<table>
<thead>
<tr>
<th>Demographic Group</th>
<th>All state/jurisdiction residents</th>
</tr>
</thead>
</table>
| Numerator         | Overall Indicator: Hospitalizations for which either the principal diagnosis or the first-listed external cause of injury code (E-code) represent drugs with the potential for abuse and dependence, excluding alcohol.  
Subindicator 1: Heroin Poisoning  
Subindicator 2: Cocaine Poisoning  
Subindicator 3: Prescription Opioid Poisoning  
Subindicator 4: Benzodiazepine-based Tranquilizer Poisoning  
Subindicator 5: Amphetamine Poisoning  
Subindicator 6: Cocaine Abuse and Dependence  
Subindicator 7: Opioid Abuse and Dependence  
For the overall indicator and each subindicator, substances that cause adverse effects in therapeutic use are excluded. |
| Denominator       | State/jurisdiction midyear population estimate |
| Measures          | 1. Annual number of hospitalizations  
2. Annual crude hospitalization rate (hospitalizations per 100,000 residents)  
3. Annual age-adjusted hospitalization rate (hospitalizations per 100,000 residents) |
| Time Period       | Calendar year of discharge from a hospital |
| Significance & Background | The number of drug overdose deaths in the U.S. increased from 17,415 in 2000 to 47,055 in 2014 (CDC WISQARS). During this timeframe, there was a 137% increase in drug overdose death rates, and, more specifically, a 200% increase in death rates due to opioid (opioid pain relievers and heroin) overdoses (Rudd et al., 2016). There are over one million emergency department (ED) visits annually for drug poisonings. About one-quarter of these drug-poisoning ED visits result in hospital admission (Albert et al., 2015).  
These indicators can inform policies and practices related to safe pain management and use of prescription drugs, and their non-medical misuse, as well as to other illicit drugs with the potential for abuse and dependence. Patterns of drug use and abuse vary greatly over time and by age group, race, ethnicity, income level, and geography. Timely monitoring of hospitalizations by specific drug type, as well as overall, can assist in rapid identification and characterization of community health threats.  
Drug-related hospitalizations are preventable through a series of mutually reinforcing activities including, but not limited to: |
To reduce inappropriate prescribing of analgesics through health insurance and care system policies and procedures, prescription drug monitoring programs, tighter standards for pain clinics, and law enforcement activities; (2) educating providers to identify and address addiction and make appropriate treatment referrals; (3) increasing availability of treatment for drug abuse or dependence; and (4) making naloxone more readily available.

| Data Sources | Inpatient hospital discharge data (numerator)  
Population estimates from the U.S. Bureau of the Census (denominator)  
Year 2000 U.S. Standard Population (for age-standarization) |
|-------------|----------------------------------------------------------|

**Limitations of Indicator**

This indicator will underestimate the true number and rate of drug-attributable hospitalizations for several reasons. (1) Cases are identified using the principal diagnosis or first-listed E-code. In many instances, a code that is among the indicator’s case definition is listed in a non-principal location. For example, in New York City between 2007 and 2014, there were an average of 82,825 annual hospitalizations in which there was “any mention” of a drug (i.e., a drug diagnosis was found via a search of all diagnoses), but 21,725 hospitalizations (24% of the total) when cases were identified using principal diagnosis only (personal communication with Ellenie Tuazon, New York City Department of Health & Mental Hygiene, August 8, 2016). It is unknown how many of the additional 76% of hospitalizations were attributable to drugs or simply involved drugs. (2) State residents who are hospitalized in another state are excluded. (3) Those hospitalized at Veteran’s Affairs, Indian Health Service, or non-acute care hospitals are excluded.

**Limitations of Data Sources**

The set of ICD9CM codes used for case-finding excludes some codes that would have captured certain drugs of interest. They were excluded because they were too broad and would have included drugs outside the indicator’s focus (i.e., drugs with potential for abuse and dependence). Counts are hospitalizations, not individuals. Thus, someone hospitalized multiple times for the same condition may be counted more than once. Practice patterns and payment mechanisms may affect decisions by health care providers to hospitalize patients, to diagnose a drug-attributable condition, or to list a drug-attributable condition as a principal diagnosis. These patterns may differ among states, thereby affecting the validity of state-to-state comparisons.

**Related Healthy People 2020 Objectives**

- IVP-10: Prevent an increase in nonfatal poisonings.
- MPS-2.3: Reduce serious injuries from the use of pain medicines.

**Other Available Data Elements**

- Age, sex, race/ethnicity, and zip code can be examined to better define the pattern of hospitalizations.
References


HOW-TO GUIDE
HOSPITALIZATIONS ATTRIBUTABLE TO DRUGS WITH POTENTIAL FOR ABUSE AND DEPENDENCE

For the calculation of counts, crude rates and age-adjusted rates, use the Excel spreadsheet at:
http://www.cste.org/resource/resmgr/AOD/age_adjustment_tables_for_dr.xls
This spreadsheet has been pre-designed to perform the appropriate calculations and display the results once the necessary data have been entered.

Case Definition
A hospitalization that is attributable to drugs with the potential for abuse and dependence excluding alcohol, tobacco, and substances that cause adverse effects in therapeutic use. A case may be identified using either the principal (i.e., first-listed) diagnosis code (specific diagnosis codes are listed in Table 1) or the principal/first-listed valid cause of injury code (Table 2).

SAS Programming
A generic SAS program has been developed that will identify the first-listed valid E-code and generate counts for the overall indicator and the sub-indicators. The program notes where users must make minor modifications (e.g., state-specific variable names and values). Two versions of the program are provided in the Appendices because states differ in how E-codes are listed within hospital discharge data.

Steps Required to Generate the Indicator and Sub-indicators
I. Obtain a hospital discharge (i.e., inpatient) dataset that meets the following criteria:
   - State of residence = <your state>
   - Ages 0 - 115
   - Both sexes
   - All races
   - In-state acute care hospitals
   - Discharge date between January 1 – December 31, <year>
   - All discharge dispositions (e.g., transfer to another hospital, inhospital death)
   - All admission types (e.g., readmission, transfer from another hospital)
   - Exclude:
     - Inpatients with unknown age
     - Out-of-state residents
     - Unknown state of residence
     - Out-of-state hospitals
     - Non-acute care hospitals
     - Federal hospitals (e.g., VA)
     - “Short stays” and “observation visits” that do not result in hospital admission

1 Some state hospital discharge data include a field that allows these types of hospital visits to be identified. States for which this is not true should assume that these types of visits have been excluded from their dataset.
The datafile must include the following fields/variables:
- Patient age
- Principal (i.e., first-listed) diagnosis code
- All cause of injury codes (“E-codes”). In some states, E-codes are listed among the fields designated as discharge diagnoses. In other states, there are separate fields containing only E-codes. In the first case, obtain all discharge diagnosis fields. In the latter case, select all E-code fields. Regardless of how E-codes are stored, run a program to identify the first-listed valid E-code (see SAS programming code provided in Appendix 1 if E-codes are embedded within discharge diagnosis fields; see SAS programming code provided in Appendix 2 if there are separate fields for E-codes).
- Other variables may be retained to allow additional analyses (e.g., sex, race/ethnicity, county of residence, source of payment).

II. Overall Indicator: Hospitalizations Attributable to Drugs with Potential for Abuse and Dependence
A) From the datafile described in Step I, select hospital discharges for which:
   1) a. the principal (first-listed) diagnosis contains an ICD9CM code listed in Table 1 and
      b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)
    
    OR

   2) the principal (first-listed) valid E-code is listed in Table 2.

B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to drugs with potential for abuse and dependence.

C) Follow these steps to populate the Excel spreadsheet with your state’s population.
   1) Go to: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml?ts=440355717799 (if necessary, turn off Pop-up Blockers for this website).
   2) Click on Advanced Search. Next click on “Show Me All.”
   3) For Step 1, enter the following in the box titled ‘topic or table name’: PEPAGESEX. Then enter your state name in the box titled ‘state, county or place (optional).’ After you enter your state, click on your state name again in the screen that pops up. Click on Go.
   4) On the resulting page, click on the box on the left corresponding to the year of interest. Next, click on View.
   5) You should now see population figures for age groups for your state for both sexes, males, and females for various years. Click on Download.
   6) In the Download box that pops up, select Microsoft Excel as the format. Click on OK.
   7) Once the next pop-up box indicates that your file is complete, click on Download, then open.
8) Use the figures under Both Sexes for the year of interest to populate the Excel spreadsheet you will use to perform age-adjusting. While the spreadsheet does not provide a population for ages 15-17, it does provide it for ages 18-24. So you can complete all of the age groups but 15-17, then figure out the population for 15-17 by subtracting your subtotal from the overall state population.

D) The spreadsheet will display:
   a. Crude rate of hospitalizations attributable to drugs per 100,000 residents;
   b. Age-standardized rate of hospitalizations attributable to drugs per 100,000 residents.

III. Sub-Indicator 1: Hospitalizations Attributable to Heroin Poisoning
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 965.01
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)
         OR
      2) the principal (first-listed) valid E-code is E850.0.
   B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to heroin poisoning.
   C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
      2) The spreadsheet will display:
         a. Crude rate of hospitalizations attributable to heroin poisoning per 100,000 residents;
         b. Age-standardized rate of hospitalizations attributable to heroin poisoning per 100,000 residents.

IV. Sub-Indicator 2: Hospitalizations Attributable to Cocaine Poisoning
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 970.81
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)

B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to cocaine poisoning.

C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
   2) The spreadsheet will display:
      a. Crude rate of hospitalizations attributable to cocaine poisoning per 100,000 residents;
      b. Age-standardized rate of hospitalizations attributable to cocaine poisoning per 100,000 residents.

V. Sub-Indicator 3: Hospitalizations Attributable to Prescription Opioid Poisoning
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 965.00, 965.02 or 965.09
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)
         
         OR
         
         1) the principal (first-listed) valid E-code is E850.1 or E850.2.

   B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to prescription opioid poisoning.

   C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
      2) The spreadsheet will display:
         a. Crude rate of hospitalizations attributable to prescription opioid poisoning per 100,000 residents;
         b. Age-standardized rate of hospitalizations attributable to prescription opioid poisoning per 100,000 residents.

VI. Sub-Indicator 4: Hospitalizations Attributable to Benzodiazepine-based Tranquilizer Poisoning
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 969.4
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)

         OR
         
         1) the principal (first-listed) valid E-code is E850.1 or E850.2.
OR

2) the principal (first-listed) valid E-code is E853.2.

B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to benzodiazepine-based tranquilizer poisoning.

C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
   2) The spreadsheet will display:
      a. Crude rate of hospitalizations attributable to benzodiazepine-based tranquilizer poisoning per 100,000 residents;
      b. Age-standardized rate of hospitalizations attributable to benzodiazepine-based tranquilizer poisoning per 100,000 residents.

VII. Sub-Indicator 5: Hospitalizations Attributable to Amphetamine Poisoning
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 969.72
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)

   B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to amphetamine poisoning.

   C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
      2) The spreadsheet will display:
         a. Crude rate of hospitalizations attributable to amphetamine poisoning per 100,000 residents;
         b. Age-standardized rate of hospitalizations attributable to amphetamine poisoning per 100,000 residents.

VIII. Sub-Indicator 6: Hospitalizations Attributable to Cocaine Abuse and Dependence
   A) From the datafile described in Step I, select hospital discharges for which:
      1) a. the principal (first-listed) diagnosis ICD9CM code is 304.2 or 305.6
         and
         b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)
B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to cocaine abuse and dependence.

1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
2) The spreadsheet will display:
   a. Crude rate of hospitalizations attributable to cocaine abuse and dependence per 100,000 residents;
   b. Age-standardized rate of hospitalizations attributable to cocaine abuse and dependence per 100,000 residents.

IX. Sub-Indicator 7: Hospitalizations Attributable to Opioid Abuse and Dependence
A) From the datafile described in Step I, select hospital discharges for which:
   1) a. the principal (first-listed) diagnosis ICD9CM code is 304.0, 304.7, or 305.5
      and
      b. the principal (first-listed) E-code is not in the range E930-E949 (“Drugs, medicinal and biological substances causing adverse effects in therapeutic use”)

B) Categorize these hospital discharges into the age groups displayed in Figure 1. Enter the results into the Excel spreadsheet. The spreadsheet will display the number of hospitalizations attributable to opioid abuse and dependence.

C) 1) Enter the age group populations into the Excel spreadsheet (see Step IIC above).
2) The spreadsheet will display:
   a. Crude rate of hospitalizations attributable to opioid abuse and dependence per 100,000 residents;
   b. Age-standardized rate of hospitalizations attributable to opioid abuse and dependence per 100,000 residents.
Table 1
ICD9CM codes and corresponding diagnoses for hospitalizations attributable to drugs with potential for abuse and dependence

<table>
<thead>
<tr>
<th>ICD9CM Code</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>292.0</td>
<td>Drug-induced mental disorders – Drug withdrawal</td>
</tr>
<tr>
<td>304[.00-.93]</td>
<td>Drug dependence</td>
</tr>
<tr>
<td>305[.20-.23]</td>
<td>Nondependent abuse of drugs – cannabis abuse</td>
</tr>
<tr>
<td>305[.30-.33]</td>
<td>Nondependent abuse of drugs – hallucinogen abuse</td>
</tr>
<tr>
<td>305[.40-.43]</td>
<td>Nondependent abuse of drugs – sedative, hypnotic or anxiolytic abuse</td>
</tr>
<tr>
<td>305[.50-.53]</td>
<td>Nondependent abuse of drugs – opioid abuse</td>
</tr>
<tr>
<td>305[.60-.63]</td>
<td>Nondependent abuse of drugs – cocaine abuse</td>
</tr>
<tr>
<td>305[.70-.73]</td>
<td>Nondependent abuse of drugs – amphetamine or related acting sympathomimetic abuse</td>
</tr>
<tr>
<td>305[.80-.83]</td>
<td>Nondependent abuse of drugs – antidepressant type abuse</td>
</tr>
<tr>
<td>305[.90-.93]</td>
<td>Nondependent abuse of drugs – other, mixed, or unspecified drug abuse</td>
</tr>
<tr>
<td>648 [.30-.34]</td>
<td>Drug dependence in pregnancy</td>
</tr>
<tr>
<td>760.72</td>
<td>Noxious influences affecting fetus or newborn via placenta or breast milk: narcotics</td>
</tr>
<tr>
<td>760.73</td>
<td>Noxious influences affecting fetus or newborn via placenta or breast milk: hallucinogenic agents</td>
</tr>
<tr>
<td>760.75</td>
<td>Noxious influences affecting fetus or newborn via placenta or breast milk: cocaine</td>
</tr>
<tr>
<td>779.5</td>
<td>Drug withdrawal syndrome in newborn</td>
</tr>
<tr>
<td>965[.00-.09]</td>
<td>Poisoning by opiates and related narcotics</td>
</tr>
<tr>
<td>967[.0-.9]</td>
<td>Poisoning by sedatives and hypnotics</td>
</tr>
<tr>
<td>969.4</td>
<td>Poisoning by benzodiazepine-based tranquilizers</td>
</tr>
<tr>
<td>969.6</td>
<td>Poisoning by psychodysleptics (hallucinogens)</td>
</tr>
<tr>
<td>969[.70-.79]</td>
<td>Poisoning by psychostimulants</td>
</tr>
<tr>
<td>970.81</td>
<td>Poisoning by other specified central nervous system stimulants - cocaine</td>
</tr>
</tbody>
</table>

Table 2
External cause of injury codes (E-codes) and corresponding causes for hospitalizations attributable to drugs with potential for abuse and dependence

<table>
<thead>
<tr>
<th>E-code</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>E850.0</td>
<td>Accidental poisoning by heroin</td>
</tr>
<tr>
<td>E850.1</td>
<td>Accidental poisoning by methadone</td>
</tr>
<tr>
<td>E850.2</td>
<td>Accidental poisoning by other opiates and related narcotics</td>
</tr>
<tr>
<td>E851</td>
<td>Accidental poisoning by barbiturates</td>
</tr>
<tr>
<td>E852[.0-.9]</td>
<td>Accidental poisoning by other sedatives and hypnotics</td>
</tr>
<tr>
<td>E853.2</td>
<td>Accidental poisoning by benzodiazepine-based tranquilizers</td>
</tr>
<tr>
<td>E854.1</td>
<td>Accidental poisoning by psychodysleptics</td>
</tr>
<tr>
<td>E854.2</td>
<td>Accidental poisoning by psychostimulants</td>
</tr>
<tr>
<td>E950.1</td>
<td>Suicide and self-inflicted poisoning by barbiturates</td>
</tr>
<tr>
<td>E950.2</td>
<td>Suicide and self-inflicted poisoning by other sedatives and hypnotics</td>
</tr>
<tr>
<td>E980.1</td>
<td>Poisoning by solid or liquid substances, undetermined whether accidentally or purposely inflicted: barbiturates</td>
</tr>
<tr>
<td>E980.2</td>
<td>Poisoning by solid or liquid substances, undetermined whether accidentally or purposely inflicted: other sedatives and hypnotics</td>
</tr>
</tbody>
</table>
Figure 1
Spreadsheet for calculating age-adjusted hospitalization rates

<table>
<thead>
<tr>
<th>Row #</th>
<th>Age Group</th>
<th>Column B</th>
<th>Column C</th>
<th>Column D</th>
<th>Column E</th>
<th>Column F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>B1/C1</td>
<td>18,987,000</td>
<td></td>
<td>D1*E1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>B2/C2</td>
<td>19,920,000</td>
<td></td>
<td>D2*E2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>B3/C3</td>
<td>20,057,000</td>
<td></td>
<td>D3*E3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-17</td>
<td>B4/C4</td>
<td>11,819,000</td>
<td></td>
<td>D4*E4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>B5/C5</td>
<td>26,258,000</td>
<td></td>
<td>D5*E5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>B6/C6</td>
<td>17,722,000</td>
<td></td>
<td>D6*E6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>B7/C7</td>
<td>19,511,000</td>
<td></td>
<td>D7*E7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>B8/C8</td>
<td>22,180,000</td>
<td></td>
<td>D8*E8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>B9/C9</td>
<td>22,479,000</td>
<td></td>
<td>D9*E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>B10/C10</td>
<td>19,806,000</td>
<td></td>
<td>D10*E10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>B11/C11</td>
<td>17,224,000</td>
<td></td>
<td>D11*E11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>B12/C12</td>
<td>13,307,000</td>
<td></td>
<td>D12*E12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>B13/C13</td>
<td>10,654,000</td>
<td></td>
<td>D13*E13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65-69</td>
<td>B14/C14</td>
<td>9,410,000</td>
<td></td>
<td>D14*E14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-74</td>
<td>B15/C15</td>
<td>8,726,000</td>
<td></td>
<td>D15*E15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td>B16/C16</td>
<td>7,415,000</td>
<td></td>
<td>D16*E16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80-84</td>
<td>B17/C17</td>
<td>4,900,000</td>
<td></td>
<td>D17*E17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85-115</td>
<td>B18/C18</td>
<td>4,259,000</td>
<td></td>
<td>D18*E18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>B19/C19</td>
<td>274,634,000</td>
<td></td>
<td>Σ(F1:F18)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An Excel version of this spreadsheet can be found on the CSTE website. The URL of this site is: [http://www.cste.org/resource/resmgr/AOD/age_adjustment_tables_for_dr.xls](http://www.cste.org/resource/resmgr/AOD/age_adjustment_tables_for_dr.xls).

Number of hospitalizations: B19
Crude rate: (B19/C19) x 100,000
Age-adjusted rate: (F19/E19) x 100,000

---

2 This US 2000 Standard Population distribution was derived from the master list of 2000 U.S. projected population (Table 1 in the document found at: [http://www.cdc.gov/nchs/data/statnt/statnt20.pdf](http://www.cdc.gov/nchs/data/statnt/statnt20.pdf)).
APPENDIX 1

Generic SAS Programming for
Generating Indicator and Sub-Indicators
Where E-codes are Embedded within
Discharge Diagnosis Fields
Program name: drughosp.generic.sas
Purpose: Generate the Drug Hospitalization indicator and its subindicators
Note: Read through all of the following program and modify according to your state hospital discharge datafile

options linesize = 100 pagesize = 50 center errors=3;
libname hdd '\location of your hospital discharge data\';

****Create the basic dataset - residents of your state, instate/acute care hospitals, age=known****;
****In the example below, the hospital discharge dataset has 34 fields for discharge diagnoses****;

data temp1 (keep=age DX1-DX34); *other variables such as sex, race, county may be kept if additional analyses are desired;
set hdd.hdd2013; *'hdd2013’ is your complete hospital discharge dataset;
if < State of Residence=Your State >
and
hosp_id in < List of in-state acute care hospitals >
and
age in < age range excluding unknown age >; *note that there may be special codes for newborns (and newborns are to be included);
run;

************************* Identify first-listed valid E-code*********************************;
*** Note that this program categorizes E-codes E930-E949 as ‘valid’ ***;
*** because codes in this range subsequently will be used to exclude cases. ***;
*** Modify depending on the number of diagnosis fields that are available in your state***;

data temp2;
set temp1;
Ecode1st='     '; * make sure there are five spaces within the quotes to initialize Ecode1st with length 5;
E967=0;
E8694=0;
array ecod  {34} $5 DX1-DX34 ;
do jj=1 to 34;
if "E800"<=substr(ecod{jj},1,4)<="E848" or
"E850"<=substr(ecod{jj},1,4)<="E868" or
"E8690"<= substr(ecod{jj},1,5) <="E8693" or
"E8695"<= substr(ecod{jj},1,5) <="E8699" or
"E880"<=substr(ecod{jj},1,4)<="E966" or
"E968"<=substr(ecods{jj},1,4)="E999"
then Ecode1st= ecod{jj};
if Ecode1st ne " then leave;
if substr(ecod{jj},1,4)="E967" then E967=1;
if substr(ecod{jj},1,5)="E8694" then E8694=1;
end;
if Ecode1st=" and E967=1 then Ecode1st='E967';
else if Ecode1st=" and E8694=1 then Ecode1st='E8694';
run;
*****Remove all hospitalizations for which Ecode1st is in the range E930 - E949*****;
*****("Drugs, medicinal and biological substances causing adverse effects in therapeutic use")*****;

data temp3;
   set temp2;
   if substr(Ecode1st,1,3) notin ('E93','E94');
run;

********** Create a drug hospitalization datafile with the appropriate agegroups **********;

data hdd.drug;       *this creates a permanent SAS dataset;
   set temp3;
   drug_dx=2;
   if substr(DX1,1,3) in ('304','967') or
      substr(DX1,1,4) in ('2920','3052','3053','3054','3055','3056','3057','3058','3059','6483','7795','9650','9694','9696','9697') or
      substr(DX1,1,5) in ('76072','76073','76075','97081')
      then drug_dx=1;     * Drug as Principal DX;
   drug_ecode=2;
   if substr(Ecode1st,1,4) in ('E851','E852') or
      substr(Ecode1st,1,5) in ('E8500','E8501','E8502','E8532','E8541','E8542', 'E9501','E9502','E9801','E9802')
      then drug_ecode=1; * Drug as first-listed valid Ecode;

   agegroup='      ';     * make sure there are six spaces within the quotes to initialize agegroup with length 6;
   if age ge 0 and age le 4 then  agegroup='  0-4 ';
   if age ge 5 and age le 9 then  agegroup='  5-9 ';
   if age ge 10 and age le 14 then  agegroup='10-14 ';
   if age ge 15 and age le 17 then  agegroup='15-17 ';
   if age ge 18 and age le 24 then  agegroup='18-24 ';
   if age ge 25 and age le 29 then  agegroup='25-29 ';
   if age ge 30 and age le 34 then  agegroup='30-34 ';
   if age ge 35 and age le 39 then  agegroup='35-39 ';
   if age ge 40 and age le 44 then  agegroup='40-44 ';
   if age ge 45 and age le 49 then  agegroup='45-49 ';
   if age ge 50 and age le 54 then  agegroup='50-54 ';
   if age ge 55 and age le 59 then  agegroup='55-59 ';
   if age ge 60 and age le 64 then  agegroup='60-64 ';
   if age ge 65 and age le 69 then  agegroup='65-69 ';
   if age ge 70 and age le 74 then  agegroup='70-74 ';
   if age ge 75 and age le 79 then  agegroup='75-79 ';
   if age ge 80 and age le 84 then  agegroup='80-84 ';
   if age ge 85 and age le 115 then  agegroup='85-115 ';
run;

data new;
   set hdd.drug;
   drug=2;
   if drug_dx=1 or drug_ecode=1 then drug=1;
* drug=1 represents those cases for which either the principal diagnosis or *
* the first-listed valid E-code is among the Drug codes in Tables 1 and 2 in the How-to Guide *;
run;
Overall Drug Hospitalization Indicator

**Overall Indicator: Hospitalizations Attributable to Drugs**

```plaintext
proc freq data=new;
    tables agegroup / nopercent;
    where drug=1;
    title1 'Overall Indicator: Hospitalizations Attributable to Drugs';
    title2 'With Potential for Abuse and Dependence';
run;
```

**Sub-indicator 1: Hospitalizations Attributable to Heroin Poisoning**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,5)= '96501' or substr(Ecode1st,1,5)= 'E8500';
    title 'Sub-indicator 1: Hospitalizations Attributable to Heroin Poisoning';
run;
```

**Sub-indicator 2: Hospitalizations Attributable to Cocaine Poisoning**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,5)='97081';
    title 'Sub-indicator 2: Hospitalizations Attributable to Cocaine Poisoning';
run;
```

**Sub-indicator 3: Hospitalizations Attributable to Prescription Opioid Poisoning**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,5) in ('96500', '96502','96509') or substr(Ecode1st,1,5) in ('E8501','E8502');
    title 'Sub-indicator 3: Hospitalizations Attributable to Prescription Opioid Poisoning';
run;
```

**Sub-indicator 4: Hospitalizations Attributable to Benzodiazepine-based Tranquilizer Poisoning**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,4)='9694' or substr(Ecode1st,1,5)='E8532';
    title 'Sub-indicator 4: Hospitalizations Attributable to Benzodiazepine-based Tranquilizer Poisoning';
run;
```

**Sub-indicator 5: Hospitalizations Attributable to Amphetamine Poisoning**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,5)='96972';
    title 'Sub-indicator 5: Hospitalizations Attributable to Amphetamine Poisoning';
run;
```

**Sub-indicator 6: Hospitalizations Attributable to Cocaine Abuse and Dependence**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,4) in ('3042','3056') ;
    title 'Sub-indicator 6: Hospitalizations Attributable to Cocaine Abuse and Dependence';
run;
```

**Sub-indicator 7: Hospitalizations Attributable to Opioid Abuse and Dependence**

```plaintext
proc freq data= hdd.drug;
    tables agegroup / nopercent;
    where substr(DX1,1,4) in ('3040','3047','3055');
    title 'Sub-indicator 7: Hospitalizations Attributable to Opioid Abuse and Dependence';
run;
```
APPENDIX 2

Generic SAS Programming for
Generating Indicator and Sub-Indicators
Where there are Separate Fields for E-codes
Program name: drughosp_generic.sas
Purpose: Generate the Drug Hospitalization indicator and its subindicators
Notes: This programming is specifically written for hospital discharge data that has separate fields for E-codes. Read through all of the following program and modify according to your state hospital discharge datafile.

options linesize = 100 pagesize = 50 center errors=3;
libname hdd ' < location of your hospital discharge data >';

****Create the basic dataset - residents of your state, instate/acute care hospitals, age=known****;
****In the example below, the hospital discharge dataset has 6 fields for E-codes****;

data temp1 (keep=age DX1 Ecode1-Ecode6); *other variables such as sex, race, county may be kept if additional analyses are desired;
   set hdd.hdd2013;       *'hdd2013' is your complete hospital discharge dataset;
   if < State of Residence=Your State >
   and
   hosp_id in < List of in-state acute care hospitals >
   and
   age in < age range excluding unknown age >; *note that there may be special codes for newborns (and newborns are to be included);
   run;

************************* Identify first-listed valid E-code*************************
*** Note that this program categorizes E-codes E930-E949 as ‘valid’ ***;
*** because codes in this range subsequently will be used to exclude cases. ***;
*** Modify depending on the number of E-code fields that are available in your state***;

data temp2;
   set temp1;
   Ecode1st='     '; * make sure there are five spaces within the quotes to initialize Ecode1st with length 5;
   E967=0;
   E8694=0;
   array ecod  {6} $5 Ecode1-Ecode6 ;
   do jj=1 to 6;
      if "E800"<=substr(ecod{jj},1,4)<="E848" or
      "E850"<=substr(ecod{jj},1,4)<="E868" or
      "E8690"<=substr(ecod{jj},1,5)<="E8693" or
      "E8695"<=substr(ecod{jj},1,5)<="E8699" or
      "E880"<=substr(ecod{jj},1,4)<="E966" or
      "E968"<=substr(ecod{jj},1,4)<="E999"
      then Ecode1st= ecod{jj};
      if Ecode1st ne " then leave;
      if substr(ecod{jj},1,4)="E967" then E967=1;
      if substr(ecod{jj},1,5)="E8694" then E8694=1;
      end;
   if Ecode1st=" and E967=1 then Ecode1st="E967";
   else if Ecode1st=" and E8694=1 then Ecode1st="E8694";
   run;
****Remove all hospitalizations for which Ecode1st is in the range E930 - E949****;
****("Drugs, medicinal and biological substances causing adverse effects in therapeutic use")****;

```sas
data temp3;
  set temp2;
  if substr(Ecode1st,1,3) notin ('E93','E94');
run;

*********** Create a drug hospitalization datafile with the appropriate agegroups ***********;

data hdd.drug;       *this creates a permanent SAS dataset;
  set temp3;
  drug_dx=2;
  if substr(DX1,1,3) in ('304','967') or
     substr(DX1,1,4) in ('2920','3052','3053','3054','3055','3056','3057','3058','3059','6483','7795',
                  '9650','9694','9696','9697') or
     substr(DX1,1,5) in ('76072','76073','76075','97081')
     then drug_dx=1;     * Drug as Principal DX;
  drug_ecode=2;
  if substr(Ecode1st,1,4) in ('E851', 'E852') or
     substr(Ecode1st,1,5) in ('E8500','E8501','E8502','E8532','E8541', 'E8542',
      'E9501', 'E9502', 'E9801', 'E9802')
     then drug_ecode=1; * Drug as first-listed valid Ecode;

  agegroup='      ';     * make sure there are six spaces within the quotes to initialize agegroup with length 6;
  if age ge 0 and age le 4 then  agegroup='  0-4 ';
  if age ge 5 and age le 9 then  agegroup='  5-9 ';
  if age ge 10 and age le 14 then  agegroup='10-14 ';
  if age ge 15 and age le 17 then  agegroup='15-17 ';
  if age ge 18 and age le 24 then  agegroup='18-24 ';
  if age ge 25 and age le 29 then  agegroup='25-29 ';
  if age ge 30 and age le 34 then  agegroup='30-34 ';
  if age ge 35 and age le 39 then  agegroup='35-39 ';
  if age ge 40 and age le 44 then  agegroup='40-44 ';
  if age ge 45 and age le 49 then  agegroup='45-49 ';#17
  if age ge 50 and age le 54 then  agegroup='50-54 ';#18
  if age ge 55 and age le 59 then  agegroup='55-59 ';#19
  if age ge 60 and age le 64 then  agegroup='60-64 ';#20
  if age ge 65 and age le 69 then  agegroup='65-69 ';#21
  if age ge 70 and age le 74 then  agegroup='70-74 ';#22
  if age ge 75 and age le 79 then  agegroup='75-79 ';#23
  if age ge 80 and age le 84 then  agegroup='80-84 ';#24
  if age ge 85 and age le 115 then  agegroup='85-115 ';#25
run;

data new;
  set hdd.drug;
  drug=2;
  if drug_dx=1 or drug_ecode=1 then drug=1;

* drug=1 represents those cases for which either the principal diagnosis or *
* the first-listed valid E-code is among the Drug codes in Tables 1 and 2 in the How-to Guide *;
run;
```
PROCEDURE FOR DATABASE ANALYSIS:

**Overall Drug Hospitalization Indicator**: Overall indicator for hospitalizations attributable to drugs with potential for abuse and dependence.

```sql
proc freq data=new;
  tables agegroup / nopercent;
  where drug=1;
  title1 'Overall Indicator: Hospitalizations Attributable to Drugs';
  title2 'With Potential for Abuse and Dependence';
run;
```

**Sub-indicator 1: Hospitalizations Attributable to Heroin Poisoning**: Specific indicator for hospitalizations due to heroin poisoning.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,5)= '96501' or substr(Ecode1st,1,5)= 'E8500';
  title 'Sub-indicator 1: Hospitalizations Attributable to Heroin Poisoning';
run;
```

**Sub-indicator 2: Hospitalizations Attributable to Cocaine Poisoning**: Specific indicator for hospitalizations due to cocaine poisoning.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,5)='97081';
  title 'Sub-indicator 2: Hospitalizations Attributable to Cocaine Poisoning';
run;
```

**Sub-indicator 3: Hospitalizations Attributable to Prescription Opioid Poisoning**: Specific indicator for hospitalizations due to prescription opioid poisoning.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,5) in ('96500', '96502','96509') or substr(Ecode1st,1,5) in ('E8501','E8502');
  title 'Sub-indicator 3: Hospitalizations Attributable to Prescription Opioid Poisoning';
run;
```

**Sub-indicator 4: Hospitalizations Attributable to Benzodiazepine-based Tranquilizer Poisoning**: Specific indicator for hospitalizations due to benzodiazepine-based tranquilizer poisoning.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,4)='9694' or substr(Ecode1st,1,5)='E8532';
  title 'Sub-indicator 4: Hospitalizations Attributable to Benzodiazepine-based Tranquilizer Poisoning';
run;
```

**Sub-indicator 5: Hospitalizations Attributable to Amphetamine Poisoning**: Specific indicator for hospitalizations due to amphetamine poisoning.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,5)='96972';
  title 'Sub-indicator 5: Hospitalizations Attributable to Amphetamine Poisoning';
run;
```

**Sub-indicator 6: Hospitalizations Attributable to Cocaine Abuse and Dependence**: Specific indicator for hospitalizations due to cocaine abuse and dependence.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,4) in ('3042','3056') ;
  title 'Sub-indicator 6: Hospitalizations Attributable to Cocaine Abuse and Dependence';
run;
```

**Sub-indicator 7: Hospitalizations Attributable to Opioid Abuse and Dependence**: Specific indicator for hospitalizations due to opioid abuse and dependence.

```sql
proc freq data= hdd.drug;
  tables agegroup / nopercent;
  where substr(DX1,1,4) in ('3040','3047','3055');
  title 'Sub-indicator 7: Hospitalizations Attributable to Opioid Abuse and Dependence';
run;
```