

CDC's Opioid Overdose Indicator Support Toolkit

**Guidance for building and reporting on
opioid-related mortality, morbidity, and
PDMP indicators**

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This toolkit was originally written as the indicator reporting guidance for the Prevention for States (PFS) and Prevention in Action component of the Data Driven Prevention Initiative (DDPI - PIA) programs.



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Indicator Quick Guide

Mortality Indicators

1. All drug overdose deaths
2. Drug overdose deaths involving opioids
3. Drug overdose deaths involving natural, semi-synthetic, and synthetic opioids
4. Drug overdose deaths involving prescription opioid pain relievers: Natural and semi-synthetic opioids and methadone
5. Drug overdose deaths involving natural and semi-synthetic opioids
6. Drug overdose deaths involving synthetic opioids other than methadone
7. Drug overdose deaths involving methadone
8. Drug overdose deaths involving heroin

Morbidity Indicators

9. All drug overdose emergency department visits
10. Emergency department visits involving all opioid overdose excluding heroin
11. Emergency department visits involving heroin overdose
12. All drug overdose hospitalizations
13. Hospitalizations involving all opioid overdose excluding heroin
14. Hospitalizations involving heroin overdose

PDMP Indicators

15. Percent of prescribers registered with PDMP
16. Number of pharmacists registered with PDMP
17. PDMP consulting requirements – pick only one, categories are mutually exclusive:
 - a. Prescribers are required to consult the PDMP before initial opioid and benzodiazepine prescriptions and at least every three months thereafter, or
 - b. Prescribers are required to consult the PDMP before initial opioid prescriptions and again within one year, or
 - c. Prescribers are not required to consult the PDMP before initial opioid prescriptions, OR such a requirement does exist but there is no required subsequent check and/or the policy includes subjective standards or broad exceptions
18. Required reporting time for pharmacy data submission
19. Proactive reporting - External PDMP Notifications
20. Proactive reporting - Internal PDMP Notifications
21. PDMP linkages – pick only one, categories are mutually exclusive:
 - a. PDMP is not linked to EHR or operational in any large health care system, or
 - b. PDMP is linked to EHR and operational in at least one large health care system, or
 - c. PDMP is linked to EHR and operational in more than one large health care system
22. Number and rate of opioid analgesic prescriptions per 1,000 state residents
23. Percent of patients receiving more than an average daily dose of ≥ 90 morphine milligram equivalents (MME) of opioid analgesics
24. Rate of multiple provider episodes for prescription opioids (five or more prescribers and five or more pharmacies in a six-month period) per 100,000 residents
25. Percent of patients prescribed long-acting/extended-release opioids who were opioid-naïve patients (i.e., patients who have not been prescribed opioid analgesics in the past 60 days)
26. Percent of patient prescription days with overlapping opioid prescriptions
27. Percent of patient prescription days with overlapping opioid and benzodiazepine prescriptions

Introduction

CDC's Opioid Overdose Indicator Support Toolkit provides detailed guidance for building and reporting on opioid-related indicators specific to measures of mortality, morbidity, and state-based prescription drug monitoring program (PDMP) data. The opioid overdose indicators in this toolkit can be used for surveillance, reporting, evaluation, and communication purposes.

Background and Purpose

The purpose of this toolkit is to assist states and communities in building indicators of opioid-related mortality, morbidity, and PDMPs. These indicators and recommendations for their calculation may also be utilized by any jurisdiction wishing to measure and monitor opioid related drug overdose mortality, non-fatal morbidity, and PDMP performance measures in their area. For states receiving CDC funds through the Prevention for States (PFS) or the Prevention in Action component of Data Driven Prevention Initiative (DDPI-PIA) programs, the guidance presented in this toolkit is aligned with the indicator reporting requirements. This document includes:

- List of indicators
- Case definition for each indicator
- Sample SAS code*
- Additional resources

*This sample program code is provided for your convenience, however the code may need to be adapted to the unique structure of your state's data.

With these indicators, states may be able to:

1. Compare rates with other types of injuries (e.g., car crashes) or diseases within your state or jurisdiction or to national or other states' rates (when state comparisons are valid) to better understand the magnitude of the problem.
2. Track changes in health outcomes and PDMP indicators over time to identify and respond to changes in opioid related drug overdose deaths, non-fatal drug overdose emergency department (ED) visits, non-fatal hospitalizations, PDMP performance measures, and to evaluate the impact of drug overdose prevention activities.
3. Compare fatal and non-fatal drug overdose rates across local jurisdictions, such as counties, to target responses in areas with high rates of drug overdose deaths and to identify potential protective factors in areas with reduced drug overdose rates.



Indicator Considerations

- These indicators capture drug overdose deaths, non-fatal drug overdose emergency department (ED) visits, and non-fatal drug overdose hospitalizations of all intents (e.g., suicide, assault, unintentional, or undetermined), to facilitate comparisons across states and local jurisdictions.
- The following types of deaths are excluded from these indicators: 1) deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), 2) deaths due to alcohol and tobacco, 3) deaths from adverse effects of drugs, and 4) deaths that occur under the influence of drugs, but do not involve acute poisoning (e.g., a car crash that occurred because the driver was drowsy from taking a prescription drug).
- The percentage of fatal drug overdoses lacking information on the death certificate about the specific drug(s) causing the death varies substantially over time and by state and local jurisdiction (e.g., some states have almost no missing data while others lack specific information on over 50% of their drug overdose deaths). State epidemiologists should understand the completeness of reporting of the specific drug(s) involved in their jurisdiction in order to understand the quality and limitations of the indicators for reporting and interpretation purposes.
- Death investigators may require weeks or months to complete their investigation (e.g., complete toxicology testing) and classify a death as a drug overdose. While the investigation is being conducted, deaths may be assigned a pending status on the death certificate. That status should be updated when the investigation is complete. State epidemiologists should have an understanding of the death investigation process in their jurisdiction in order to determine the quality of the indicators for reporting and interpretation purposes.
- Additional information about the completeness and specificity of drug overdose information from death certificate data may be found in both the CSTE [State Special Emphasis Report: Instructions for Drug Overdose Death Data](#) (page 10) and the CSTE [Recommendations and Lessons Learned for Improved Reporting of Drug Overdose Deaths on Death Certificates](#).
- Because many drug overdose deaths involve more than one drug, the same death may be counted in more than one indicator. For example, rates for the individual indicator “Drug Overdose Deaths Involving Natural and Semi-Synthetic Opioids” (Indicator 5) and “Drug Overdose Deaths Involving Methadone” (Indicator 7) will not sum to the rate for “Drug Overdose Deaths Involving Prescription Opioid Pain Relievers: Natural and Semi-Synthetic Opioids and Methadone” (Indicator 4) because some deaths could involve both methadone and a natural or semi-synthetic opioid.
- It is anticipated that complete drug overdose death data files will be available within nine (9) months after the end of a calendar year.

Preparing the Datasets

Background on State Vital Statistics Data

Vital statistics death data are required to generate the indicators. In general, the mortality data set for these indicators is the same data set used for mortality injury indicators in state injury programs. States must have access to mortality data that include the multiple contributing cause-of-death fields in order to calculate all of the drug overdose mortality indicators.

The analysis uses the following fields from the mortality data file: year of death, state of residence (or other residence variable based on jurisdiction of interest), underlying cause of death, contributory/multiple causes of death, and age.

Instructions for Using a Vital Statistics Dataset

1. Use vital statistics data for deaths that occurred in the year for analysis. This time frame may be altered if necessary based on data access and quality and should be indicated in the reporting template.
2. Select death records for residents of the state (or other jurisdiction of interest) regardless of where the death occurred. For states without access to out-of-state death data, the indicators may be run with in-state resident deaths only. This should be noted on the reporting template.
3. Identify deaths with the following underlying causes of death: Drug overdose deaths: X40-X44, X60-X64, X85, Y10-Y14
4. Create flags that will be used to determine the number of deaths within each of the following drugs/drug categories. Search all contributory cause-of-death fields for the following ICD-10 codes. Note that some deaths may have more than one T-code listed. When multiple T-codes on a death certificate belong to the same drug category of a calculated indicator (e.g., a drug overdose death involving multiple opioids), numeration of the death in that category for that indicator will only be counted once. Conversely, when drug overdose deaths have multiple T-codes from different calculated indicator categories (e.g., heroin and prescription opioid pain relievers), those deaths will be included in more than one category and thus, counted more than once (categories are not exclusive):
 - Any opioid: T40.0, T40.1, T40.2, T40.3, T40.4, T40.6
 - Heroin: T40.1
 - Natural, semi-synthetic and synthetic opioids (including methadone): T40.2, T40.3, T40.4
 - Prescription opioid pain relievers[†]: T40.2, T40.3
 - Methadone: T40.3
 - Synthetic opioids, other than methadone: T40.4
 - Natural and semi-synthetic opioids (“other opioids”): T40.2
5. Create an age category variable that classifies the age of the decedent into 11 categories required for age adjusting: <1 year, 1-4 years, 5-14 years, 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, 75-84 years, 85+ years.
6. Calculate the numbers of deaths for each age category within each indicator. Counts should be exported or copied and pasted into the reporting template. The attached sample SAS code offers an export procedure for exporting counts.

[†] Given the recent surge in illegally-made fentanyl, it is recommended that synthetic opioids (other than methadone) be analyzed separately from other prescription opioids. <https://www.cdc.gov/drugoverdose/data/analysis.html>

Background on State Emergency Department Data

The availability of statewide, centralized, emergency department (ED) data sets is increasing. In 2013, nearly two-thirds of states reported having access to ED data¹. Many of these data sets are standardized around administrative or billing data. Because many injuries are seen only in the ED, such databases are of increasing importance for injury surveillance.

Instructions for Creating and Using the Drug Overdose Subset from a State Emergency Department Data Set

To calculate the morbidity indicators for emergency department visits found within this guide, create a drug overdose subset of ED records using the following specifications²:

- Include only data from nonfederal, acute care-affiliated facilities. This excludes Veterans Affairs (VA) and other federal hospitals, rehabilitation centers, and psychiatric hospitals.
- Include ED visits involving state residents only.
- If the data are available, include out-of-state ED visits of state residents.
- Exclude records of patients seen in the ED and then admitted to the hospital. For most states, these records are not included in the ED data set.
- Exclude records of patients seen in the ED and with a discharge status of Death or Deceased.
- Include records for ED visits between January 1, and December 31 of the reporting year.
- Create the ED drug overdose subset by searching ICD-9-CM principal diagnosis codes **and** external cause-of-injury codes³:
 - Using the principal diagnosis:
 - Search only the principal diagnosis field for the diagnosis codes 960-979.
 - Using the external cause of injury:
 - Search all diagnosis fields.
 - If a designated external-cause-of-injury field is in the data set, start with that field.
 - Count the first-listed external-cause-of-injury code from the list below.

Principal Diagnosis		First-listed External Cause of Injury
960-979	OR	E850-E858, E950.0-E950.5, E962.0
		E980.0-E980.5

- Once the ED drug overdose subset has been created, calculate the case counts for the morbidity indicators for emergency department visits as defined for each individual indicator (see pages 20-22).

Background on State Hospital Discharge Data

At least 90% of all states maintain statewide, centralized, electronic databases of hospital discharge records for nonfederal, acute care hospitals located within their borders⁴. The information collected varies from state to state. Many states use the standard uniform billing form (UB-04) as the basis for their hospital discharge database. Others use only a subset of variables from the UB-04 for their databases, and a few collect additional variables.

The UB-04, developed by the National Uniform Billing Committee, includes such data elements as⁵:

- patient's age
- sex
- zip code
- admission date
- length of stay
- total charges
- principal diagnosis
- up to 17 additional diagnoses

For hospitalizations involving injuries, an external cause of injury should also be coded. External-cause-of-injury codes describe several aspects of an injury: intentionality, mechanism, location of occurrence, external cause status (e.g., civilian activity done for pay, military activity), and activity⁶. Completeness of external-cause-of-injury coding varies by state.

Instructions for Creating the Drug Overdose Subset from a State Hospital Discharge Dataset

To calculate the morbidity indicators for hospitalizations found within this guide, create a drug overdose subset of hospital discharge records using the following specifications²:

- Include only nonfederal, acute care, or inpatient. This excludes Veterans Affairs (VA) and other federal hospitals, rehabilitation centers, and psychiatric hospitals.
- Include readmissions and transfers occurring in the hospital.
- Include hospitalizations of state residents only.
- Include out-of-state hospitalizations of state residents if the data are available.
- Include records with a date of discharge between January 1 and December 31 of the reporting year.
- Exclude records of patients who are hospitalized and have a discharge status of Death or Deceased.
- Create the drug overdose hospitalization subset by searching ICD-9-CM principal diagnosis codes **AND** external-cause-of-injury codes³:
 - Using the principal diagnosis:
 - Search only the principal diagnosis field for the diagnosis codes 960-979.
 - Using the external cause of injury:
 - Search all diagnosis fields.
 - If a designated external-cause-of-injury field is in the data set, start with that field.
 - Count the first-listed external-cause-of-injury code from the list below.

Principal Diagnosis		First-listed External Cause of Injury
960-979	OR	E850-E858, E950.0-E950.5, E962.0
		E980.0-E980.5

- Once the drug overdose hospitalization subset has been created, calculate case counts for the morbidity indicators for hospitalization as defined for each individual indicator (see pages 23-25).

Background on PDMP Data

Prescription Drug Monitoring Programs (PDMPs) are state-run electronic databases used to track the prescribing and dispensing of controlled prescription drugs to patients. The information collected by PDMPs varies from state to state. Some commonly collected elements include dispensing date, dispensing quantity, days of supply, national drug code (NDC), patient information, prescriber information, and pharmacy information.

Instructions for Using PDMP Data

In order to build the PDMP indicators in this toolkit, it is preferred that states have physical access to their PDMP data, for instance, SAS datasets.

In order to use the PDMP indicator sample SAS code, please check the following:

- 1) Your PDMP SAS data has the necessary variables and columns as shown in the data dictionary below
- 2) The variables/columns' names are exactly the same as those in the data dictionary; if you have different names in your data, please change the names to those in the data dictionary.

The SAS program files for calculating PDMP indicators titled "prepare PDMP data" should be run first to prepare your PDMP SAS dataset for calculating the indicators found within this toolkit.

Variable Name	Type	Values	Label	Format
pharmacy	char	alpha-numeric	Deidentified pharmacy ID	
pharmzip	char	digits	Pharmacy zip code	
prescriber	char	alpha-numeric	Deidentified prescriber ID	
preszip	char	digits	Prescriber zip code	
dayssupply	num	digits	Days supply of prescription	
filldate	num	sas date	Date filled	MDDYY10
metric_qty	num	digits	Quantity prescribed	
ndcnum	num	digits	National Drug Code (NDC) number	
birthyr	num	four digits	Patient year of birth	
patientid	char	alpha-numeric	Deidentified patient ID	
patzip	char	digits	Patient zip code	
drugname	char	characters	Drug name	
payment_method*	char	characters	Method of payment*	
patstate	char	two character state abbr.	Patient state	
pharmst	char	two character state abbr.	Pharmacy state	
presst	char	two character state abbr.	Prescriber state	
gender	char	varying	Patient gender	

*Method of payment: 01=Private Pay, 02=Medicaid, 03=Medicare, 04=Commercial Insurance, 05=Military Installations and VA, 06=Workers' Compensation, 07=Indian Nations, 99=Other

Population Denominators

State (or other jurisdiction) resident populations should be calculated for the corresponding year-of-death data by the same age categories as required for age adjusting (<1 year, 1-4 years, 5-14 years, 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, 75-84 years, 85+ years.) Population data should be obtained from CDC WONDER bridged race population estimates (see <http://wonder.cdc.gov/bridged-race-population.html>.) The vintage year of the population used should correspond to the year of the indicator data and should be noted when referencing the source of the population estimates. [Vintage year definition (from WONDER): “Each year following the decennial census, the U.S. Census Bureau produces a series of postcensal estimates that includes estimates for the current data year and revised estimates for earlier years...A series of estimates is referred to as a Vintage and the last year in a series is used to name it.”]

The population estimates should be copied and pasted into the reporting template for calculating rates.

Reporting the Indicators

The following pages contain specific case definitions for each of the indicators. These case definitions should be applied when determining case counts.

Before using the provided sample SAS code:

- 1) Make sure your SAS data directory is correct
- 2) Verify that variable names in your data are the same as the names in the SAS program
- 3) Update the year (in the sample code, 2013 is used as an example)
- 4) fill in your state name’s abbreviation through the SAS program where a state abbreviation appears



Additional Resources

Supporting Literature, Articles, and Resources

Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting System (WISQARS). Atlanta, GA: CDC, National Center for Injury Prevention and Control (producer); 2015. Available at: www.cdc.gov/ncipc/wisqars.

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Gabella BA, Proescholdbell SK, Johnson RL, Thomas KE. State special emphasis report: Instructions for drug overdose death data. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2014. Available at: <http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/Injury/2012-Drug-Deaths-SER-Instruc.pdf>.

Council of State and Territorial Epidemiologists (CSTE) Overdose Subcommittee. Search Tool to Identify Specific Drugs and Other Terms Associated with Drug Overdose Deaths from the Death Certificate Literal Text. Available at: <http://www.cste.org/members/group.aspx?id=87615>.

Council of State and Territorial Epidemiologists (CSTE) Overdose Subcommittee. Recommendations and Lessons Learned for Improved Reporting of Drug Overdose Deaths on Deaths Certificates. Available at: http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PDFs/PDFs2/4_25_2016_FINAL-Drug_Overdos.pdf.

Warner M, Paulozzi LJ, Nolte KB, Davis GG, Nelson LS. State variation in certifying manner of death and drugs involved in drug intoxication deaths. Acad Forensic Pathol 2013;3(2):231–7. Available at: <http://s3.documentcloud.org/documents/1151267/heroin-project-2014-study-on-overdose-deaths.pdf>

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3. Injury Surveillance Workgroup 7. Consensus Recommendations for National and State Poisoning Surveillance. Atlanta, GA: The Safe States Alliance; 2012. Available at: <http://www.cste.org/?InjuryResources>.
4. Abellera J, Annett JL, Conn JM, Kohn M. How States Are Collecting and Using Cause of Injury Data: 2004 Update of the 1997 Report. A Survey by CSTE, APHA-ICEHS, and STIPDA. Available at: <http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/Injury/ECODEFinal3705.pdf>.
5. Centers for Medicare and Medicaid Services. Medicare Billing: 837I and Form CMS-1450. Available at: <http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/837I-FormCMS-1450-ICN006926.pdf>.
6. The U.S. Department of Health and Human Services and the Centers for Medicare and Medicaid Services. International Classification of Diseases 9th Revision Clinical Modification. Available at: www.cdc.gov/nchs/icd/icd9cm.htm.

Mortality Indicators (with applicable ICD-10 codes)

Mortality Indicators	Applicable ICD-10 codes
1. All Drug Overdose Deaths	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent
2. Drug Overdose Deaths Involving Opioids	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with any of the following ICD-10 contributing cause-of-death codes: T40.0: Opium T40.1: Heroin T40.2: Natural and semisynthetic opioids T40.3: Methadone T40.4: Synthetic opioids, other than methadone T40.6: Other and unspecified narcotics
3. Drug Overdose Deaths Involving Natural, Semi-synthetic and Synthetic Opioids	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with any of the following ICD-10 contributing cause-of-death codes: T40.2: Natural and semisynthetic opioids T40.3: Methadone T40.4: Synthetic opioids, other than methadone
4. Drug Overdose Deaths Involving Prescription Opioid Pain Relievers: Natural and Semi-synthetic Opioids and Methadone	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with any of the following ICD-10 contributing cause-of-death codes: T40.2: Natural and semisynthetic opioids T40.3: Methadone
5. Drug Overdose Deaths Involving Natural and Semi-synthetic Opioids	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with the following ICD-10 contributing cause-of-death code: T40.2: Natural and semisynthetic opioids
6. Drug Overdose Deaths Involving Synthetic Opioids Other than Methadone	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with the following ICD-10 contributing cause-of-death code: T40.4: Synthetic opioids other than methadone
7. Drug Overdose Deaths Involving Methadone	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with the following ICD-10 contributing cause-of-death code: T40.3: Methadone
8. Drug Overdose Deaths Involving Heroin	Deaths with any of the following ICD-10 codes as an underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent AND with the following ICD-10 contributing cause-of-death code: T40.1: Heroin

Mortality Indicator 1: All Drug Overdose Deaths

Definition of the indicator	Drug overdose deaths caused by acute poisonings. This indicator includes all overdose deaths, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. This indicator does not include: (1) deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), 2) deaths due to alcohol and tobacco, and 3) deaths that occur under the influence of drugs, but do not involve acute poisoning (e.g., a car crash that occurred because the driver was drowsy from taking a prescription drug).
Demographic group	All state residents.
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).
Limitations of indicator	Drug overdose deaths represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose. The indicator does not distinguish between prescription and illicit drugs as the cause of death.
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete; while investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause code of R99, “other ill-defined and unspecified causes of mortality”). Analysis of the percentage of death certificates with an underlying cause of death of R99 by age, over time, and by jurisdiction should be conducted to determine potential impact of incomplete underlying causes of death on drug overdose death indicators.

Mortality Indicator 2: Drug Overdose Deaths Involving Opioids

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve any opioid as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Opioids include both prescription opioid pain relievers such as hydrocodone, oxycodone, and morphine, as well as heroin, opium, and synthetic opioids such as fentanyl that may be prescription or illicitly-manufactured. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.						
Demographic group	All state residents.						
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: - X40-X44: Accidental poisonings by drugs - X60-X64: Intentional self-poisoning by drugs - X85: Assault by drug poisoning - Y10-Y14: Drug poisoning of undetermined intent With any of the following ICD-10 multiple cause-of-death codes: <table> <tr> <td>T40.0: Opium</td><td>T40.3: Methadone</td></tr> <tr> <td>T40.1: Heroin</td><td>T40.4: Synthetic opioids, other than methadone</td></tr> <tr> <td>T40.2: Natural and semisynthetic opioids</td><td>T40.6: Other and unspecified narcotics</td></tr> </table>	T40.0: Opium	T40.3: Methadone	T40.1: Heroin	T40.4: Synthetic opioids, other than methadone	T40.2: Natural and semisynthetic opioids	T40.6: Other and unspecified narcotics
T40.0: Opium	T40.3: Methadone						
T40.1: Heroin	T40.4: Synthetic opioids, other than methadone						
T40.2: Natural and semisynthetic opioids	T40.6: Other and unspecified narcotics						
Denominator	Midyear population for the calendar year under surveillance.						
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).						
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).						
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).						
Limitations of indicator	Drug overdose deaths involving opioids represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose. The indicator does not distinguish between prescription and illicit drugs as the cause of death. This indicator also does not distinguish between opioids used for the treatment of pain and opioids used for the treatment of substance use disorder.						
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete; while investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause-of-death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving opioids. The percentage of death certificates with information on the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific drugs may have involved opioids. Estimates of fatal drug overdoses involving opioids may be underestimated from lack of drug specificity.						

Mortality Indicator 3: Drug Overdose Deaths Involving Natural, Semi-Synthetic and Synthetic Opioids

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve opioid pain relievers as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Opioid pain relievers include prescribed drugs such as hydrocodone, oxycodone, morphine, as well as synthetic opioids such as fentanyl that may be prescription or illicitly-manufactured. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.								
Demographic group	All state residents.								
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: <table> <tr> <td>X40-X44: Accidental poisonings by drugs</td><td>X60-X64: Intentional self-poisoning by drugs</td></tr> <tr> <td>X85: Assault by drug poisoning</td><td>Y10-Y14: Drug poisoning of undetermined intent</td></tr> </table> With any of the following ICD-10 multiple cause-of-death codes: <table> <tr> <td>T40.2: Natural and semisynthetic opioids</td><td>T40.3: Methadone</td></tr> <tr> <td colspan="2">T40.4: Synthetic opioids, other than methadone</td></tr> </table>	X40-X44: Accidental poisonings by drugs	X60-X64: Intentional self-poisoning by drugs	X85: Assault by drug poisoning	Y10-Y14: Drug poisoning of undetermined intent	T40.2: Natural and semisynthetic opioids	T40.3: Methadone	T40.4: Synthetic opioids, other than methadone	
X40-X44: Accidental poisonings by drugs	X60-X64: Intentional self-poisoning by drugs								
X85: Assault by drug poisoning	Y10-Y14: Drug poisoning of undetermined intent								
T40.2: Natural and semisynthetic opioids	T40.3: Methadone								
T40.4: Synthetic opioids, other than methadone									
Denominator	Midyear population for the calendar year under surveillance.								
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).								
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).								
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).								
Limitations of indicator	Drug overdose deaths involving prescription opioid pain relievers represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose. Illicitly-manufactured drugs (e.g., non-pharmaceutical fentanyl) cannot be distinguished from pharmaceutical drugs with ICD-10 mortality data. Therefore, this indicator may overestimate the number of deaths involving prescription opioid pain relievers when deaths involve illicitly-manufactured synthetic opioid drugs.								
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete; while investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving opioid pain relievers. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific drugs involved may have involved opioid pain relievers. Estimates of fatal drug overdoses involving opioid pain relievers may be underestimated from lack of drug specificity. Additionally, deaths involving heroin might be misclassified as involving morphine (a natural opioid), because morphine is a metabolite of heroin.								

Mortality Indicator 4: Drug Overdose Deaths Involving Prescription Opioid Pain Relievers: Natural and Semi-Synthetic Opioids and Methadone

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve certain subcategories of prescription opioid pain relievers as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Prescription opioid pain relievers include such drugs as hydrocodone, oxycodone, morphine, and methadone. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.
Demographic group	All state residents.
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent With any of the following ICD-10 multiple cause-of-death codes: T40.2: Natural and semisynthetic opioids T40.3: Methadone
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).
Limitations of indicator	Drug overdose deaths involving prescription opioid pain relievers represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose. This indicator does not distinguish between opioids used for the treatment of pain and opioids used for the treatment of substance use disorder. This indicator also does not distinguish between pharmaceutical opioids and illicitly-manufactured opioids. Drug overdose deaths involving these drugs are captured in Indicator 6, “Drug Overdose Deaths Involving Synthetic Opioids Other than Methadone.”
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete. While investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving opioid pain relievers. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific drugs may have involved opioid pain relievers. Estimates of fatal drug overdoses involving opioid pain relievers may be underestimated from lack of drug specificity. Additionally, deaths involving heroin might be misclassified as morphine (a natural opioid), as morphine is a metabolite of heroin.

Mortality Indicator 5: Drug Overdose Deaths Involving Natural and Semi-Synthetic Opioids

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve natural and semisynthetic opioids as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Natural and semisynthetic opioids include drugs such as morphine, codeine, hydrocodone, and oxycodone. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.				
Demographic group	All state residents.				
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: <table> <tr> <td>X40-X44: Accidental poisonings by drugs</td><td>X60-X64: Intentional self-poisoning by drugs</td></tr> <tr> <td>X85: Assault by drug poisoning</td><td>Y10-Y14: Drug poisoning of undetermined intent</td></tr> </table> With the following ICD-10 multiple cause-of-death code: T40.2: Natural and semisynthetic opioids	X40-X44: Accidental poisonings by drugs	X60-X64: Intentional self-poisoning by drugs	X85: Assault by drug poisoning	Y10-Y14: Drug poisoning of undetermined intent
X40-X44: Accidental poisonings by drugs	X60-X64: Intentional self-poisoning by drugs				
X85: Assault by drug poisoning	Y10-Y14: Drug poisoning of undetermined intent				
Denominator	Midyear population for the calendar year under surveillance.				
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).				
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).				
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).				
Limitations of indicator	Drug overdose deaths involving natural and semisynthetic opioids represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose.				
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete. While investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving opioid pain relievers. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific types of drugs involved may include some deaths involving natural and semisynthetic opioids. Estimates of fatal drug overdoses involving natural and semisynthetic opioids may be underestimated from lack of drug specificity. Additionally, deaths involving heroin might be misclassified as involving morphine (a naturally derived opioid), because morphine is a metabolite of heroin.				

Mortality Indicator 6: Drug Overdose Deaths Involving Synthetic Opioids Other than Methadone

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve synthetic opioids other than methadone as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Synthetic opioids include such drugs as tramadol and fentanyl that may be prescription or illicitly-manufactured. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.
Demographic group	All state residents.
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent With the following ICD-10 multiple cause-of-death code: T40.4: Synthetic opioids other than methadone
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).
Limitations of indicator	Drug overdose deaths involving synthetic opioids other than methadone represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and overdose. ICD-10 codes for underlying and multiple causes of death by specific drugs do not distinguish between prescription (or “pharmaceutical”) drugs manufactured legally from those manufactured illicitly and will both be captured by this category.
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete. While investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving synthetic opioids other than methadone. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific types of drugs involved may have involved synthetic opioids other than methadone. Estimates of fatal drug overdoses involving synthetic opioids may be underestimated from lack of drug specificity. Additionally, synthetic opioid drugs produced illicitly (e.g., non-pharmaceutical fentanyl) are not identified separately from prescription (“pharmaceutical”) synthetic opioids in ICD-10 codes. Consequently, numbers of deaths from synthetic opioids may represent both deaths from prescription synthetic opioids and non-pharmaceutical synthetic opioids.

Mortality Indicator 7: Drug Overdose Deaths Involving Methadone

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve methadone as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined) or type of drug. Methadone is a synthetic opioid used both as a pain reliever and in medicated assisted therapy for opioid use disorder. Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.
Demographic group	All state residents.
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent With the following ICD-10 multiple cause-of-death code: T40.3: Methadone
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).
Limitations of indicator	Drug overdose deaths involving methadone represent only a small proportion of the overall burden of drug misuse, abuse, dependence, and non-fatal overdose. This indicator does not distinguish between opioids used for the treatment of pain and opioids used for the treatment of substance use disorder.
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete. While investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may contribute to an undercount of drug overdose deaths involving methadone. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how the information is reported on death certificates may also vary. Drug overdose deaths that lack information about the specific types of drugs involved may have involved methadone. Estimates of fatal drug overdoses involving methadone may be underestimated from lack of drug specificity.

Mortality Indicator 8: Drug Overdose Deaths Involving Heroin

Definition of the indicator	Drug overdose deaths caused by acute poisonings that involve heroin as a contributing cause of death, regardless of intent (e.g., unintentional, suicide, assault, or undetermined). Deaths related to chronic use of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.
Demographic group	All state residents.
Numerator	Deaths with any of the following ICD-10 codes as the underlying cause of death: X40-X44: Accidental poisonings by drugs X60-X64: Intentional self-poisoning by drugs X85: Assault by drug poisoning Y10-Y14: Drug poisoning of undetermined intent With the following ICD-10 multiple cause-of-death code: T40.1: Heroin
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual number of deaths. Annual mortality rate—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).
Data resources	Death certificate data from vital statistics agencies (numerator) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Calendar year based on date of death. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., report drug overdose deaths occurring from January 1 through June 30 and July 1 through December 31).
Limitations of indicator	Drug overdose deaths involving heroin represent only a portion of the adverse health outcomes associated with heroin use (e.g., opioid use disorder, infectious diseases from injection drug use).
Limitations of data resources	The accuracy of indicators based on codes found in vital statistics data is limited by the completeness and quality of reporting and coding. Death investigations may require weeks or months to complete. While investigations are being conducted, deaths may be assigned a pending status on the death certificate (ICD-10 underlying cause of death code of R99, “other ill-defined and unspecified causes of mortality”). Death certificates with incomplete underlying causes of death may undercount drug overdose deaths involving heroin. The percentage of death certificates with information regarding the specific drug(s) involved in drug overdose deaths varies substantially by state and local jurisdiction and may vary over time. The substances tested for, the circumstances under which the tests are performed, and how information is reported on death certificates may also vary. Drug overdose deaths that lack information on the specific drugs involved may have involved heroin. Additionally, some deaths involving heroin might be misclassified as involving morphine (a natural opioid) because morphine is a metabolite of heroin.

Morbidity Indicators (with applicable ICD-9-CM codes)

Morbidity Indicators – Emergency Department Visits		
9. All Drug Overdose Emergency Department Visits	ED visits with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	960-979: Poisoning by Drugs, Medicinal, and Biological Substances	E850-E858: Accidental Poisoning by Drugs, Medicinal Substances, and Biologicals E950.0-E950.5: Suicide and Self-Inflicted Poisoning by Solid or Liquid Substances E962.0: Assault by Drugs and Medicinal Substances E980.0-E980.5: Poisoning by Solid or Liquid Substances Undetermined Whether Accidentally or Purposely Inflicted
10. Emergency Department Visits Involving All Opioid Overdose Excluding Heroin	ED visits with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	965.00: Poisoning by Opium 965.02: Poisoning by Methadone 965.09: Poisoning by Other Opiates and Related Narcotics	E850.1: Accidental Poisoning by Methadone E850.2: Accidental Poisoning by Other Opiates and Related Narcotics
11. Emergency Department Visits Involving Heroin Overdose	ED visits with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	965.01: Poisoning by Heroin	E850.0: Accidental Poisoning by Heroin

Morbidity Indicators – Hospitalizations		
12. All Drug Overdose Hospitalizations	Hospitalizations with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	960-979: Poisoning by Drugs, Medicinal, and Biological Substances	E850-E858: Accidental Poisoning by Drugs, Medicinal Substances, and Biologicals E950.0-E950.5: Suicide and Self-Inflicted Poisoning by Solid or Liquid Substances E962.0: Assault by Drugs and Medicinal Substances E980.0-E980.5: Poisoning by Solid or Liquid Substances Undetermined Whether Accidentally or Purposely Inflicted
13. Hospitalizations Involving All Opioid Overdose Excluding Heroin	Hospitalizations with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	965.00: Poisoning by Opium 965.02: Poisoning by Methadone 965.09: Poisoning by Other Opiates and Related Narcotics	E850.1: Accidental Poisoning by Methadone E850.2: Accidental Poisoning by Other Opiates and Related Narcotics
14. Hospitalizations Involving Heroin Overdose	Hospitalizations with the following ICD-9-CM codes:	
	Principal Diagnosis	OR First-listed External Cause of Injury
	965.01: Poisoning by Heroin	E850.0: Accidental Poisoning by Heroin

Morbidity Indicator 9: All Drug Overdose Emergency Department Visits

Definition of the indicator	All drug overdose emergency department visits caused by non-fatal acute poisonings due to the effects of drugs, regardless of intent (e.g., suicide, unintentional, or undetermined) or type of drug. Emergency department visits related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.									
Demographic group	All state residents.									
Numerator	Emergency Department Visits for All Drug Overdose ICD-9-CM Codes³<table><tr><td>Principal Diagnosis</td><td></td><td>First-listed External Cause of Injury</td></tr><tr><td>960-979</td><td>OR</td><td>E850-E858, E950.0-E950.5, E962.0</td></tr><tr><td></td><td></td><td>E980.0-E980.5</td></tr></table>	Principal Diagnosis		First-listed External Cause of Injury	960-979	OR	E850-E858, E950.0-E950.5, E962.0			E980.0-E980.5
Principal Diagnosis		First-listed External Cause of Injury								
960-979	OR	E850-E858, E950.0-E950.5, E962.0								
		E980.0-E980.5								
Denominator	Midyear population for the calendar year under surveillance.									
Measures of frequency	Annual number of emergency department visits. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).									
Data resources	State emergency department data (numerator) and population estimates from CDC Wonder (denominator).									
Period for case definition	Calendar year (January 1 through December 31) based on date of ED visit. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related ED visit occurring from January 1 through June 30 and July 1 through December 31).									
Limitations of indicator	Injuries that result in emergency department visits represent only a portion of the overall burden of all drug overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.									
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in emergency department data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.									

Morbidity Indicator 10: Emergency Department Visits Involving All Opioid Overdose Excluding Heroin

Definition of the indicator	Emergency department visits caused by non-fatal acute poisonings due to the effects of all opioids, excluding heroin, regardless of intent (e.g., suicide, unintentional, or undetermined). Emergency department visits related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.						
Demographic group	All state residents.						
Numerator	Emergency Department Visits for All Opioid Overdose Excluding Heroin ICD-9-CM Codes³ <table><tr><td>Principal Diagnosis</td><td></td><td>First-listed External Cause of Injury</td></tr><tr><td>965.00, 965.02, 965.09</td><td>OR</td><td>E850.1, E850.2</td></tr></table>	Principal Diagnosis		First-listed External Cause of Injury	965.00, 965.02, 965.09	OR	E850.1, E850.2
Principal Diagnosis		First-listed External Cause of Injury					
965.00, 965.02, 965.09	OR	E850.1, E850.2					
Denominator	Midyear population for the calendar year under surveillance.						
Measures of frequency	Annual number of emergency department visits. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).						
Data resources	State emergency department data (numerator) and population estimates from CDC Wonder (denominator).						
Period for case definition	Calendar year (January 1 through December 31) based on date of ED visit. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related ED visit occurring from January 1 through June 30 and July 1 through December 31).						
Limitations of indicator	Injuries that result in emergency department visits represent only a portion of the overall burden of opioid overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.						
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in emergency department data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.						

Morbidity Indicator 11: Emergency Department Visits Involving Heroin Overdose

Definition of the indicator	Emergency department visits caused by non-fatal acute poisonings due to the effects of heroin, regardless of intent (e.g., suicide, unintentional, or undetermined). Emergency department visits related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.						
Demographic group	All state residents.						
Numerator	Emergency Department Visits for Heroin Overdose ICD-9-CM Codes³ <table><tr><td>Principal Diagnosis</td><td></td><td>First-listed External Cause of Injury</td></tr><tr><td>965.01</td><td>OR</td><td>E850.0</td></tr></table>	Principal Diagnosis		First-listed External Cause of Injury	965.01	OR	E850.0
Principal Diagnosis		First-listed External Cause of Injury					
965.01	OR	E850.0					
Denominator	Midyear population for the calendar year under surveillance.						
Measures of frequency	Annual number of emergency department visits. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).						
Data resources	State emergency department data (numerator) and population estimates from CDC Wonder (denominator).						
Period for case definition	Calendar year (January 1 through December 31) based on date of ED visit. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related ED visit occurring from January 1 through June 30 and July 1 through December 31).						
Limitations of indicator	Injuries that result in emergency department visits represent only a portion of the overall burden of heroin overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.						
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in emergency department data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.						

Morbidity Indicator 12: All Drug Overdose Hospitalizations

Definition of the indicator	All drug overdose hospitalizations caused by non-fatal acute poisonings due to the effects of drugs, regardless of intent (e.g., suicide, unintentional, or undetermined) or type of drug. Hospitalizations related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.		
Demographic group	All state residents.		
Numerator	Hospitalizations for All Drug Overdose ICD-9-CM Codes³		
	Principal Diagnosis	OR	First-listed External Cause of Injury
	960-979		E850-E858, E950.0-E950.5, E962.0
			E980.0-E980.5
Denominator	Midyear population for the calendar year under surveillance.		
Measures of frequency	Annual number of hospitalizations. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).		
Data resources	State hospital discharge data (numerator) and population estimates from CDC Wonder (denominator).		
Period for case definition	Calendar year (January 1 through December 31) based on date of discharge. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related hospitalization occurring from January 1 through June 30 and July 1 through December 31).		
Limitations of indicator	Injuries that result in hospitalizations represent only a portion of the overall burden of all drug overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.		
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in hospitalization data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.		

Morbidity Indicator 13: Hospitalizations Involving All Opioid Overdose Excluding Heroin

Definition of the indicator	Hospitalizations caused by non-fatal acute poisonings due to the effects of all opioids drugs, excluding heroin, regardless of intent (e.g., suicide, unintentional, or undetermined). Hospitalizations related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.								
Demographic group	All state residents.								
Numerator	Hospitalizations for All Opioid Overdose Excluding Heroin ICD-9-CM Codes³<table><tr><td>Principal Diagnosis</td><td></td><td>First-listed External Cause of Injury</td></tr><tr><td>965.00, 965.02, 965.09</td><td>OR</td><td>E850.1, E850.2</td></tr></table>			Principal Diagnosis		First-listed External Cause of Injury	965.00, 965.02, 965.09	OR	E850.1, E850.2
Principal Diagnosis		First-listed External Cause of Injury							
965.00, 965.02, 965.09	OR	E850.1, E850.2							
Denominator	Midyear population for the calendar year under surveillance.								
Measures of frequency	Annual number of hospitalizations. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).								
Data resources	State hospital discharge data (numerator) and population estimates from CDC Wonder (denominator).								
Period for case definition	Calendar year (January 1 through December 31) based on date of discharge. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related hospitalization occurring from January 1 through June 30 and July 1 through December 31).								
Limitations of indicator	Injuries that result in hospitalization represent only a portion of the overall burden of opioid overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.								
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in hospitalization data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.								

Morbidity Indicator 14: Hospitalizations Involving Heroin Overdose

Definition of the indicator	Hospitalizations caused by non-fatal acute poisonings due to the effects of heroin, regardless of intent (e.g., suicide, unintentional, or undetermined). Hospitalizations related to late effects, adverse effects, and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded from this indicator.								
Demographic group	All state residents.								
Numerator	Hospitalizations for Heroin Overdose ICD-9-CM Codes ³								
	<table><tr><td>Principal Diagnosis</td><td></td><td>First-listed External Cause-of-Injury</td></tr><tr><td>965.01</td><td>OR</td><td>E850.0</td></tr></table>			Principal Diagnosis		First-listed External Cause-of-Injury	965.01	OR	E850.0
Principal Diagnosis		First-listed External Cause-of-Injury							
965.01	OR	E850.0							
Denominator	Midyear population for the calendar year under surveillance.								
Measures of frequency	Annual number of hospitalizations. Annual incidence—crude and age-adjusted (standardized by the direct method to the year 2000 standard U.S. population).								
Data resources	State hospital discharge data (numerator) and population estimates from CDC Wonder (denominator).								
Period for case definition	Calendar year (January 1 through December 31) based on date of discharge. If feasible and high quality data are available, jurisdictions are encouraged to analyze their data twice a year (e.g., overdose related hospitalization occurring from January 1 through June 30 and July 1 through December 31).								
Limitations of indicator	Injuries that result in hospitalization represent only a portion of the overall burden of heroin overdoses. Cases are selected based on the principal diagnosis code or first-listed valid external cause code only, not on any mention of an opioid overdose code. The sensitivity and specificity of these indicators may vary by year, hospital location, and drug type.								
Limitations of data resources	The accuracy of indicators based on ICD-9-CM codes found in hospitalization data is limited by the completeness and quality of reporting and coding. The overall completeness of external cause coding is of particular concern and should be reviewed in conjunction with the indicator.								

PDMP Indicators

PDMP Indicators
15. Percent of prescribers registered with PDMP 16. Number of pharmacists registered with PDMP 17. PDMP consulting requirements – pick only one, categories are mutually exclusive: a. Prescribers are required to consult the PDMP before initial opioid and benzodiazepine prescriptions and at least every three months thereafter, or b. Prescribers are required to consult the PDMP before initial opioid prescriptions and again within one year, or c. Prescribers are not required to consult the PDMP before initial opioid prescriptions, OR such a requirement does exist but there is no required subsequent check and/or the policy includes subjective standards or broad exceptions 18. Required reporting time for pharmacy data submission 19. Proactive reporting – External PDMP Notifications 20. Proactive reporting – Internal PDMP Notifications 21. PDMP linkages – pick only one, categories are mutually exclusive: a. PDMP is not linked to EHR or operational in any large health care system, or b. PDMP is linked to EHR and operational in at least one large health care system, or c. PDMP is linked to EHR and operational in more than one large health care system 22. Number and rate of opioid analgesics per 1,000 state residents 23. Percent of patients receiving more than an average daily dose of ≥ 90 morphine milligram equivalents (MME) of opioid analgesics 24. Rate of multiple provider episodes for prescription opioids (five or more prescribers and five or more pharmacies in a six-month period) per 100,000 residents 25. Percent of patients prescribed long-acting/extended-release (LA/ER) opioids who were opioid-naïve (i.e., patients who have not taken opioid analgesics in 60 days). 26. Percent of patient prescription days with overlapping opioid prescriptions 27. Percent of patient prescription days with overlapping opioid and benzodiazepine prescriptions

PDMP Indicator 15: Percent of prescribers registered with PDMP

Definition of the indicator	Percentage of healthcare professionals with prescribing privileges (i.e., with a DEA number) for controlled substances and registered with the state PDMP.
Numerator	All healthcare professionals with prescribing privileges for controlled substances and registered with the state PDMP.
Denominator	DEA licensed prescribers who wrote at least one prescription during the calendar year being reported.

PDMP Indicator 16: Number of pharmacists registered with PDMP

Definition of the indicator	All healthcare professionals able to dispense controlled substances and registered with the state PDMP.
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PDMP Indicator 17: PDMP consulting requirements

Definition of the indicator	Pick only one, categories are mutually exclusive: a. Prescribers are required to consult the PDMP before initial opioid and benzodiazepine prescriptions and at least every three months thereafter, or b. Prescribers are required to consult the PDMP before initial opioid prescriptions and again within one year, or c. Prescribers are not required to consult the PDMP before initial opioid prescriptions, OR such a requirement does exist but there is no required subsequent check and/or the policy includes subjective standards or broad exceptions.
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PDMP Indicator 18: Required reporting time for pharmacy data submission

Definition of the indicator	The timeframe in which a pharmacy is required to report dispensing data to the PDMP.
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Optional data to report Average number of days from dispensing to being able to access data in the PDMP.

PDMP Indicator 19: Proactive reporting – External PDMP Notifications

Definition of the indicator	A type of proactive reporting in which reports are sent to prescribers outside the PDMP system. No action by intended recipient is necessary to receive the report (i.e., email or mail reports without accessing the PDMP or without the request of the PDMP user).
Numerator	The number of external PDMP reports sent to prescribers.
Denominator	Number of DEA licensed prescribers who wrote at least one prescription in the last six months.

PDMP Indicator 20: Proactive reporting – Internal PDMP Notifications

Definition of the indicator	A type of proactive reporting in which reports are sent to prescribers within the PDMP system. The intended recipient or entity of the notification must log in to the PDMP to receive the actual report (i.e., dashboard, email, or mail reports while accessing the PDMP or at the request of the PDMP user).
Numerator	The number of internal PDMP reports sent to prescribers.
Denominator	Number of DEA licensed prescribers who wrote at least one prescription in the last six months.

PDMP Indicator 21: PDMP linkages

Definition of the indicator	Pick only one, categories are mutually exclusive: a. PDMP is not linked to EHR or operational in any health care system (hospitals, clinics, FQHCs, rural health centers, etc.), or b. PDMP is linked to EHR and operational in at least one health care system, or c. PDMP is linked to EHR and operational in more than one health care system.
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PDMP Indicator 22: Number and rate of opioid analgesics per 1,000 state residents

Definition of the indicator	Opioid analgesic controlled substance prescriptions dispensed. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Schedule II, III, and IV opioid analgesic prescriptions dispensed to state residents within the state. Exclusion criteria can be found above in the definition of the indicator.
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Annual and quarterly number of prescriptions. Annual and quarterly crude prescription rates.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Annually and quarter year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31).
Limitations of indicator	Prescription numbers represent only one measure of prescription opioids in a state. Dosage and duration of prescriptions are not captured by the measure. The indicator does not capture whether the dispensed medications were taken as prescribed or taken by prescribed patient. The indicator does not capture opioids used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Numbers of prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the number of prescriptions captured. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

PDMP Indicator 23: Percent of patients receiving more than an average daily dose of ≥ 90 morphine milligram equivalents (MME) of opioid analgesics

Definition of the indicator	Patients with an average of ≥ 90 MME of opioid analgesic drugs prescribed per day in a given quarter. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Number of patients with an average of ≥ 90 MME of opioid analgesic drugs prescribed per day in a given quarter, limited to schedule II, III, and IV drugs. Exclusion criteria can be found above in the definition of the indicator. Average MME per day is calculated from total number of MMEs from all drugs prescribed per day, inclusive of overlapping prescriptions of either the same or and differing drugs, divided by the total number of prescription days. Limited to state residents with prescriptions in the state PDMP.
Denominator	State residents who received an opioid analgesic prescription, identified as numerator, for the quarter in the calendar year under surveillance in the state PDMP.
Measures of frequency	Quarterly percentage of patients receiving more than an average daily dose of ≥ 90 MME.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs).
Period for case definition	Quarter year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31).
Limitations of indicator	High MME represents only one measure of opioid prescribing. Neither patient diagnosis nor clinician specialty is delineated with the indicator, nor is co-prescribing of drugs that are contraindicated (e.g., benzodiazepines). The indicator does not capture whether the dispensed medications were taken as prescribed or taken by the prescribed patient. The indicator does not capture opioids used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Indicators at the patient level also depend on specific PDMP procedures for determining which prescriptions belong to the same patient. Prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the prescriptions captured. Methods used to identify and match/link unique patients within a PDMP vary in completeness and accuracy. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

PDMP Indicator 24: Rate of multiple provider episodes for prescription opioids per 100,000 residents

Definition of the indicator	Number of patients receiving prescriptions for opioid analgesics from five or more prescribers dispensed at five or more pharmacies in a six-month period, per 100,000 residents. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Number of patients receiving prescriptions for opioid analgesics from five or more prescribers and that are dispensed at five or more pharmacies in a six-month period, limited to schedule II, III, and IV drugs. Other exclusion criteria can be found above in the definition of the indicator. Limited to state residents with prescriptions in the state PDMP.
Denominator	Midyear population for the calendar year under surveillance.
Measures of frequency	Semi-annual rate of patients receiving prescriptions for opioid analgesics from five or more prescribers dispensed at five or more pharmacies in a six-month period.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs) and population estimates from the U.S. Census Bureau or suitable alternative (denominator).
Period for case definition	Half year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through June 30, July 1 through December 31).
Limitations of indicator	Multiple provider episodes (MPE) represents only one measure of opioid prescribing. Neither patient diagnoses nor clinician specialty is delineated with the indicator. The indicator does not capture whether the dispensed medications were taken as prescribed or taken by the prescribed patient. The indicator does not capture opioids used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Indicators at the patient level also depend on specific PDMP procedures for determining which prescriptions belong to the same patient. Prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the prescriptions captured. Methods used to identify and match/link unique patients within a PDMP vary in completeness and accuracy. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

PDMP Indicator 25: Percent of patients prescribed long-acting/extended-release opioids who were opioid-naïve

Definition of the indicator	Patients with no prescribed opioid prescriptions in the previous 60 days who were prescribed at least one long acting/extended release (LA/ER) opioid, among all patients with LA/ER opioid prescriptions. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Number of patients per quarter prescribed at least one LA/ER opioid prescription who had not been dispensed an opioid prescription in the previous 60 days. Limited to schedule II, III, and IV drugs. Other exclusion criteria can be found above in the definition of indicator. Limited to state residents with prescriptions in the state PDMP.
Denominator	State residents in the state PDMP who received an LA/ER opioid prescription for the quarter in the calendar year under surveillance.
Measures of frequency	Quarterly percentage of patients receiving LA/ER prescriptions who were opioid-naïve.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs).
Period for case definition	Quarter year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31).
Limitations of indicator	Percentage of opioid-naïve patients receiving LA/ER opioids represents only one measure of opioid prescribing. Neither patient diagnosis nor clinician specialty is delineated with the indicator. The indicator does not capture whether the dispensed medications were taken as prescribed or taken by the prescribed patient. The indicator does not capture opioids used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Indicators at the patient level also depend on specific PDMP procedures for determining which prescriptions belong to the same patient. Prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the prescriptions captured. Methods used to identify and match/link unique patients within a PDMP vary in completeness and accuracy. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

PDMP Indicator 26: Percent of patient prescription days with overlapping opioid prescriptions

Definition of the indicator	Total number of days that patients had more than one prescribed opioid prescription, among all prescription days. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Total number of days per quarter any patient has more than one opioid prescription. A day with more than two overlapping prescriptions is still counted as one day of overlapping prescriptions. Prescriptions are limited to schedule II, III, and IV drugs. Other exclusion criteria can be found above in the definition of indicator. Limited to state residents with prescriptions in the state PDMP.
Denominator	Total number of opioid prescription days, i.e. sum of prescribed opioid days (exclusion criteria of opioids applied), for state residents in the state PDMP for the quarter. A prescribed day with overlapping opioid prescriptions (≥ 2) is only counted as one prescribed opioid day.
Measures of frequency	Quarterly percentage of days that patients had more than one opioid prescription on the same day.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs).
Period for case definition	Quarter year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31).
Limitations of indicator	Overlapping opioid prescriptions is only one measure of opioid prescribing. The indicator does not capture whether the opioids prescribed were long acting/extended release or short acting. Neither patient diagnosis nor clinician specialty is delineated with indicator. The indicator does not capture whether the dispensed medications were taken as prescribed or taken by the prescribed patient. The indicator does not capture opioids used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Indicators at the patient level also depend on specific PDMP procedures for determining which prescriptions belong to the same patient. Prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the prescriptions captured. Methods used to identify and match/link unique patients within a PDMP vary in completeness and accuracy. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

PDMP Indicator 27: Percent of patient prescription days with overlapping opioid and benzodiazepine prescriptions

Definition of the indicator	Total number of days that patients had an opioid and benzodiazepine prescription on the same day, among all opioid prescription days. This indicator includes select dispensed prescription opioids as entered into the state prescription drug monitoring program (PDMP) system. Drugs administered to patients by substance abuse treatment programs are usually excluded from PDMP files and therefore will not be captured by this indicator. Additional exclusion criteria are: (1) drugs not typically used in outpatient settings or otherwise not critical for calculating dosages in morphine milligram equivalents (MME), such as cough and cold formulations including elixirs, and combination products containing antitussives, decongestants, antihistamines, and expectorants; (2) buprenorphine products indicated for medication assisted treatment (MAT) to treat opioid use disorder. CDC's National Center for Injury Prevention and Control has compiled a file of controlled substances (opioids with their oral MME conversion factors, benzodiazepines, muscle relaxants, stimulants, and zolpidem) at the National Drug Code level to help with analyzing PDMP data, also called the CDC MME file. The CDC MME file should be used to identify select opioids in PDMP data. The MME file already excludes drugs under exclusion criteria (1). To further exclude buprenorphine products for MAT, please carefully follow the accompanying toolkit SAS program for merging the MME file with PDMP data. CDC's MME file is available at: http://www.cdc.gov/drugoverdose/media/.
Demographic group	All state residents.
Numerator	Total number of days per quarter any patient had at least one opioid AND at least one benzodiazepine prescription on the same day. Prescriptions are limited to schedule II, III, and IV drugs. Other exclusion criteria can be found above in the definition of the indicator. Limited to state residents with prescriptions in the state PDMP.
Denominator	Total number of opioid prescription days, i.e. sum of prescribed opioid days (exclusion criteria of opioids applied), for state residents in the state PDMP for the quarter. A prescribed day with overlapping opioid prescriptions (≥ 2) and/or overlapping opioid and benzodiazepine prescriptions (≥ 2) is only counted as one prescribed opioid day.
Measures of frequency	Quarterly percentage of days that patients have both an opioid and benzodiazepine prescription on the same day.
Data resources	Prescription data from the state prescription drug monitoring program (also called prescription monitoring programs and controlled substances programs).
Period for case definition	Quarter year based on dispensed date of prescription (i.e., prescriptions dispensed from January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31).
Limitations of indicator	Overlapping opioid and benzodiazepine prescriptions are only one measure of opioid prescribing. The indicator does not capture prescription dosage, nor whether the opioids prescribed were long acting/extended release or short acting. The indicator does not capture whether the dispensed medications were taken as prescribed or taken by the prescribed patient. The indicator does not capture opioids, benzodiazepines or any other drugs used outside of medical care. The indicator does not capture prescriptions of state residents when they are filled in other states.
Limitations of data resources	The accuracy of indicators based on PDMP data is limited by the completeness and quality of the data. Indicators at the patient level also depend on specific PDMP procedures for determining which prescriptions belong to the same patient. Prescriptions captured by a PDMP will vary based on the schedule of controlled substances (schedules II-V) required to be reported to the PDMP. Types of pharmacies required to enter into the PDMP (Veterans Affairs, Indian Health Service, mail-order, online/Internet, resident prescriptions dispensed at out-of-state pharmacies) will also affect the prescriptions captured. Methods used to identify and match/link unique patients within a PDMP vary by completeness and accuracy. Rescheduling and upscheduling of specific drugs (e.g., tramadol, hydrocodone) will affect trends over time.

Sample SAS Code for Mortality Indicators

```

/*-----*/
/*
/* Code to calculate drug overdose deaths from a multiple cause of death
/* mortality file. This code produces counts for all ages, and by age
/* categories. The counts are then exported into Excel files, where crude
/* rates and age-adjusted rates are then calculated. Some users may prefer
/* to calculate rates using SAS instead of Excel (code not shown).
/*
/*
/* Date created: January 25, 2016.
/* Last updated: April 25, 2016.
/* Code written by: RARudd, CDC/NCIPC/Rx Drug Overdose Epi & Surv Team.
/*
/*-----*/;

```

```
libname mortdata "\\path to mortality data is here\";
```

```
/* format for age category variable, if needed. */
```

```
proc format;
```

```
VALUE AGECAT_F
```

```
  .='missing'
```

```
  1='<1 yr old'
```

```
  2='1-4 yrs'
```

```
  3='5-14 yrs'
```

```
  4='15-24 yrs'
```

```
  5='25-34 yrs'
```

```
  6='35-44 yrs'
```

```
  7='45-54 yrs'
```

```
  8='55-64 yrs'
```

```
  9='65-74 yrs'
```

```
 10='75-84 yrs'
```

```
 11='85+ yrs'
```

```
;
```

```
RUN;
```

```

/*****
/* The following data step sets up a datafile from a state mortality file that
/* would contain all resident deaths for a state for a specified year. This data
/* step creates a file that will contain deaths only from drug poisonings (also
/* referred to as drug overdoses). The state file should include all resident deaths,
/* whether or not they occurred in state or out of state.
/* In this code, the "ICD10-3" variable indicates a variable that contains the
/* 3 digit alphanumeric underlying cause of death code (for example, X40, X41,
/* etc.) and "raxis1" through "raxis20" contains the 20 multiple cause of death
/* of codes, which are 4 digit alphanumeric codes (e.g., T402).
/*
/* The data set needs to contain an age category variable that has the age of the
/* decedent coded into the following age categories: <1, 1-4 yrs, 5-14 yrs,
/* 15-24 yrs, 25-34 yrs, 35-44 yrs, 45-54 yrs, 55-64 yrs, 65-74 yrs, 75-84 yrs, 85+ yrs.
/*
/* Note in the drug definitions below, a death coded as involving "any opioid"
/* includes opium, heroin, natural and semi-synthetic opioids, methadone, synthetic
/* opioids, and unspecified narcotics (the large majority of which are opioids).
/*
/* Note that two different categories of "prescription opioid deaths" are calculated
/* below. One definition includes deaths from natural and semi-synthetic opioids
/* (T40.2), methadone (T40.3), and synthetic opioids other than methadone (T40.4).
/* This definition may include a fairly large percentage of deaths in the T40.4
/* category that involve illicit opioids, such as non-pharmaceutical fentanyl.
/* It should be considered whether the number of deaths from illicit opioids in this
/* definition require it to be footnoted in publications (noting the type of drugs
/* involved in the category) or possibly omitted from publications.
/*
/* A second definition of "prescription opioid deaths" included below includes only
/* deaths from natural and semi-synthetic opioids (T40.2) and methadone (T40.3).
/* This more limited definition of prescription opioid deaths allows for deaths from
/* synthetic opioids (other than methadone) to be analyzed separately from other
/* prescription opioids, and thereby removes the need to discuss the potential
/* impact of illicit fentanyl on the category.
/*
/* Also included is code to calculate the number of drug overdose deaths involving
/* benzodiazepenes and the number of drug overdose deaths where a specific drug
/* or the type of narcotic drug is not listed on the death certificate. Although this
/* information is not required for reporting to CDC, the calculations are important
/* for examining data quality (unspecified drugs or unspecified narcotics on death
/* certificate) and for examining the co-occurrence of benzodiazepines
/* in opioid overdose deaths.
/*
/* Deaths of any intent (unintentional, intentional, undetermined) are captured in
/* these counts.
*****/

```

```

data drug_dths_2014;
set mortdata.state_mortality_file_name;

```

```

/**** Limiting file to drug poisoning deaths only. ****/
if ("X40"<=ICD10_3<="X44" or "X60"<=ICD10_3<="X64" or ICD10_3="X85" or "Y10"<=ICD10_3<="Y14") ;

drugpois=1;          /**** all records in file are drug poisoning (overdose) deaths ****/
anyopioid=0;         /**** drug OD deaths involving any type of opioid ****/
heroin=0;            /**** drug OD deaths involving heroin ****/
rxopioid_incl_T404=0; /**** drug OD deaths involving prescription opioids (see note above) ****/
rxopioid_wo_T404=0;  /**** drug OD deaths involving prescription opioids (see note above) ****/
opioid_402=0;        /**** drug OD deaths involving natural and semi-synthetic opioids ****/
opioid_403=0;        /**** drug OD deaths involving methadone ****/
opioid_404=0;        /**** drug OD deaths involving synthetic opioids, excl methadone ****/
oth_unspec_narc=0;   /**** drug OD deaths involving unspecified narcotic ****/
T509=0;              /**** drug OD deaths with at least one drug unspecified ****/
alltcodesbut509=0;   /**** drug OD deaths involving any specified drug ****/
benzos=0;            /**** drug OD deaths involving benzodiazepenes ****/

/**** Creating a flag variable that will be used to count numbers of deaths involving ****/
/**** various drugs. ****/

ARRAY drugs (20) $ raxis1--raxis20 ;

DO i = 1 to 20;
  if drugs(i) in ("T400","T401","T402","T403","T404","T406") then anyopioid=1;
  if drugs(i)="T401" then heroin=1;
  if drugs(i) in ("T402","T403","T404") then rxopioid_incl_T404=1;
  if drugs(i) in ("T402","T403") then rxopioid_wo_T404=1;
  if drugs(i) ="T402" then opioid_402=1;
  if drugs(i) ="T403" then opioid_403=1;
  if drugs(i) ="T404" then opioid_404=1;

  *these categories are not required indicators but are useful for checking data quality;
  if drugs(i)="T406" then oth_unspec_narc=1;
  if drugs(i)="T509" then T509=1;
  if ("T360"<=drugs(i)<="T508") then alltcodesbut509=1;

  *Note: benzos are not a required indicator but coding is offered as benzos are often tracked with opioid deaths.
;
  if drugs(i)="T424" then benzos=1;
END;

format agecat agecat_f. ; /* format statement, if needed, for agecat variable */
run;

/*****
/* Proc freqs on drug overdose death categories. */
*****/

Title1 "Drug poisoning (overdose) deaths, by drug involved, all intents" ;
Title2 "(note that categories are not exclusive, as drug overdose deaths";

```

```

Title3 "may include more than one drug)";
proc freq data=drug_dths_2014 ;
  tables drugpois anyopioid heroin rxopioid_incl_T404 rxopioid_wo_T404 opioid_403 opioid_404
  oth_unspec_narc benzos / missing;
run;

Title;
Title1 "Drug poisoning (overdose) deaths with no drug specified";
Title2 h=2.5 "(divide this count by total number of drug OD deaths to obtain % without any drug specified)";
proc freq data=drug_dths_2014 ;
  tables T509 / missing;
  where allcodesbut509=0 and T509=1;
run;

Title1 "Drug poisoning (overdose) deaths that involve both prescription opioids" ;
Title2 "and benzodiazepines";
Title3 ;
proc freq data=drug_dths_2014 ;
  tables (rxopioid_incl_T404 rxopioid_wo_T404 ) * benzos / nocol norow nopercnt missing;
run;

/*****
/* Running numbers of deaths overall and by age categories needed for
/* age adjusting, then exported to Excel file.
*****/;

Title;
%macro counts(var1);
proc freq data=drug_dths_2014 ;
  tables &var1 / out=&var1;
run;
%mend counts;

%counts(drugpois)
%counts(anyopioid)
%counts(heroin)
%counts(rxopioid_incl_T404)
%counts(rxopioid_wo_T404)
%counts(opioid_402)
%counts(opioid_403)
%counts(opioid_404)

data drug_cts;
  length category $ 60 catnum 3;
  set drugpois (in=a)
    anyopioid (in=b)
    heroin (in=c)
    rxopioid_incl_T404 (in=d)
    rxopioid_wo_T404 (in=e)

```

```

        opioid_402 (in=f)
        opioid_403 (in=g)
        opioid_404 (in=h)
;

if a then do; category="All drug poisoning (overdose) deaths"; catnum=1; end;
if b then do; category="Drug OD deaths involving any opioid"; catnum=2; end;
if c then do; category="Drug OD deaths involving heroin"; catnum=3; end;
if d then do; category="Drug OD deaths involving prescription opioids, incl synthetic opioids"; catnum=4; end;
if e then do; category="Drug OD deaths involving prescription opioids, excluding synthetic opioids"; catnum=5; end;
if f then do; category="Drug OD deaths involving natural/semi-synthetic opioids"; catnum=6; end;
if g then do; category="Drug OD deaths involving methadone"; catnum=7; end;
if h then do; category="Drug OD deaths involving synthetic opioids, excl methadone"; catnum=8; end;

if drugpois=1 or anyopioid=1 or heroin=1 or rxopioid_incl_T404 or rxopioid_wo_T404 or opioid_402=1 or
opioid_403=1 or opioid_404=1;

drop drugpois anyopioid heroin rxopioid_incl_T404 rxopioid_wo_T404 opioid_402 opioid_403 opioid_404
percent;
run;

proc print data=drug_cts; run;

LIBNAME tables "\\{path to for exported file location goes here}\\drugdths_2014.xls";
DATA tables.overall;
    SET drug_cts;
RUN;
libname tables CLEAR; quit;

/*****
*** Drug OD deaths by age category. ***
*****/

Title;
%macro agecats(var1,outname,outname2);
proc freq data=drug_dths_2014 ;
    tables agecat * &var1 / norow nocol nopercnt sparse out=&outname;
run;

data &outname2;
    retain agecatname &var1 count;
    set &outname;
    agecatname=vvalue(agecat);
    drop percent agecat;
    where &var1=1;
run;

%mend agecats;

```

```
%agecats(drugpois,drugpoisage,drugpoisagecat)
%agecats(anyopioid,opioidage,opioidagecat)
%agecats(heroin,heroinage,heroinagecat)
%agecats(rxopioid_incl_T404,rxopi_def1_age,rxopi_def1_agecat)
%agecats(rxopioid_wo_T404,rxopi_def2_age,rxopi_def2_agecat)
%agecats(opioid_402,opi_402age,opi_402agecat)
%agecats(opioid_403,opi_403age,opi_403agecat)
%agecats(opioid_404,opi_404age,opi_404agecat)
```

```
proc print data=drugpoisage; run;
proc print data=drugpoisagecat; format _all_ ;run;
```

```
proc print data=heroinage; run;
proc print data=heroinagecat; run;
```

```
/* ***** */
/* This data step exports each SAS data set to a sheet in an Excel workbook. The name of the */
/* workbook is given in the libname statement. The new data set (e.g., "drugpois") becomes the name */
/* of the Excel sheet in the workbook. (Note that a text substitution macro could also be used for these */
/* exports, but for ease of understanding, the libname/data step was written for each data set export. */
/* */
/* This code may cause errors for any user who is exporting from 64-bit SAS to 32-bit Excel. To address */
/* that environment, alternative SAS coding for exporting to Excel is included following the data steps. */
/* ***** */
```

```
LIBNAME tables "\\{path to exported file location goes here}\\drugdths_2014.xls";
DATA tables.drugpois;
  SET drugpoisagecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\\drugdths_2014.xls";
DATA tables.allopioids;
  SET opioidagecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\\drugdths_2014.xls";
DATA tables.rxopi_incl_syn;
  SET rxopi_def1_agecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\\drugdths_2014.xls";
DATA tables.rxopi_wo_syn;
  SET rxopi_def2_agecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\drugdths_2014.xls";
DATA tables.nat_semisyn;
    SET opi_402agecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\drugdths_2014.xls";
DATA tables.methadone;
    SET opi_403agecat;
RUN;
libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\drugdths_2014.xls";
DATA tables.synthetic;
    SET opi_404agecat;
RUN; libname tables CLEAR; quit;
```

```
LIBNAME tables "\\{path to exported file location goes here}\drugdths_2014.xls";
DATA tables.heroin;
    SET heroinagecat;
RUN;
libname tables CLEAR; quit;
```

```

/*****
/* Exporting SAS files, if using 64-bit SAS and 32-bit Excel.
*****/

```

```
proc export data=work.drugpoisagecat
    outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
    dbms=xls replace label;
    sheet="drugpois";
```

```
proc export data=work.opioidagecat
    outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
    dbms=xls replace label;
    sheet="allopoids";
```

```
proc export data=work.rxopi_def1_agecat
    outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
    dbms=xls replace label;
    sheet="rxopi_incl_syn";
```

```
proc export data=work.rxopi_def2_agecat
    outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
    dbms=xls replace label;
    sheet="rxopi_wo_syn";
```

```
proc export data=work.opi_402agecat
  outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
  dbms=xls replace label;
  sheet="nat_semisyn";
```

```
proc export data=work.opi_403agecat
  outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
  dbms=xls replace label;
  sheet="methadone";
```

```
proc export data=work.opi_404agecat
  outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
  dbms=xls replace label;
  sheet="synthetic";
```

```
proc export data=work.heroinagecat
  outfile=" C:\_YOUR_FILE_PATH_\drugdths_2014.xls"
  dbms=xls replace label;
  sheet="heroin";
```

Sample SAS Code for Morbidity Indicators – Emergency Department Visits

*Sample PfS Non-Fatal(Morbidity)Indicators SAS program;

```
/*-----*/
/*
/* Code to calculate drug overdose emergency department visits
/* This code produces counts for all ages, and by age
/* categories. The counts are exported into Excel files, where crude
/* rates and age-adjusted rates can then be calculated.
/*
/* Date created: May 13, 2016.
/* Last updated: July 11, 2016.
/* Code written by: Kun Zhang and Pedro Martinez, CDC/NCIPC/Rx Drug Overdose Team.*/
/*
/*-----*/;
```

*folder/path to create permanent data set with libname statement, if needed;

libname stateED "\\path to where state ED visit data is located\"; *State ED Visits Folder location;

libname PfsNFM "\\path to where ED visit PfS Morbidity Indicators is will be saved\"; *PfS Non-Fatal Morbidity Indicators Folder;

/* format for age category variable, if needed. */

option obs=Max;

proc format;

value agecat_f

.= 'missing'

1= '<1 yr old'

2= '1-4 yrs'

3= '5-14 yrs'

4= '15-24 yrs'

5= '25-34 yrs'

6= '35-44 yrs'

7= '45-54 yrs'

8= '55-64 yrs'

9= '65-74 yrs'

10= '75-84 yrs'

11= '85+ yrs'

;

run;

```
/******
```

```
/* The following two data step sets up a data file from state emergency department (ED) visits
and may require additional SAS programming to adapt state specific variable names, libname
statement paths, inclusion and exclusion criteria. The data steps are to be run for 2013 and
2014 baseline years.
```

The first data step creates an all drug overdose (also referred to as drug poisonings).

The originating state file should:

- Include nonfederal, acute care-affiliated facilities excluding Veterans Affairs (VA) and other federal hospitals, rehabilitation centers, and psychiatric hospitals.
- Include ED visits for state residents only.
 - If the data are available, out-of-state ED visits of state residents should be included.
- Include records that have an ED visit between January 1, 2013 and December 31, 2014.
 - Exclude records of patients that are seen in the ED and then admitted to the hospital. For most states, these records are not included in their ED data.
- Exclude records of patients that are seen in the ED and resulted in a discharge status of death or deceased.

The second data step will run counts for the PfS non-fatal morbidity indicators.

```
/* This code is written to utilize ICD-9-CM codes. The dx1 variable contains 3 to 5 characters and reflects
the principal diagnoses codes. The ecode variable contains 4 to 5 characters and reflect
the first-listed external-cause code. The ecode array do loop is set to query 10 ecode fields, however
states may need to adapt the array do loop to reflect the number of ecodes available in their data sets.
```

```
/* The data set needs to contain an age category variable that has the age coded into the following age
categories:
```

```
<1, 1-4 yrs, 5-14 yrs, 15-24 yrs, 25-34 yrs, 35-44 yrs, 45-54 yrs, 55-64 yrs, 65-74 yrs, 75-84 yrs, 85+ yrs.
```

```
*/
```

```
/* ED visits of any intent (unintentional, intentional, undetermined) are captured in */
/* these counts; */
```

*PfS Non-Fatal(Morbidity)Indicators SAS program to create drug overdose subset;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

```
Data PfsNFM.drug_edd_year;
```

```
set stateED.yourEDdata_year;
```

```
*age categories;
```

```
if age<1 then agecat=1;
```

```
if 1 <=age<5 then agecat=2;
```

```
if 5 <=age<15 then agecat=3;
```

```
if 15 <=age<25 then agecat=4;
```

```
if 25 <=age<35 then agecat=5;
```

```
if 35 <=age<45 then agecat=6;
```

```
if 45 <=age<55 then agecat=7;
```

```
if 55 <=age<65 then agecat=8;
```

```
if 65 <=age<75 then agecat=9;
```

```
if 75 <=age<85 then agecat=10;
```

```
if age>=85 then agecat=11;
```

*insert inclusion and exclusion statements here to limit the data set according to the guidance document;

*Principal diagnoses codes;

overdose1=0;

if '960' <= substr(dx1,1,3) <= '979' then overdose1=1;

*first-listed e-codes;

overdose2=0;

array ecode(10) \$ ecode1-ecode10; * different states might have different number of ecodes;

do i = 1 to 10;

if ('E850' <= substr(ecode[i],1,4) <= 'E858') or ('E9500' <= substr(ecode[i],1,5) <= 'E9505') or
('E9800' <= substr(ecode[i],1,5) <= 'E9805') or substr(ecode[i],1,5)='9620' then overdose2=1;

if overdose1=1 or overdose2=1;

end;

format agecat agecat_f. ;

run;

*Pfs Non-Fatal(Morbidity)Indicators SAS program to create indicators data set;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

data PfsNFM.NFindicators_year;

set PfsNFM.drug_edd_year;

opioid1=0;

heroin1=0;

if dx1 in ('96500','96502','96509') then opioid1=1;

if dx1='96501' then heroin1=1;

opioid2=0;

heroin2=0;

array ecode(10) \$ ecode1-ecode10; /* different states might have different number of ecodes */

do i = 1 to 10;

if ecode[i] in ('E8501','E8502') then opioid2=1;

if ecode[i]='E8500' then heroin2=1;

opioid=0;

heroin=0;;

if opioid1=1 or opioid2=1 then opioid=1;

if heroin1=1 or heroin2=1 then heroin=1;

end;

if overdose1=1 or overdose2=1 then alldrug=1; else alldrug=0;

run;

*Pfs Non-Fatal(Morbidity)Indicators SAS program to calculate counts/frequency;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

*All drug overdoses;

proc freq data=PfsNFM.NFindicators_year ; *update this line to reflect NFindicators data set name;

tables agecat*alldrug / missprint nocum nopercnt nocol norow out=NFalldrugEDD;

```
where alldrug=1; format agecat agecat_f. ;
run;
```

*Opioid Overdoses Excluding Heroin;

```
proc freq data=PfsNFM.NFindicators_year; *update this line to reflect NFindicators data set name;
tables agecat*opioid/ missprint nocum nopercnt nocol norow out=NFopioid;
Where opioid=1; format agecat agecat_f. ;
run;
```

*Heroin Overdoses;

```
proc freq data=PfsNFM.NFindicators_year; *update this line to reflect NFindicators data set name;
tables agecat*heroin/ missprint nocum nopercnt nocol norow out=NFheroin;
Where heroin =1; format agecat agecat_f. ;
run;
```

*Pfs Non-Fatal(Morbidity)Indicators SAS program to export frequency tables to excel in separate tabs per indicators, XML format;

*Use the counts and enter into the Age-Adjusted Excel Workbook for the corresponding Year, Emergency Visits data set, and Indicators;

```
ods tagsets.excelxp
file = 'path to where you want to save the XML file\NFindicators.xml' newfile=none STYLE=printer;
*ED Visits - All drug overdoses; *update year of sheet name to reflect analysis year;
ods tagsets.excelxp options (sheet_name= 'Alldrug OD ED YY');
proc print data=NFalldrug; Title NF All Drug Overdose ED Visits; run;
```

*ED Visits - Opioids excluding Heroin Overdoses; *update year of sheet name to reflect analysis year;

```
ods tagsets.excelxp options (sheet_name= 'Opioid OD ED YY');
proc print data=NFopioid; Title NF Opioids excluding Heroin Overdose ED Visits; run;
```

*ED Visits - Heroin Overdoses; *update year of sheet name to reflect analysis year;

```
ods tagsets.excelxp options (sheet_name= 'Heroin OD ED YY');
proc print data=NFheroin; Title NF Heroin Overdose ED Visits; run;
ods tagsets.excelxp close;
```

*end of SAS programs;

Sample SAS Code for Morbidity Indicators – Hospitalizations

*Sample Pfs Non-Fatal(Morbidity)Indicators SAS program;

```
/*-----*/
/*
/* Code to calculate drug overdose hospitalizations
/* This code produces counts for all ages, and by age
/* categories. The counts are exported into Excel files, where crude
/* rates and age-adjusted rates can then be calculated.
/*
/* Date created: May 13, 2016.
/* Last updated: July 11, 2016.
/* Code written by: Kun Zhang and Pedro Martinez, CDC/NCIPC/Rx Drug Overdose Team.*/
/*
/*-----*/;
```

*folder/path to create permanent data set with libname statement, if needed;

libname stateHDD "\\path to where state HDD is located\"; *State HDD Folder location;

libname PfsNFM "\\path to where Hospitalization Pfs Morbidity Indicators is will be saved\"; *Pfs Non-Fatal Morbidity Indicators Folder;

/* format for age category variable, if needed. */

option obs=Max;

proc format;

value agecat_f

.= 'missing'

1= '<1 yr old'

2= '1-4 yrs'

3= '5-14 yrs'

4= '15-24 yrs'

5= '25-34 yrs'

6= '35-44 yrs'

7= '45-54 yrs'

8= '55-64 yrs'

9= '65-74 yrs'

10= '75-84 yrs'

11= '85+ yrs'

;

run;

```

/*****
/* The following two data step sets up a data file from state hospital discharge data
and may require additional SAS programming to adapt state specific variable names, libname
statement paths, inclusion and exclusion criteria. The data steps are to be run for 2013 and
2014 baseline years.

```

The first data step creates an all drug overdose (also referred to as drug poisonings).
The originating state file should:

- Include only nonfederal, acute care, or inpatient facilities in your hospital discharge data (HDD) injury subset. This excludes Veterans Affairs (VA) and other federal hospitals, rehabilitation centers, and psychiatric hospitals.
- Include readmissions and transfers occurring in the hospital.
- Include hospitalizations of state residents only.
- If the data are available, out-of-state hospitalizations of state residents should be included.
- Include records that have a date of discharge between January 1, 2013 and December 31, 2014.
- Baseline discharge years from 2013 to 2014, will be reported individually per each indicator.
- Exclude records of patients that are hospitalized and resulted in a discharge status of death or

deceased.

The second data step will run counts for the PfS non-fatal morbidity indicators.

```

/* This code is written to utilize ICD-9-CM codes. The dx1 variable contains 3 to 5 characters and reflects
the principal diagnoses codes. The ecode variable contains 4 to 5 characters and reflect
the first-listed external-cause code. The ecode array do loop is set to query 10 ecode fields, however
states may need to adapt the array do loop to reflect the number of ecodes available in their data sets.

```

```

/* The data set needs to contain an age category variable that has the age coded into the following age
categories:

```

<1, 1-4 yrs, 5-14 yrs, 15-24 yrs, 25-34 yrs, 35-44 yrs, 45-54 yrs, 55-64 yrs, 65-74 yrs, 75-84 yrs, 85+ yrs.

```

*/

```

```

/* Hospitalizations of any intent (unintentional, intentional, undetermined) are captured in */

```

```

/* /* these counts; */

```

*PfS Non-Fatal(Morbidity)Indicators SAS program to create drug overdose subset;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

```

Data PfsNFM.drug_hdd_year;
set stateHDD.yourHDDdata_year;
*age categories;
if age<1 then agecat=1;
if 1 <=age<5 then agecat=2;
if 5 <=age<15 then agecat=3;
if 15<=age<25 then agecat=4;
if 25<=age<35 then agecat=5;
if 35<=age<45 then agecat=6;
if 45<=age<55 then agecat=7;
if 55<=age<65 then agecat=8;
if 65<=age<75 then agecat=9;
if 75<=age<85 then agecat=10;
if age>=85 then agecat=11;

```

*insert inclusion and exclusion statements here to limit the data set according to the guidance document;

*Principal diagnoses codes;

overdose1=0;

if '960' <= substr(dx1,1,3) <= '979' then overdose1=1;

*first-listed e-codes;

overdose2=0;

array ecode(10) \$ ecode1-ecode10; /* different states might have different number of ecodes;

do i = 1 to 10;

if ('E850' <= substr(ecode[i],1,4) <= 'E858') or ('E9500' <= substr(ecode[i],1,5) <= 'E9505') or
('E9800' <= substr(ecode[i],1,5) <= 'E9805') or substr(ecode[i],1,5)='9620' then overdose2=1;

if overdose1=1 or overdose2=1;

end;

format agecat agecat_f. ;

run;

*PfS Non-Fatal(Morbidity)Indicators SAS program to create indicators data set;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

data PfsNFM.NFindicators_year;

set PfsNFM.drug_hdd_year;

opioid1=0;

heroin1=0;

if dx1 in ('96500','96502','96509') then opioid1=1;

if dx1='96501' then heroin1=1;

opioid2=0;

heroin2=0;

array ecode(10) \$ ecode1-ecode10; /* different states might have different number of ecodes */

do i = 1 to 10;

if ecode[i] in ('E8501','E8502') then opioid2=1;

if ecode[i]='E8500' then heroin2=1;

opioid=0;

heroin=0;;

if opioid1=1 or opioid2=1 then opioid=1;

if heroin1=1 or heroin2=1 then heroin=1;

end;

if overdose1=1 or overdose2=1 then alldrug=1; else alldrug=0;

run;

*PfS Non-Fatal(Morbidity)Indicators SAS program to calculate counts/frequency;

*Baseline Years for 2013 and 2014 counts will be calculated and reported separately per indicator;

*All drug overdoses;

proc freq data=PfsNFM.NFindicators_year ; /*update this line to reflect NFindicators data set name;

tables agecat*alldrug / missprint nocum nopercnt nocol norow out=NFalldrug;

where alldrug=1; **format** agecat agecat_f. ;

```

run;

*Opioid Overdoses Excluding Heroin;
proc freq data=PfsNFM.NFindicators_year; *update this line to reflect NFindicators data set name;
tables agecat*opiod/ missprint nocum nopercnt nocol norow out=NFopiod;
Where opiod=1; format agecat agecat_f. ;
run;

*Heroin Overdoses;
proc freq data=PfsNFM.NFindicators_year; *update this line to reflect NFindicators data set name;
tables agecat*heroin/ missprint nocum nopercnt nocol norow out=NFheroin;
Where heroin =1; format agecat agecat_f. ;
run;

*PfS Non-Fatal(Morbidity)Indicators SAS program to export frequency tables to excel in separate tabs per indicators,
XML format;
*Use the counts and enter into the Age-Adjusted Excel Workbook for the corresponding Year, hospital discharge data
set, and Indicators;

ods tagsets.excelxp
file = 'path to where you want to save the XML file\NFindicatorsHDD.xml' newfile=none STYLE=printer;
*Hospitalizations - All drug overdoses; *update year of sheet name to reflect analysis year;
ods tagsets.excelxp options (sheet_name= 'Alldrug OD HDD YY');
proc print data=NFalldrug; Title NF All Drug Overdose Hospitalizations; run;

*Hospitalizations - Opioids excluding Heroin Overdoses; *update year of sheet name to reflect analysis year;
ods tagsets.excelxp options (sheet_name= 'Opioid OD HDD YY');
proc print data=NFopiod; Title NF Opioids excluding Heroin Overdose Hospitalizations; run;

*Hospitalizations - Heroin Overdoses; *update year of sheet name to reflect analysis year;
ods tagsets.excelxp options (sheet_name= 'Heroin OD HDD YY');
proc print data=NFheroin; Title NF Heroin Overdose Hospitalizations; run;
ods tagsets.excelxp close;

*end of SAS programs;

```

Sample SAS Code for PDMP Indicators

```

/*****
/*****  PDMP indicators  *****/
/***** */

*** CDC - PDO ***
*** May, 2016 ***

/* Create your libraries, these libraries should be used for all indicators
   This should always be the first step when you work on the indicators */
LIBNAME permlib '';
LIBNAME pdmplib '';
LIBNAME fmtbasic '';
OPTIONS FMTSEARCH=(FMTBASIC.FORMATS) obs=max;

/* Prepare PDMP dataset */

/* The very first step after creating libraries is to read and prepare your PDMP data,
   using year of 2013 as an example */

/* This mme file should be provided by CDC */
/* The mme file includes mme conversion factors for opioids */
data mmefile(keep=ndcnum master_form strength mme_conversion_factor generic_drug_name
  product_name drug drugcat deaclasscode dea_class);
set pdmplib.mmefile_2015;
run;

/* Your PDMP data (as SAS data set) should be including the following data elements or variables:
   patientid, birthyr, patstate, patzip, gender,
   prescriber, preszip, presst,
   filldate, dayssupply, metric_qty, drugname,
   ndcnum (numeric NDC number),
   pharmacy, pharmzip, pharmst */

/* IF your variable names are different,
   please make sure your variable names are the same as those above */

/* first, link the mme_file to the PDMP data */
proc sql;
create table pdmp_mmefile_link as
select a.*,b.*
from pdmplib.pdmp_2013 a
left join mmefile b
on a.ndcnum=b.ndcnum; /* if ndcnum is not numeric in your PDMP data, you need to convert it to numeric first */
quit;

data permlib.prescriptions2013;
set pdmp_mmefile_link;

cy = 2013;

```

```

if patientid~="";

if birthyr > 2013 or birthyr <= 1901 then age =.;
else age=cy-birthyr;

if age=. then agecat=.;
else if age <= 11 then agecat=1;
else if age <= 17 then agecat=2;
else if age <= 24 then agecat=3;
else if age <= 34 then agecat=4;
else if age <= 44 then agecat=5;
else if age <= 54 then agecat=6;
else if age <= 64 then agecat=7;
else agecat=8;

if gender = 1 then sex=1;
else if gender=2 then sex=2;
else sex=.;

if payment_method in (.,0,99) then cash=.;
else if payment_method = 1 then cash=1;
else cash= 0;

if payment_method in (.,0,99) then medicaid=.;
else if payment_method = 2 then medicaid=1;
else medicaid= 0;

if payment_method in (.,0,99) then medicare=.;
else if payment_method = 3 then medicare=1;
else medicare= 0;

if payment_method in (.,0,99) then commercial=.;
else if payment_method = 4 then commercial=1;
else commercial= 0;

/* To get rid of some outlier values */

if metric_qty <= 0 then negdose=1;
else negdose=0;

if dayssupply <= 0 then errorsupp=1;
else errorsupp=0;

if negdose = 1 or errorsupp = 1 or drugcat ne 1 then mme=.;
else mme=strength*mme_conversion_factor*(metric_qty/dayssupply);

if errorsupp=1 or negdose=1 or strength = . then opi_exclude=1;
else opi_exclude=0;

fillmonth=month(filldate);
monyear=put(fillmonth,2.)||'-2013';

if fillmonth in (1,2,3)      then qtryear='Q1-2013';
else if fillmonth in (4,5,6) then qtryear='Q2-2013';
else if fillmonth in (7,8,9) then qtryear='Q3-2013';
else if fillmonth in (10,11,12) then qtryear='Q4-2013';

```

```

if patstate in ('your state','your state') then patient_subset=1;
/* for example, if the state is Kentucky, put KY and ky in "your state",
   make sure KY and ky are the only two values for Kentucky in your data*/
else patient_subset=0;

if pharmst in ('your state', 'your state') then pharmacy_subset=1;
else pharmacy_subset=0;

if presst in ('your state', 'your state') then prescriber_subset=1;
else prescriber_subset=0;

/* Calculate distances */

pharm_distance=zipcitydistance(patzip,pharmzip);
prescriber_distance=zipcitydistance(patzip,preszip);

format agecat agecat. sex sex. drugcat drugcat.;
run;

/* Calculate PDMP indicators */

/* 22. Number and rate of opioid analgesics per 1,000 state residents */

%macro usage_drug (dsnin /*prescription data set*/,
                  qtr1 /*first quarter suffix*/,
                  qtr2 /*second quarter suffix*/,
                  qtr3 /*third quarter suffix*/,
                  qtr4 /*fourth quarter suffix*/,
                  state /*state*/,
                  dsnout1 /*output data set for opioids*/,
                  censusyear1 /*census year for first quarter*/,
                  censusyear2 /*census year for second quarter*/,
                  censusyear3 /*census year for third quarter*/,
                  censusyear4 /*census year for fourth quarter*/ );

options obs=max;

/* Read prescription data */
data opioids;
set permllib.&dsnin (keep=drugcat drug qtryear deaclasscode patient_subset);

if patient_subset=1; /* only keep state residents */
if deaclasscode in ('2','3','4'); /* keep drug schedules 2,3,4 */
if drugcat=1; /* only keep opioids */
drop deaclasscode patient_subset;
run;

/* counts by opioid drug, quarter */
proc sql;
create table opioids1 as
select drug, qtryear, count(*) as count
from opioids
where drug ne ''

```

```

group by drug, qtryear
order by drug, qtryear;
quit;

/* Transpose counts so there is one line for each type of opioid drug */
proc transpose data=opioids1 out=opioids2 prefix=count;
by drug;
id qtryear;
var count;
run;

data usage_opioids1;
set opioids2;
array count(4) count&qtr1 count&qtr2 count&qtr3 count&qtr4;

do i = 1 to 4;
  if count(i)=. then count(i)=0;
end;

drop _name_ i; drop _name_;
format drugcat drugcat.;
run;

/* read Census data,
   please give your folder a libname "pdmplib" where you stored the census data */
data census;
set pdmplib.census;
if state = "&state"; /* this is to only select your state's population */
drop state;
run;

/* combine prescription counts and census data */
proc sql;
create table usage_opioids2 as
select *
from census, usage_opioids1;
quit;

/* calculate rates per 1,000 people */
data usage_opioids3;
set usage_opioids2;

array counts(*) count&qtr1 count&qtr2 count&qtr3 count&qtr4;
array rates(*) rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4;
array pop(*) pop&censusyear1 pop&censusyear2 pop&censusyear3 pop&censusyear4;

do i = 1 to dim(counts);
  rates(i)=(counts(i)*1000)/pop(i);
end;

rateyr = sum(rate&qtr1, rate&qtr2, rate&qtr3, rate&qtr4);

array qtrrates{*} rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4 rateyr;

do j = 1 to dim(qtrrates);
  if qtrrates(j)=. then qtrrates(j)=0;

```

```

end;

keep drug rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4 rateyr;
run;

/* Create tables of prescription rates by types of opioids and by quarters */
proc sql;
create table usage_opioids4 as
select drug, rate&qtr1 format=comma12.2, rate&qtr2 format=comma12.2, rate&qtr3 format=comma12.2,
       rate&qtr4 format=comma12.2, rateyr format=comma12.2
from usage_opioids3
union
select 'total' as drug, sum(rate&qtr1) as rate&qtr1 format=comma12.2,
       sum(rate&qtr2) as rate&qtr2 format=comma12.2,
       sum(rate&qtr3) as rate&qtr3 format=comma12.2,
       sum(rate&qtr4) as rate&qtr4 format=comma12.2,
       sum(rateyr) as rateyr format=comma12.2
from usage_opioids3
quit;

data opi;
set usage_opioids4;

if drugcat=1 then do;
    drop drugcat;
    output opi;
end;
run;

/* need to enter where you want to store the output Excel table in front of \&dsnout1 */
proc export data=opi
outfile="\&dsnout1"
dbms=csv
replace;
run;

proc print data=opi;
run;

%mend usage_drug;

%usage_drug(prescriptions2013, Q1_2013, Q2_2013, Q3_2013, Q4_2013, state, usage_opi_2013.csv, 2013, 2013, 2013, 2013);
/* please change the macro elements in parentheses the accordingly */

/* PDMP indicator */
/* 23. Percent of patients receiving more than an average daily dose of >=90 morphine milligram equivalents */

%macro dailymme (dsnin);

/* First, read prescriptions */

data opioids;
set permllib.&dsnin(keep=patientid filldate dayssupply drug mme mme_conversion_factor qtryear);
if patient_subset=1; /* only state residents */

```

```

if drugcat=1 and opi_exclude=0; /* only keep opioids */
if deaclasscode in ('2','3','4');

enddate=sum(filldate, dayssupply)-1; /* find end date of prescription based on fill date and days of supply */
format enddate MMDDYY10.;
run;

/* *****
/* Processed by person to get mean MME for each person accounting for overlapping days if there are any */
/* *****

proc sort data=opioids;
by patientid filldate;
run;

/* create one record of fill dates for each person */

proc transpose data=opioids out=startdt_person (drop=_name_) prefix=start;
by patientid;
var filldate;
run;

/* create one record of end dates for each person/drug combo */

proc transpose data=opioids out=stopdt_person (drop=_name_) prefix=stop;
by patientid;
var enddate;
run;

/* create one record of mmes for each person/drug combo */

proc transpose data=opioids out=mme_person (drop=_name_) prefix=mme;
by patientid;
var mme;
run;

/* Merge transposed data sets */

data persontot1;
merge startdt_person stopdt_person mme_person;
by patientid;

array start(*) start;;
array stop(*) stop;;
array mme(*) mme;;
array sum_mme{4} sum_mme1-sum_mme4; /* sum of MME of each day within a quarter */
array days{366} days1-days366; /* so we can assign each day as a day having opioids or a day without opioids */
array q{366} q1-q366;

do i = 1 to 4;
sum_mme(i)=0;
end;

do i = 1 to 366;
days(i)=0;
q(i)=0;

```

```

end;

/* Count prescriptions */
count=0;

do k= 1 to dim(start);
  if start(k) ne . then count=count+1;
end;

/* Update sum of MME for each quarter */

do l = 1 to count;
  do date=start(l) to stop(l);
    dayofyear=mod(juldate(date),1000);
    days(dayofyear)=1;
    quarter=qtr(date);
    q(dayofyear)=quarter;
    sum_mme(quarter)=sum(sum_mme(quarter),mme(l));
  end;
end;

keep patientid days1-days366 q1-q366 sum_mme1-sum_mme4;
run;

/* Prescription days and mean MME for each person */

data persontot2;
set persontot1;

array totdays(4) totdays1-totdays4;
array sum_mme(4) sum_mme1-sum_mme4;
array meanmme(4) meanmme1-meanmme4;
array days(366) days1-days366;
array q(366) q1-q366;
array highmme(4) highmme1-highmme4;

do i = 1 to 4;
  totdays(i)=0;
end;

do i=1 to 366;
  if 1 <= q(i) <=4 then totdays(q(i))=sum(totdays(q(i)), days(i));
end;

do j = 1 to 4;
  if totdays(j)=0 then meanmme(j)=.;
  else meanmme(j)=sum_mme(j)/totdays(j);
  if meanmme(j) >90 then highmme(j)=1;
  else if 0 <= meanmme(j) <=90 then highmme(j)=0;
end;

keep patientid totdays1-totdays4 meanmme1-meanmme4 highmme1-highmme4;

run;

/* Calculate average MME for all patients and determine what percentage had mean MME>=90 */

```

```

proc sql;
create table high_mme as
select mean(highmme1)*100 as high_mme1,
       mean(highmme2)*100 as high_mme2,
       mean(highmme3)*100 as high_mme3,
       mean(highmme4)*100 as high_mme4
from persontot2;
quit;

%mend dailymme;

%daily_mme(prescriptions2013);

/* PDMP indicator */
/* 24. Rate of multiple provider episodes */

/* This is the program to calculate multiple provider episodes (MPE) per 100,000
The program contains two parts. The first part is to prepare the data that was
generated by program named "prepare PDMP data". The second part is a macro which
calls in the data generated by the first part to produce the final MPE rates */

/*****
***** Part I *****/
*****/

data prescriptions1;
set perm.lib.prescriptions2013 (keep=patientid agecat drugcat drug prescriber pharmacy deaclasscode patient_subset qtryear);

/* Keep opioids */
if drugcat=1;

/* Exclude schedules other than 2,3,4, also exclude prescriptions missing schedule data */
if deaclasscode in ('2','3','4');

/* Keep state residents */
if patient_subset=1;

if qtryear in ('Q1-2013', 'Q2-2013') then half=1;
else if qtryear in ('Q3-2013', 'Q4-2013') then half=2;

if agecat=. then agecatb=.;
else if agecat in (1,2) then agecatb=1;
else if agecat in (3,4) then agecatb=2;
else if agecat in (5,6) then agecatb=3;
else if agecat in (7,8) then agecatb=4;

drop patient_subset;
run;

/* Identify people engaged with questionable activity in each half of the year -
anybody with five prescribers, five pharmacies during the half */

/*****

```

```
proc sort data=prescriptions1;
by patientid half prescriber;
run;
```

```
data prescribercount (keep=patientid prescribers1 prescribers2);
set prescriptions1;
by patientid half prescriber;
array prescribers(2) prescribers1 prescribers2;
retain prescribers1-prescribers2 0;
if first.prescriber then prescribers(half)=prescribers(half)+1;
if last.patientid then do;
    output;
    prescribers1=0;
    prescribers2=0;
end;
run;
```

```
proc sort data=prescriptions1;
by patientid half pharmacy;
run;
```

```
data pharmacycount (keep=patientid pharmacies1 pharmacies2);
set prescriptions1;
by patientid half pharmacy;
array pharmacies(2) pharmacies1 pharmacies2;
retain pharmacies1-pharmacies2 0;
if first.pharmacy then pharmacies(half)=pharmacies(half)+1;
if last.patientid then do;
    output;
    pharmacies1=0;
    pharmacies2=0;
end;
run;
```

```
proc sql;
create table potential_qa as
select a.patientid, a.prescribers1, a.prescribers2, b.pharmacies1, b.pharmacies2
from prescribercount a, pharmacycount b
where a.patientid=b.patientid and ((prescribers1 >= 5 & pharmacies1 >= 5) or (prescribers2 >= 5 & pharmacies2 >= 5))
order by patientid;
quit;
```

```
proc sql;
create table qa_any as
select b.*
from potential_qa a
left join prescriptions1 b
on a.patientid=b.patientid
order by patientid;
quit;
```

```
data qa_prescriptions_sch2 qa_prescriptions_sch23 qa_prescriptions_sch234;
set qa_any;
if deaclasscode='2' then output qa_prescriptions_sch2;
if deaclasscode in ('2','3') then output qa_prescriptions_sch23;
if deaclasscode in ('2','3','4') then output qa_prescriptions_sch234;
```

```

run;

/*****/
proc sort data=qa_prescriptions_sch234;
by patientid half prescriber;
run;

data prescribercount_sch234 (keep=patientid prescribers1 prescribers2);
set qa_prescriptions_sch234;
by patientid half prescriber;
array prescribers(2) prescribers1 prescribers2;
retain prescribers1 prescribers2 0;
if first.prescriber then prescribers(half)=prescribers(half)+1;
if last.patientid then do;
    output;
    prescribers1=0;
    prescribers2=0;
end;
run;

proc sort data=qa_prescriptions_sch234;
by patientid half pharmacy;
run;

data pharmacycount_sch234 (keep=patientid pharmacies1 pharmacies2);
set qa_prescriptions_sch234;
by patientid half pharmacy;
array pharmacies(2) pharmacies1 pharmacies2;
retain pharmacies1 pharmacies2 0;
if first.pharmacy then pharmacies(half)=pharmacies(half)+1;
if last.patientid then do;
    output;
    pharmacies1=0;
    pharmacies2=0;
end;
run;

proc sql;
create table qa_sch234 as
select a.patientid, a.prescribers1 as sch234_prescribers1, a.prescribers2 as sch234_prescribers2, b.pharmacies1 as
    sch234_pharmacies1, b.pharmacies2 as sch234_pharmacies2
from prescribercount_sch234 a, pharmacycount_sch234 b
where a.patientid=b.patientid and ((a.prescribers1 >= 5 & b.pharmacies1 >= 5) or (a.prescribers2 >= 5 & b.pharmacies2 >= 5))
order by patientid;
quit;

data permllib.mpe_half_2013;
merge qa_any
    qa_sch234 (in=in234);
by patientid;

if sch234_prescribers1 >= 5 and sch234_pharmacies1 >= 5 then sch234_qa1=1;
else sch234_qa1=0;
if sch234_prescribers2 >= 5 and sch234_pharmacies2 >= 5 then sch234_qa2=1;
else sch234_qa2=0;

```

```
keep patientid--agecatb sch234_qa1 sch234_qa2;
run;
```

```
/******  
***** Part II *****  
*****
```

```
%macro mpe_half_opioid (dsnin /*multiple provider episode data set*/,  
                        half1 /*first half suffix*/,  
                        half2 /*second half suffix*/,  
                        state /*state*/,  
                        dsnout /*output data set*/,  
                        censusyear1 /*census year for first half of the year*/,  
                        censusyear2 /*census year for second half of the year*/);
```

```
/* Read MPE data set generated in Part I */
```

```
data prescriptions1;  
set permlib.&dsnin(keep= patientid agecatb drugcat sch234_qa1 sch234_qa2);
```

```
if agecatb=. then delete;
```

```
opioid1=0;  
opioid2=0;
```

```
/* If MPE found in quarter, set drug category/ half variable to 1 */
```

```
if sch234_qa1=1 then do;  
  if drugcat=1 then opioid1=1;  
end;
```

```
if sch234_qa2=1 then do;  
  if drugcat=1 then opioid2=1;  
end;
```

```
run;
```

```
/* Create patient data set for opioid use involving MPE */
```

```
proc sql;  
create table opioid_1 as  
select distinct patientid, max(opioid1) as opioid1, max(opioid2) as opioid2, agecatb  
from prescriptions1  
group by patientid;  
quit;
```

```
proc sql;  
create table opioid_totals as  
select sum(opioid1) as count1, sum(opioid2) as count2, 5 as agecatb  
from opioid_1;  
quit;
```

```

data classes1;
set opioid_totals;
format drugcat drugcat. agecatb agecatb;

array counts(2) count1 count2;

do i = 1 to 2;
  if counts(i)=. then counts(i)=0;
end;

drop i;
run;

/* Read Census data */
data census;
set pdmplib.census;
if state = "&state"; /* this is to only select your state's population */
drop state;
run;

/* Combine census with MPE counts */

proc sql;
create table classes2 as
select *
from census a, classes1 b;
quit;

/* Rates by 1000000 people */
data classes3;
set classes2;

if agecatb=5 then rate&half1 =(count1*100000)/pop&censusyear1;
if agecatb=5 then rate&half2 =(count2*100000)/pop&censusyear2;
rateyr = mean(rate&half1, rate&half2);

array halfrates{*} rate&half1 rate&half2 rateyr;

do j = 1 to dim(halfrates);
  if halfrates(j)=. then halfrates(j)=0;
end;
run;

/* Generate the final table of MPE rates */
proc sql;
create table classes4 as
select drugcat, agecatb format=agecatb. , rate&half1 format=comma12.2, rate&half2 format=comma12.2, rateyr
format=comma12.2
from classes3;
quit;

/* Export the final table
  need to enter where you want to store the output Excel table in front of \&dsnout */
proc export data=classes4

```

```

outfile="\&dsnout"
dbms=csv
replace;
run;

%mend mpe_half_opioid;

%mpe_half_opioid(mpe_half_2013, half1, half2, state, mpe_half_opioid_2013.csv, 2013, 2013);
/* Please change the macro elements in parentheses the accordingly */

/* PDMP indicator */
/* 25. Percent of patients prescribed long-acting/extended-release opioids who were opioid-naive patients */

%macro opioid_naive (dsnin1 /*prescription data set for previous year, if available.
                        if not, leave blank. the first quarter's % opi-naive will be high*/,
                    dsnin2 /*prescription data set for target year*/,
                    perstart /*three months prior beginning of target year*/,
                    perend /*end of year*/,
                    qtr1 /*first quarter suffix*/,
                    qtr2 /*second quarter suffix*/,
                    qtr3 /*third quarter suffix*/,
                    qtr4 /*fourth quarter suffix*/,
                    dsnout /*output data set*/);

/* Merge prescription data for previous year and target year */

data prescriptions1;

set %if (&dsnin1^=) %then /*if we have data for the previous year, include that */
    permlib.&dsnin1 (keep=patientid filldate dayssupply drugcat deaclasscode opi_exclude drug mme
                    patient_subset longshort qtryear);
    permlib.&dsnin2 (keep=patientid filldate dayssupply drugcat deaclasscode opi_exclude drug mme
                    patient_subset longshort qtryear);

if &perstart <= filldate <= &perend;

if patient_subset=1; /* Select state residents */
if drugcat=1 and opi_exclude=0; /* Select opioids */
enddate=sum(filldate, dayssupply)-1; /* Determine prescription end date from fill date, days supply */

/* Exclude schedules other than 2,3,4 */

if deaclasscode in ('2','3','4');
run;

proc sort data=prescriptions1;
by patientid filldate enddate;
run;

/* Find all prescriptions with 60-day clean period (no opioids) */

data opi_naive1;
set prescriptions1;
by patientid filldate enddate;

```

```
lagdate = lag(enddate);
```

```
if first.patientid or (filldate-lagdate > 60) then do;
  output;
end;
run;
```

```
/* Take first prescription in quarter */
proc sort data=opi_naive1 out=opi_naive2 nodupkey;
by patientid qtryear;
run;
```

```
/* Merge with opioid prescriptions to find count of opioid-naive patients with Long-acting opioid in quarter */
proc sql;
create table opi_naive3 as
select a.patientid, a.qtryear, b.filldate, b.enddate, b.dayssupply, b.dayssupply, (b.mme*b.dayssupply) as qty
from opi_naive2 a, prescriptions1 b
where a.patientid=b.patientid and b.longshort='Long' and (a.qtryear=b.qtryear) and b.filldate >= a.filldate
order by a.patientid, a.qtryear;
quit;
```

```
/* Count all LA Opioid patients per quarter */
proc sql;
create table opi_naive_counts1 as
select qtryear, count(distinct patientid) as opi_naive_patients, count(*) as prescriptions, sum(dayssupply) as days,
       sum(qty) as qty
from opi_naive3
group by qtryear;
quit;
```

```
data prescriptions2 (keep=qtryear patientid);
set prescriptions1;
if longshort='Long';
run;
```

```
proc sql;
create table opi_la_counts1 as
select qtryear, count(distinct patientid) as opi_la_patients
from prescriptions2
group by qtryear;
quit;
```

```
/* For the proc transpose procedures below to work as desired, qtryear needs to be
of the form 'Q1-2011' */
```

```
/* Get one row of opioid naive patient counts */
proc transpose data=opi_naive_counts1 out=opi_naive_counts2 prefix=opi_naive_patients;
id qtryear;
var opi_naive_patients;
run;
```

```
/* Get one row of opioid naive prescription counts */
proc transpose data=opi_naive_counts1 out=opi_naive_counts3 prefix=prescriptions;
id qtryear;
var prescriptions;
run;
```

```

/* Get one row of total doses */
proc transpose data=opi_naive_counts1 out=opi_naive_counts4 prefix=qty;
id qtryear;
var qty;
run;

/* Get one row of opioid naive patient prescription days */
proc transpose data=opi_naive_counts1 out=opi_naive_counts5 prefix=days;
id qtryear;
var days;
run;

/* Get one row of opioid LA patient counts */
proc transpose data=opi_la_counts1 out=opi_la_counts2 prefix=opi_la_patients;
id qtryear;
var opi_la_patients;
run;

/* Merge transposed data sets */
data combine1;
merge opi_naive_counts2 opi_naive_counts3 opi_naive_counts4 opi_naive_counts5 opi_la_counts2;
run;

/* Calculate % of patients prescribed LA opioids who were opioid-naïve and mean daily dosage per LA prescription */

data combine2;
set combine1;
array opi_naive{*} opi_naive_patients&qtr1 opi_naive_patients&qtr2 opi_naive_patients&qtr3 opi_naive_patients&qtr4;

array opi_la{*} opi_la_patients&qtr1 opi_la_patients&qtr2 opi_la_patients&qtr3 opi_la_patients&qtr4;

array days{*} days&qtr1 days&qtr2 days&qtr3 days&qtr4;

array qty{*} qty&qtr1 qty&qtr2 qty&qtr3 qty&qtr4;

array prescriptions{*} prescriptions&qtr1 prescriptions&qtr2 prescriptions&qtr3 prescriptions&qtr4;

array rate{*} rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4;

array avg{*} avg&qtr1 avg&qtr2 avg&qtr3 avg&qtr4;

do i = 1 to dim(opi_naive);
  if opi_la(i)=0 then rate(i)=.;
  else rate(i) = (opi_naive(i)/opi_la(i))*100;
  if days(i)=0 then avg(i)=.;
  else avg(i)= qty(i)/days(i);
end;

rateyr=mean(rate&qtr1, rate&qtr2, rate&qtr3, rate&qtr4);
avggyr =mean(avg&qtr1, avg&qtr2, avg&qtr3, avg&qtr4);

keep rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4 rateyr avg&qtr1 avg&qtr2 avg&qtr3 avg&qtr4 avggyr;

run;

```

```

/* Put data in output format */
data row1;
set combine2 (keep=rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4 rateyr);
category='Rate';
run;

data row2;
set combine2 (keep=avg&qtr1 avg&qtr2 avg&qtr3 avg&qtr4 avgyr);
rate&qtr1=avg&qtr1;
rate&qtr2=avg&qtr2;
rate&qtr3=avg&qtr3;
rate&qtr4=avg&qtr4;
rateyr=avgyr;
drop avg&qtr1 avg&qtr2 avg&qtr3 avg&qtr4 avgyr;
category='avg';
run;

data combine3;
set row1 row2;
run;

proc sql;
create table combine4 as
select category, rate&qtr1 format=comma12.2, rate&qtr2 format=comma12.2, rate&qtr3 format=comma12.2,
           rate&qtr4 format=comma12.2, rateyr format=comma12.2
from combine3;
run;

proc print data=combine4;
run;

/* please enter where you want to store the Excel file in front of \&dsnout */
proc export data=combine4
outfile="\&dsnout"
dbms=csv
replace;
run;

%mend opioid_naive;

*Example where prescription data set for previous year is available;
%opioid_naive(prescriptions2012, prescriptions2013, '01oct2012'd, '31dec2013'd, Q1_2013, Q2_2013, Q3_2013, Q4_2013,
opi_naive_2013.csv);
/* please change the macro elements in parentheses the accordingly */

*Example where no prescription data set for previous year is available;
%opioid_naive( , prescriptions2013, '01oct2012'd, '31dec2013'd, Q1_2013, Q2_2013, Q3_2013, Q4_2013, opi_naive_2013.csv);
/* please change the macro elements in parentheses the accordingly */

/* PDMP indicator */
/* 26. and 27. Percent of overlapping prescribed days */

```

```

%macro overlap (dsnin, year, qtr1, qtr2, qtr3, qtr4, dsnout1);

data opioid1 (keep=patientid filldate enddate) benzo1 (keep=patientid filldate enddate);
set permllib.&dsnin (keep=patientid filldate dayssupply drugcat opi_exclude drug patient_subset deaclasscode qtryear);

if patient_subset=1; /* select state residents */
if deaclasscode in ('2','3','4');

enddate=sum(filldate, dayssupply)-1; /* Calculate end date from fill date and days of supply */
format enddate MMDDYY10.;

if enddate>mdy(12,31,&year) then enddate=mdy(12,31,&year);

if opi_exclude ne 1 and drugcat=1 then output opioid1;
else if drugcat=3 then output benzo1;
run;

/*****
/*   start identifying the overlapping days for opioids   */
*****/
proc sort data=opioid1;
by patientid filldate;
run;

/* create one record of fill dates for each patient */
proc transpose data=opioid1 out=startdt (drop=_name_) prefix=start;
by patientid;
var filldate;
run;

/* create one record of end dates for each patient */
proc transpose data=opioid1 out=stopdt (drop=_name_) prefix=stop;
by patientid;
var enddate;
run;

/* Merge transposed data sets */
data opioid2;
merge startdt stopdt;
by patientid;
run;

/* For each patient, determine whether there were overlapping prescriptions in a quarter */
/* This step takes hours to run */
data opioid3;
set opioid2;
by patientid;

retain i count;
array start(*) start;;
array stop(*) stop;;

intvnum =dim(start);
minstart=min(of start:);
maxstop =max(of stop:);

```

```

/* this step makes every date a single row */
/* number of rows of each patient is determined by gap between minstart and maxstop */
do date=minstart to maxstop;
  i=1;
  count=0;
  do while (count<2 and i < intvnum);
    if (start(i) <= date <= stop(i)) then count=count+1;
    i=i+1;
  end;
  if count >=1 then filled_opioid=1; else filled_opioid=0;
  if count=2 then overlap=1; else overlap=0;
  quarter=qtr(date);
  year=year(date);
  qtryear='Q' || put(quarter,1.) || '-' || put(year,4.);
  output;
end;
format maxstop MMDDYY10.;
format minstart MMDDYY10.0;
format date MMDDYY10.;
run;

/* Get sums of prescription days and overlap days by quarter */
proc sql;
create table opioid_overlap1 as
select qtryear, sum(filled_opioid) as prescription_days, sum(overlap) as overlap_days
from opioid3
group by qtryear;
quit;

/* Create one record for prescription days across quarters */
proc transpose data=opioid_overlap1 out=opioid_combined_days prefix=prescription_days;
id qtryear;
var prescription_days;
run;

/* Create one record for overlap days across quarters */
proc transpose data=opioid_overlap1 out=opioid_combined_overlap prefix=overlap_days;
id qtryear;
var overlap_days;
run;

/* Merge transposed data sets */
data overlap_opioid;
merge opioid_combined_days opioid_combined_overlap;
overlap_type=1;
run;

/* ***** */
/* Repeat part of the process for benzos */
/* ***** */
proc sort data=benzo1;
by patientid filldate;
run;

```

```
proc transpose data=benzo1 out=startdt (drop=_name_) prefix=start;
by patientid;
var filldate;
run;
```

```
proc transpose data=benzo1 out=stopdt (drop=_name_) prefix=stop;
by patientid;
var enddate;
run;
```

```
data benzo2;
merge startdt stopdt;
by patientid;
run;
```

```
data benzo3(keep=patientid qtryear date filled_benzo overlap quarter year);
set benzo2;
by patientid;
retain i count;
array start(*) start;;
array stop(*) stop;;
intvnum=dim(start);
minstart=min(of start:);
maxstop=max(of stop:);
do date=minstart to maxstop;
  i=1;
  count=0;
  do while (count<2 and i < intvnum);
    if (start(i) <= date <= stop(i)) then count=count+1;
    i=i+1;
  end;
  if count >=1 then filled_benzo=1; else filled_benzo=0;
  if count=2 then overlap=1; else overlap=0;
  quarter=qtr(date);
  year=year(date);
  qtryear='Q'| |put(quarter,1.)| | '-' | |put(year,4.);
  output;
end;
drop i;
run;
```

```
/******
/* Determine if patient had opioid prescription and benzo prescription on same day */
/******
```

```
Proc sort data=opioid3;
by patientid qtryear date;
run;
```

```
proc sort data=benzo3;
by patientid qtryear date;
run;
```

```
data opioid_benzo_overlap1;
merge opioid3 benzo3;
```

```

by patientid qtryear date;
if filled_opioid=1 or filled_benzo=1 then filled=1;
else filled=0;
if filled_opioid=1 and filled_benzo=1 then overlap=1;
else overlap=0;
run;

/* Get sums of prescription days and overlap days by quarter */
proc sql;
create table opioid_benzo_overlap2 as
select qtryear, sum(filled) as prescription_days, sum(overlap) as overlap_days
from opioid_benzo_overlap1
group by qtryear;
run;

/* Create one record for prescription days across quarters */
proc transpose data=opioid_benzo_overlap2 out=opioid_benzo_combined_days prefix=prescription_days;
id qtryear;
var prescription_days;
run;

/* Create one record for overlap days across quarters */
proc transpose data=opioid_benzo_overlap2 out=opioid_benzo_combined_overlap prefix=overlap_days;
id qtryear;
var overlap_days;
run;

/* Merge transposed data sets */
data overlap_opioid_benzo;
merge opioid_benzo_combined_days opioid_benzo_combined_overlap;
overlap_type=2;
run;

/* Merge all overlap data sets and calculate percent of prescription days that were overlap days */
data overlap1;
set overlap_opioid
    overlap_opioid_benzo;
array prescriptions(*) prescription_days&qtr1 prescription_days&qtr2 prescription_days&qtr3 prescription_days&qtr4;

array overlaps(*) overlap_days&qtr1 overlap_days&qtr2 overlap_days&qtr3 overlap_days&qtr4;

array rates(*) rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4;

do i = 1 to dim(prescriptions);
    rates(i)=(overlaps(i)/prescriptions(i))*100;
end;

array qtrrates{(*)} rate&qtr1 rate&qtr2 rate&qtr3 rate&qtr4;

do j = 1 to dim(qtrrates);
    if qtrrates(j) = . then qtrrates(j)=0;
end;

drop i j _name_;
run;

```

```
proc sql;
create table overlap2 as
select overlap_type, rate&qtr1 format=comma9.2, rate&qtr2 format=comma9.2,rate&qtr3 format=comma9.2, rate&qtr4
format=comma9.2
from overlap1
where overlap_type in (1,2)
order by overlap_type;
quit;
```

```
/* please enter where you want to store the Excel file in front of \&dsnout1 */
```

```
proc export data=overlap2
outfile=" \&dsnout1"
dbms=csv
replace;
run;
```

```
%mend overlap;
```

```
%overlap (prescriptions2013, 2013, Q1_2013, Q2_2013, Q3_2013, Q4_2013, overlap_2013.csv);
```

```
/* please change the macro elements in parentheses the accordingly */
```