-risk profile for FDA-regulated drugs
- Limited drug specificity in ICD-10 coded mortality data
- Information written by medical certifiers on death certificates could provide better specificity
- Similar efforts utilizing literal text analysis
  - Prions (Creutzfeldt-Jakob Disease)
  - Not-in-traffic surveillance
  - State-specific drug poisoning deaths



# DRUG-INVOLVED MORTALITY (DIM) PROJECT: AN INTERAGENCY COLLABORATION



## DIM Project: An interagency collaboration

- Memorandum of Understanding (FDA and CDC)
  - Coordinate and collaborate by utilizing expertise, resources, and relationships to increase capability and readiness to respond to emergency situations
- Letter of Agreement (CDER and NCHS)
  - Agreement to leverage information on DIM written in death certificates
  - CDER provides 1 on-site FTE
  - NCHS provides training, resources, and relevant data access



## Project aim: Surveillance of DIM

- To explore the utility of National Vital Statistics System – Mortality data (NVSS-M) linked with SuperMICAR literal text to provide data needed for public health surveillance of deaths associated with specific drugs



## Scientific objective:

### Develop methodology for identifying DIM

- Evaluate the ability to identify specific drugs in literal text
  - Quantify the number of cases associated with specific drugs
- Understand how drugs are portrayed in literal text
- Assess strengths and limitations of using death certificate literal text vs. ICD-10 codes for research and surveillance



## Programmatic objective: Optimize collaboration

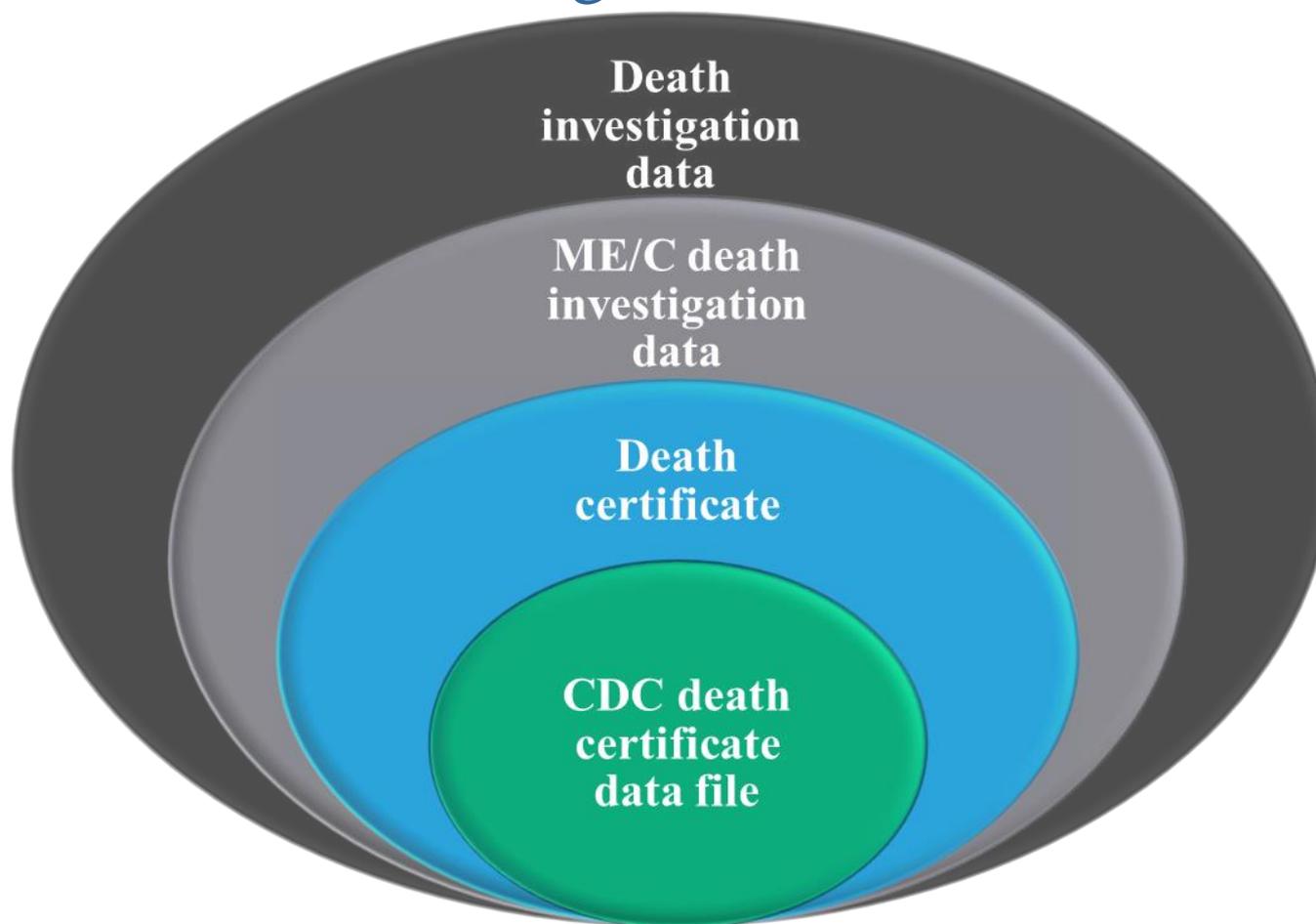
- Recommend methods for routine sharing of DIM data between NCHS and CDER --- for example:
  - Standardized processes for data requests
  - Development of request forms
  - Automation of simple searches and analyses
  - Establishment of roles/responsibilities for FDA and CDC personnel
- Maintain interagency collaboration for projects of mutual benefit
- Optimize project by using physical, intellectual, and data resources in NCHS and CDER



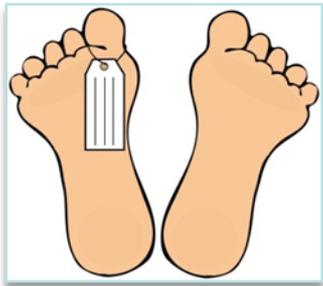
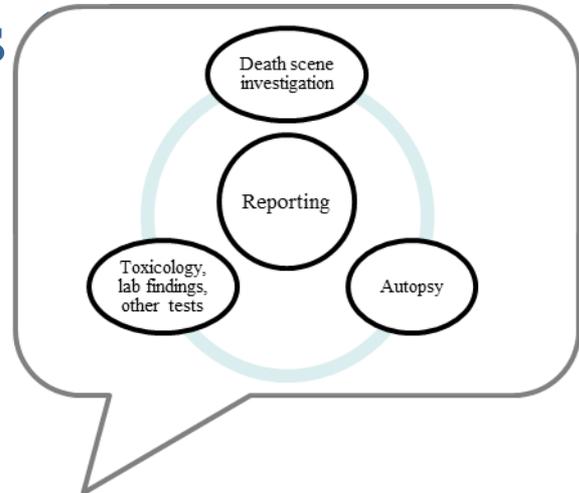
# DEATH CERTIFICATE DATA WITH FOCUS ON DIM



# CDC death certificate data file: A subset of death investigation data

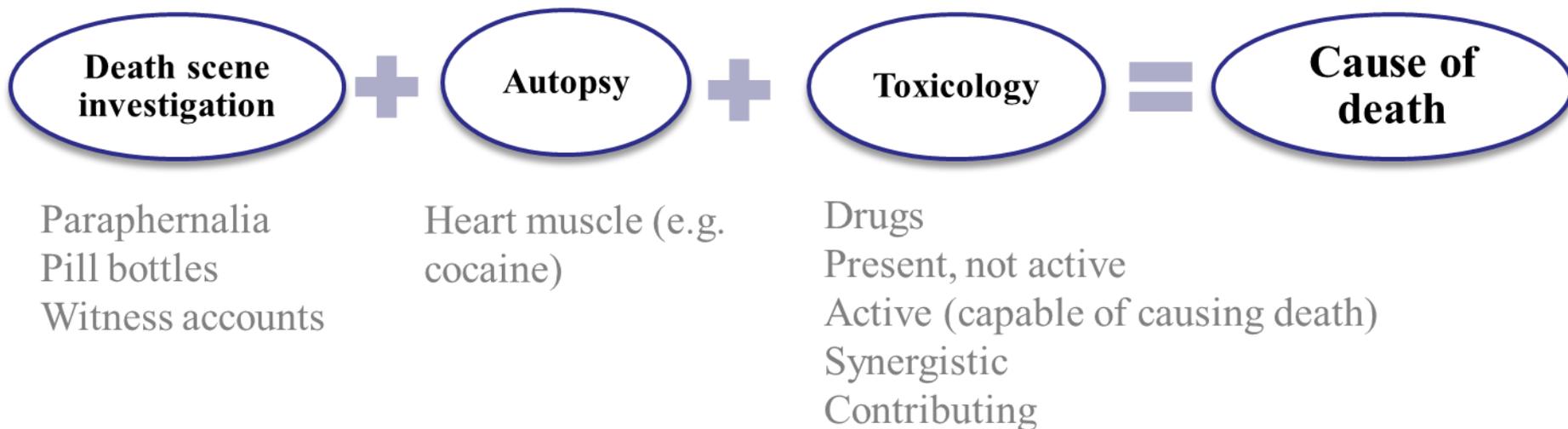


# Death investigation data from medical examiners and coroners



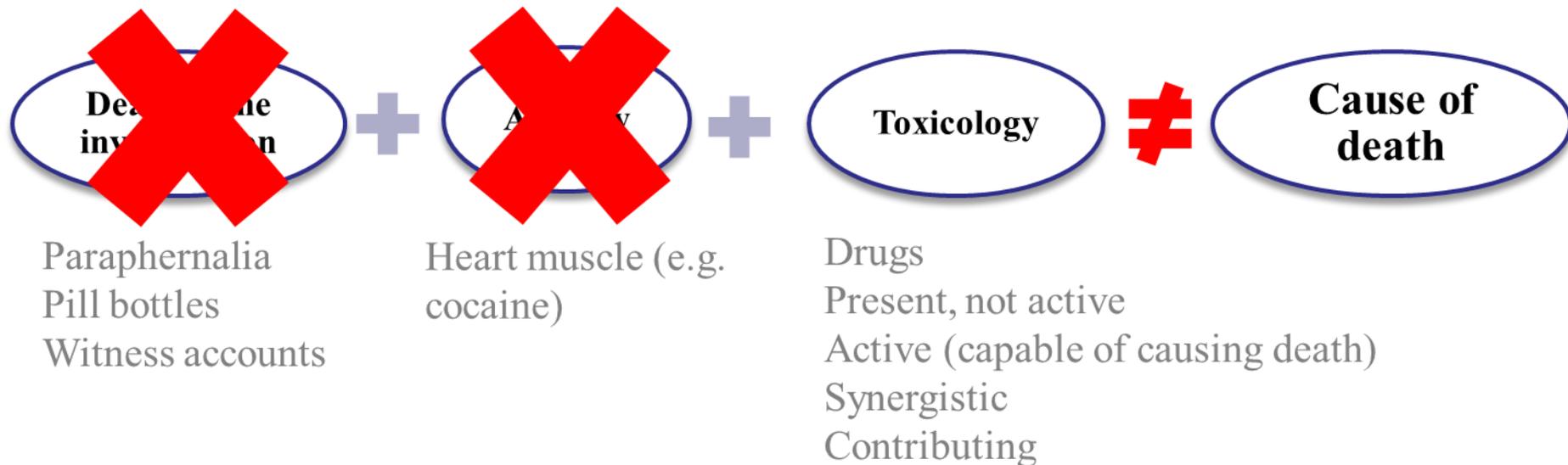


# Death investigation data encompasses multiple data sources





# DIM investigation is more than toxicology



# Death certificate text fields → electronic literal text → ICD codes

CAUSE OF DEATH (See Instructions and examples)

32. PART I. Enter the chain of events -- diseases, injuries, or complications -- that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

IMMEDIATE CAUSE (Final disease or condition resulting in death)

a. **Literal text**

Due to (or as a consequence of):

b. \_\_\_\_\_

Due to (or as a consequence of):

c. \_\_\_\_\_

Due to (or as a consequence of):

d. \_\_\_\_\_

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST.

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in Part I.

33. WAS AN AUTOPSY PERFORMED?  
 Yes  No

34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH?  
 Yes  No

35. DID TOBACCO USE CONTRIBUTE TO DEATH?  
 Yes  Probably  No  Unknown

36. IF FEMALE:  
 Not pregnant within past year  
 Pregnant at time of death  
 Not pregnant but pregnant within 42 days of death  
 Not pregnant but pregnant 42 days to 1 year before death  
 Unknown if pregnant within the past year

37. MANNER OF DEATH  
 Natural  Pending  
 Accident  Investigation  
 Suicide  Could not be Determined  
 Homicide

38. DATE OF INJURY (No Day/No/No/No Month)

39. TIME OF INJURY

40. PLACE OF INJURY (e.g., Decedent's home, construction site, restaurant, wooded area)

41. INJURY AT WORK?  
 Yes  No

42. LOCATION OF INJURY: State: \_\_\_\_\_ City or Town: \_\_\_\_\_ Apartment No. \_\_\_\_\_ Zip Code: \_\_\_\_\_

43. DESCRIBE HOW INJURY OCCURRED

44. IF TRANSPORTATION INJURY, SPECIFY  
 Driver/Operator  
 Passenger  
 Pedestrian  
 Other (specify): \_\_\_\_\_

**Literal text**



Multiple cause of death files

## Mortality Medical Data System

Super-MICAR  
literal  
text

Process  
data

ICD-10  
coded  
MCOB



# Specific drug mentioned in Parts I and Part II of death certificate

CAUSE OF DEATH (See instructions and examples)	
<p>32. <b>Part I.</b> Enter the <u>chain of events</u>--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.</p>	
<p>IMMEDIATE CAUSE (Final Disease or condition -----&gt; resulting in death)</p>	<p>a. <u>Acute polydrug toxicity</u> Due to (or as a consequence of):</p>
<p>Sequentially list conditions, if any, leading to the cause listed on line a. Enter the <b>UNDERLYING CAUSE</b> (disease or injury that initiated the events resulting in death) <b>LAST</b></p>	<p>b. <u>Oxycodone and alprazolam</u> Due to (or as a consequence of):</p>
	<p>c. _____ Due to (or as a consequence of):</p>
	<p>d. _____</p>
<p><b>PART II.</b> Enter other <u>significant conditions contributing to death</u> but not resulting in the underlying cause given in PART I</p>	
<p><u>Opioid addiction</u></p>	
<p>43. DESCRIBE HOW INJURY OCCURRED:</p>	
<p><u>Ingested oxycodone and alprazolam</u></p>	



# IDENTIFICATION OF MENTIONS OF DRUGS/SUBSTANCES IN LITERAL TEXT



## Automated identification of drug mentions and classification of involvement

- SAS programs were developed to automate the identification of mentions of drugs and substances from literal text and ascertain their involvement (if any) in death
- Steps (in general)
  - Identify mentions of drugs and substances
    - Based on investigator-defined list of drugs/substances
  - Use contextual words surrounding drug mentions to classify involvement



## DIM programs consider death certificate text characteristics

- Punctuation and letter case (upper case)
- Drug name variations and descriptive words
  - Generic, brand, metabolites, abbreviations, misspellings, other
  - Descriptive words may appear, e.g., “*RX AND ILLICIT* DRUGS”
- Phrasal syntax
  - Generally no sentences
  - Interchangeability of words in phrase
    - E.g., “\_\_\_\_\_ OVERDOSE” may refer to oxycodone, alprazolam ,or both
  - Phrases help classify DIM vs. non-DIM cases
    - E.g., “Insulin overdose” vs. “Insulin-dependent diabetes”



# **DIM PROJECT: STRENGTHS, LIMITATIONS, AND FUTURE ENDEAVORS**



## Literal text analysis has inherent limitations

- Incompleteness of data
  - Drugs not written on death certificates
  - Other information missing (e.g., routes of administration)
- Non-specificity: Mentions of drugs not otherwise specified
- Hurdles to understanding validity of literal text analysis
  - Temporal/geographic variation: Missingness, lack of specificity
  - Appreciation of toxicology (e.g., morphine is metabolite of heroin)
- Context may be important



## DIM project can address major knowledge gap

- Better identification of specific drugs
- DIM encompasses
  - Poisoning
  - Adverse effects (e.g., anaphylaxis)
  - Drugs ‘on board’
  - DIM in other external injuries (e.g., motor vehicle accidents)
  - Other
- Many potential research opportunities with national scope
  - Retrospective research
  - Prospective surveillance



## FDA and NCHS pursuing pilot projects driven by specific questions

- Currently developing research/surveillance questions
- Results will further help appreciate strengths and limitations of literal text analysis