# Drug Abuse Warning Network, 2009: Methodology Report

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES**
**Substance Abuse and Mental Health Services Administration**
**Center for Behavioral Health Statistics and Quality**

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# INTRODUCTION

This publication describes the methodologies used by the Drug Abuse Warning Network (DAWN), a program of the Center for Behavioral Health Statistics and Quality (CBHSQ), Substance Abuse and Mental Health Services Administration (SAMHSA), to collect, prepare, and analyze information on drug-related emergency department (ED) visits in the United States. An understanding of the methodology behind the collection and processing of DAWN data allows data users to better evaluate the validity, representativeness, and meaning of the findings. The methods described here were initiated in 2004 and are current as of 2009. Prior to 2004, DAWN methodology was substantially different. Therefore, earlier findings cannot be compared with findings from 2004 through 2009.

This report is organized into eight parts:

- *Overview of the DAWN data program*—Brief summary of DAWN and its purpose.
- *Information collected by DAWN*—What constitutes a drug-related ED visit and the data items collected for each visit.
- *Development of the ED component of DAWN*—How DAWN data on drug-related ED visits are collected and processed to make representative national and metropolitan area estimates using survey data.
- *DAWN publications and data dissemination*—How DAWN data are organized, summarized, and presented to address different statistical and analytic goals.
- *Quality assurance/quality control*—Methods and procedures used to ensure DAWN data are as accurate, precise, and reliable as possible.
- *Data limitations*—DAWN collects data on ED visits from a sample of hospitals and relies solely on existing medical records maintained by the hospitals; as a result, there are some limitations to consider when interpreting results.
- *History of DAWN*—How DAWN came into existence and has been maintained for almost 40 years.
- *Glossary of DAWN terms, 2009 update*—Resource to help understand the nature of DAWN visits and DAWN terminology.

Additional information about DAWN is provided on the DAWN Web site.[1] Available at the site are

- annual reports for 2004 through 2009 that summarize overall DAWN findings;
- short reports that highlight DAWN findings on specialized topics or for specific metropolitan areas;
- detailed tables of DAWN estimates for 2004 through 2009 for the Nation and select metropolitan areas;
- methodology and design reports;

[1] https://dawninfo.samhsa.gov/default.asp.

- background information on SAMHSA, CBHSQ, and the contractors responsible for DAWN data collection and analysis; and
- links to other SAMHSA Web sites.

# 1. OVERVIEW OF DAWN DATA PROGRAM

## 1.1 Overview of DAWN

The Drug Abuse Warning Network (DAWN) is a public health surveillance system that continuously monitors drug-related visits to hospital emergency departments (EDs).[2] Annually, DAWN produces estimates of drug-related visits to hospital EDs for the Nation as a whole and for selected metropolitan areas. DAWN is used to monitor trends in drug misuse and abuse, identify the emergence of new substances and drug combinations, assess health hazards associated with drug abuse, and estimate the impact of drug misuse and abuse on the Nation's health care system.

DAWN employs a multistage sampling design for the selection of EDs for analysis. Stratified simple random sampling with oversampling in selected metropolitan areas is used to select the hospitals. Days of the month are then systematically selected from within a hospital, and, finally, a census of ED visits is selected for these days.

## 1.2 Hospitals eligible to participate in DAWN

DAWN's target sample frame consists of all non-Federal, short-stay, general medical and surgical hospitals in the United States that have one or more EDs open 24 hours a day.

## 1.3 ED visits eligible for inclusion in DAWN

A DAWN case is any ED visit involving recent drug use. DAWN cases are identified by the systematic review of ED medical records in participating hospitals. DAWN captures both ED visits that are directly caused by drugs and those in which drugs are a contributing factor but not the direct cause of the ED visit. These criteria encompass all types of drug-related events, including accidental ingestion and adverse reaction, as well as drug misuse or abuse.

## 1.4 Drugs reported for DAWN ED visits

DAWN collects data on all types of drugs—illegal drugs, prescription and over-the-counter medications, dietary supplements, and both pharmaceutical and nonpharmaceutical inhalants. DAWN notes whether alcohol is involved in addition to drug(s) for patients of all ages. Because alcohol is considered an illicit drug for minors, alcohol abuse without the involvement of other drugs is considered a drug-related ED visit for patients under the age of 21. DAWN does not report current medications (i.e., medications and pharmaceuticals taken regularly by the patient as prescribed or indicated) that are unrelated to the ED visit.

[2] Drug-related visits are defined by DAWN as any ED visit related to recent drug use. Additional detail on DAWN's definition of drug-related visits is provided in Section 2.1.

DAWN classifies drugs using a modified version of the Multum *Lexicon*, © 2011, a drug vocabulary and classification tool originated by Multum Information Services, Inc. DAWN has adapted the *Lexicon* to allow for the inclusion of illegal drugs, inhalants, and alternative medicines that are reported to DAWN.

## 1.5 DAWN estimates of ED visits

DAWN produces weighted estimates of drug-related ED visits that are the result of drug misuse or abuse, adverse reactions to drugs, and accidental ingestion of drugs. Among visits resulting from drug misuse or abuse, separate estimates are made of visits involving illicit drugs, nonmedical use of pharmaceuticals, and alcohol. Estimates are also made of ED visits resulting from drug-related suicide attempts, ED visits made by patients seeking detoxification services, and visits involving alcohol for patients under the age of 21. For each of these types of visits, estimates are available by patient gender, age group, and race/ethnicity. Estimates are also provided for each visit's disposition (e.g., treated and released, admitted to the hospital intensive care unit, died). For each of these categories of visits, estimates are made of the different types of drugs involved.

These sets of estimates are prepared for the Nation as a whole and for selected metropolitan areas where hospital participation was high enough to produce reliable results.

## 1.6 Uses of DAWN data

DAWN is the only data system providing estimates of the number of ED admissions associated with drug misuse and abuse and the particular drugs involved both for the United States as a whole and also for selected metropolitan areas. These estimates are used to monitor trends in major substances of abuse (e.g., heroin, cocaine, marijuana), to assess alcohol use by minors that results in ED visits, to identify emerging new drugs of abuse (e.g., synthetic cannabinoids, methamphetamine), to identify the abuse potential of prescription and over-the-counter drugs to better inform labeling and scheduling decisions, and to reveal changing patterns of drug abuse. Furthermore, DAWN is the only national data collection system on drug abuse with the capacity to monitor specific and relatively infrequently used substances of abuse (such as club drugs, phencyclidine [PCP], or medications used to treat attention deficit hyperactivity disorder) as they emerge and diffuse across population groups and geographic areas.

DAWN is a major component of the Nation's capacity to monitor trends in the morbidity and mortality associated with drug misuse and abuse. It is used by national, State, and local professionals to monitor trends in the health hazards associated with substance abuse and to identify emerging trends and changing patterns of drug abuse. DAWN offers data of value to policymakers, law enforcement officers, pharmacologists, and health professionals. The data are used by the White House Office of National Drug Control Policy to monitor national trends; the Drug Enforcement Administration for surveillance, diversion control, and intelligence; and the Food and Drug Administration and pharmaceutical industry to conduct postmarketing surveillance of prescription and over-the-counter pharmaceuticals, actively monitor adverse events associated

with medications that are new or old, and assess the abuse potential for labeling and scheduling decisions. State and local professionals, including law enforcement and the Community Epidemiology Work Group, use DAWN to assess changes in local trends and patterns of drug use. The Substance Abuse and Mental Health Services Administration (SAMHSA) itself uses DAWN to target program resources to areas of greatest need and to monitor adverse events associated with buprenorphine treatment for opiate addiction.

## 1.7 DAWN reports, tables, and data files

The DAWN Web site provides a complete listing of all publicly available reports and tables using DAWN data.[3] Public use files are expected to be available on the Substance Abuse and Mental Health Data Archive (SAMHDA) site in 2011.[4]

[3] https://dawninfo.samhsa.gov/default.asp.
[4] http://www.icpsr.umich.edu/icpsrweb/SAMHDA/.

# 2. INFORMATION COLLECTED BY DAWN

## 2.1 ED visits eligible for DAWN

A Drug Abuse Warning Network (DAWN) case is any emergency department (ED) visit related to recent drug use. DAWN includes ED visits associated with substance abuse and misuse, both intentional and accidental. DAWN also includes ED visits related to the use of drugs as directed for legitimate therapeutic purposes. To be a DAWN case, the drug must be implicated in the ED visit, but it does not need to be the direct cause. The reason a patient used a drug is not a factor in determining whether the ED visit is a DAWN case.

The DAWN visit eligibility criteria are intended to be broad and inclusive and to have few exceptions. They take into account the fact that documentation in medical records varies in clarity and comprehensiveness across hospitals and among clinicians within hospitals. The criteria are designed to minimize the potential for judgments that could cause data to vary systematically and unexpectedly across different data collectors and hospitals. In addition, the criteria allow for the capture of a diverse set of drug-related visits that can be aggregated or disaggregated to serve a variety of analytical purposes and the interests of multiple audiences.

There are a few clearly delineated exceptions to the DAWN eligibility criteria. An ED visit is **not** a DAWN visit if

- there is no evidence of recent drug use;
- the patient left the ED without being treated;
- the patient consumed a nonpharmaceutical substance but did not inhale it;
- the patient has a history of drug use but no recent use;
- alcohol is the only substance involved and the patient is an adult (aged 21 or older);
- drugs mentioned in the ED record are not related to the ED visit (e.g., list of current medications);
- drugs identified in toxicology testing are not related to the visit, and the medical record does not contain any additional drug-related information that would make the visit a DAWN case; or
- the patient is being treated as a consequence of undermedication (i.e., taking too little of a drug).

## 2.2 Case types in DAWN

By design, DAWN's broad case criteria yield a diverse set of visits. To bring order to this heterogeneous mix of ED visits, DAWN Reporters[5] assign each visit to one of eight case types. The eight case types are as follows:

- suicide attempt;
- seeking detoxification;
- alcohol only, in patients younger than 21;
- adverse reaction;
- overmedication;
- malicious poisoning (e.g., drug-facilitated sexual assault, product tampering);
- accidental ingestion; and
- other.

Each ED visit is assigned to a *single* case type. Because many ED visits meet the criteria for more than one case type, the case types are assigned based on an algorithm depicted in the "DAWN Decision Tree" (Figure 1). Each ED visit is assigned to the first applicable case type. To assist DAWN Reporters with case assignment, a series of questions and decision rules is included with the Decision Tree; detailed instructions are included in the *ED Reference Guide.*[6]

The final category in the decision tree, *Other,* is reserved for DAWN visits that do not meet any of the rules for classification into one of the first seven types. Most cases of drug abuse are classified as *Other*. This approach, which never directly identifies drug abuse, comes from the recognition that medical records frequently lack explicit documentation of substance abuse. This lack of documentation may occur for several reasons. First, the distinctions among use, misuse, and abuse are often subjective. Second, if there is a low index of suspicion for drug abuse in some types of patients (e.g., older adults), ED physicians may be unlikely to label those types of patients as drug abusers. Third, ED staff may be concerned that the patient's insurance company will disallow coverage if the visit is related to substance abuse.

The case type of a visit, in combination with the types of drugs involved, is used to construct groupings of visits that have similar characteristics—for example, visits for drug abuse involving illicit drugs. Section 4.1 provides additional detail on how visits are grouped for the purpose of analyses.

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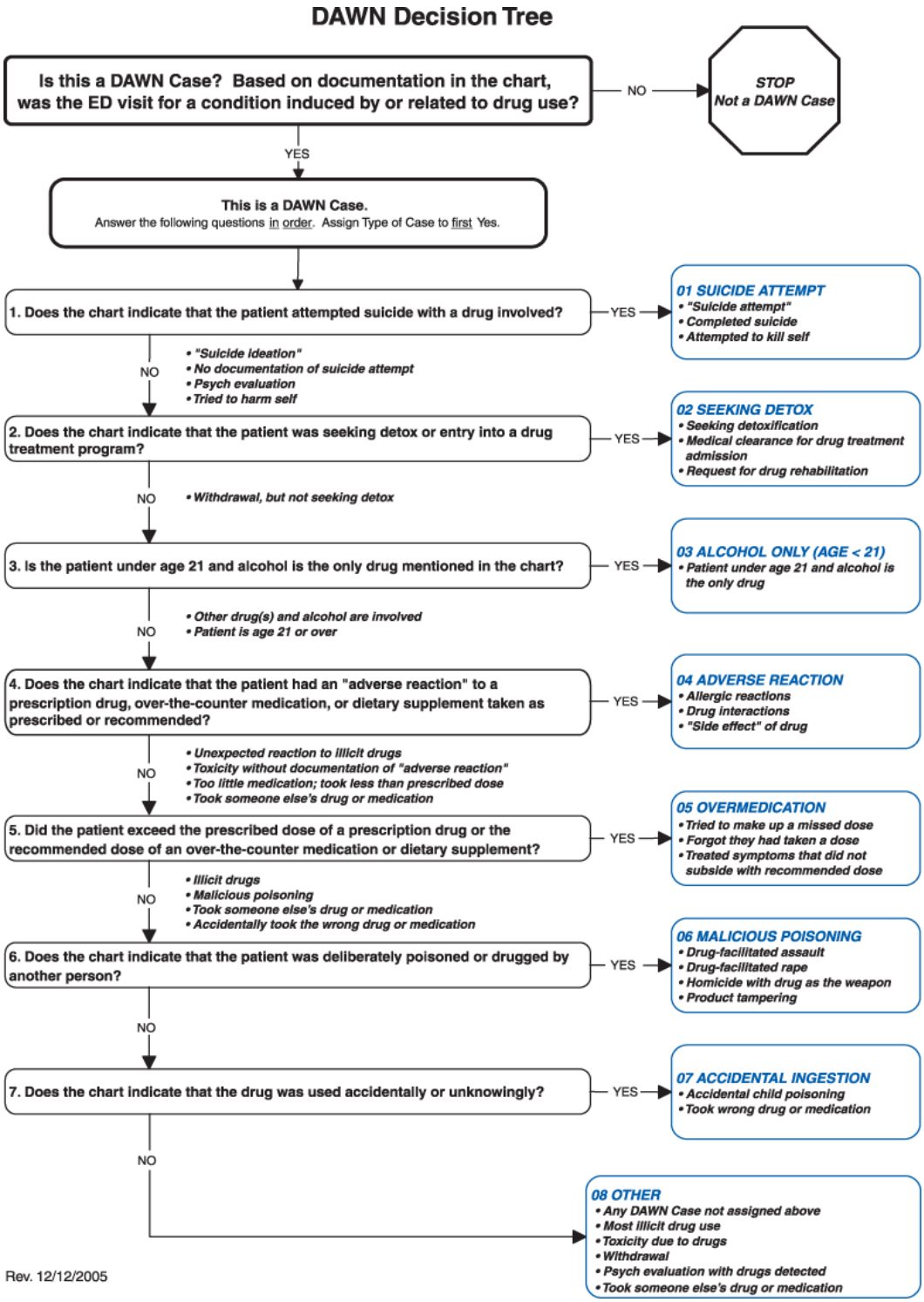
[5] DAWN Reporters are responsible for reviewing ED visit records, deciding if a visit is eligible for DAWN, and, if so, recording select data items for the visit. Additional information on collection of DAWN data is provided in Section 3.2.

[6] https://dawninfo.samhsa.gov/collect/.

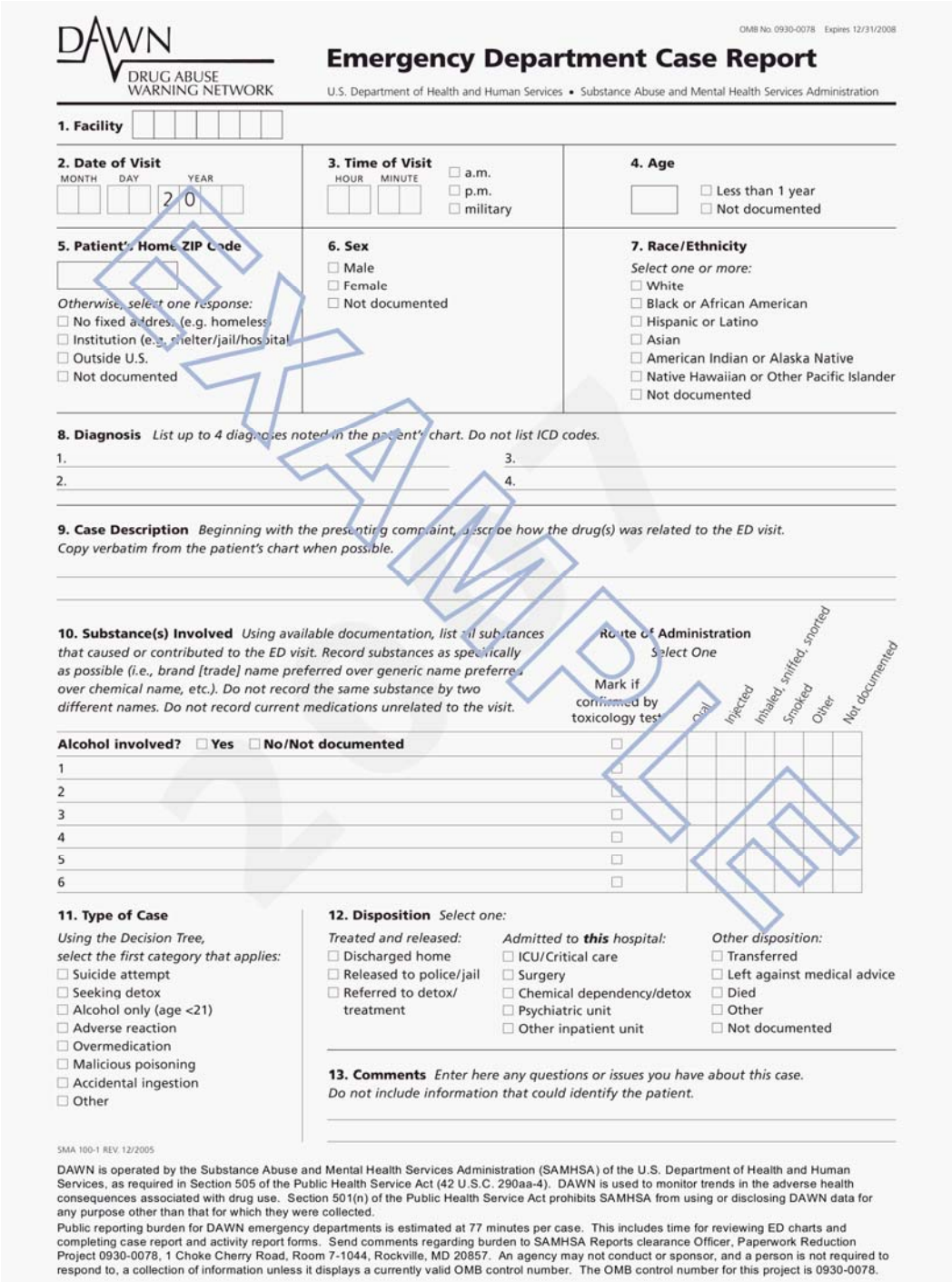
**Figure 1. Type of case decision tree**



## 2.3 Key data items

Figure 2 depicts the data items collected by DAWN. Additional detail on key items is provided in the following sections.

**Figure 2. DAWN ED case form**



DAWN
DRUG ABUSE WARNING NETWORK

OMB No. 0930-0078 Expires 12/31/2008

**Emergency Department Case Report**

U.S. Department of Health and Human Services • Substance Abuse and Mental Health Services Administration

**1. Facility**

**2. Date of Visit** MONTH DAY YEAR 2 0

**3. Time of Visit** HOUR MINUTE ☐ a.m. ☐ p.m. ☐ military

**4. Age** ☐ Less than 1 year ☐ Not documented

**5. Patient's Home ZIP Code**

*Otherwise, select one response:*
☐ No fixed address (e.g. homeless)
☐ Institution (e.g. shelter/jail/hospital)
☐ Outside U.S.
☐ Not documented

**6. Sex**
☐ Male
☐ Female
☐ Not documented

**7. Race/Ethnicity**
*Select one or more:*
☐ White
☐ Black or African American
☐ Hispanic or Latino
☐ Asian
☐ American Indian or Alaska Native
☐ Native Hawaiian or Other Pacific Islander
☐ Not documented

**8. Diagnosis** *List up to 4 diagnoses noted in the patient's chart. Do not list ICD codes.*

1. 3.
2. 4.

**9. Case Description** *Beginning with the presenting complaint, describe how the drug(s) was related to the ED visit. Copy verbatim from the patient's chart when possible.*

**10. Substance(s) Involved** *Using available documentation, list all substances that caused or contributed to the ED visit. Record substances as specifically as possible (i.e., brand [trade] name preferred over generic name preferred over chemical name, etc.). Do not record the same substance by two different names. Do not record current medications unrelated to the visit.*

**Route of Administration** *Select One*

| | Mark if confirmed by toxicology test | Oral | Injected | Inhaled, sniffed, snorted | Smoked | Other | Not documented |
|---|---|---|---|---|---|---|---|
| **Alcohol involved?** ☐ Yes ☐ No/Not documented | ☐ | | | | | | |
| 1 | ☐ | | | | | | |
| 2 | ☐ | | | | | | |
| 3 | ☐ | | | | | | |
| 4 | ☐ | | | | | | |
| 5 | ☐ | | | | | | |
| 6 | ☐ | | | | | | |

**11. Type of Case**
*Using the Decision Tree, select the first category that applies:*
☐ Suicide attempt
☐ Seeking detox
☐ Alcohol only (age <21)
☐ Adverse reaction
☐ Overmedication
☐ Malicious poisoning
☐ Accidental ingestion
☐ Other

**12. Disposition** *Select one:*

*Treated and released:*
☐ Discharged home
☐ Released to police/jail
☐ Referred to detox/ treatment

*Admitted to **this** hospital:*
☐ ICU/Critical care
☐ Surgery
☐ Chemical dependency/detox
☐ Psychiatric unit
☐ Other inpatient unit

*Other disposition:*
☐ Transferred
☐ Left against medical advice
☐ Died
☐ Other
☐ Not documented

**13. Comments** *Enter here any questions or issues you have about this case. Do not include information that could identify the patient.*

SMA 100-1 REV. 12/2005

DAWN is operated by the Substance Abuse and Mental Health Services Administration (SAMHSA) of the U.S. Department of Health and Human Services, as required in Section 505 of the Public Health Service Act (42 U.S.C. 290aa-4). DAWN is used to monitor trends in the adverse health consequences associated with drug use. Section 501(n) of the Public Health Service Act prohibits SAMHSA from using or disclosing DAWN data for any purpose other than that for which they were collected.

Public reporting burden for DAWN emergency departments is estimated at 77 minutes per case. This includes time for reviewing ED charts and completing case report and activity report forms. Send comments regarding burden to SAMHSA Reports clearance Officer, Paperwork Reduction Project 0930-0078, 1 Choke Cherry Road, Room 7-1044, Rockville, MD 20857. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number for this project is 0930-0078.

### 2.3.1 Patient demographics

DAWN collects information on basic patient demographics: sex, age, race/ethnicity, and patient home zip code. The zip code variable has space to indicate if the patient was homeless, institutionalized, or from outside the United States and therefore had no home zip code.

ED records vary in the level and type of detail provided. Although sex, age, and zip code are usually present in patients' ED records, race/ethnicity is often missing or insufficient (e.g., "European"). Although it is possible to record multiple race/ethnicities, for reporting purposes race/ethnicity is collapsed into a single variable with five levels:

- non-Hispanic White,
- non-Hispanic Black,
- Hispanic,
- race/ethnicity not tabulated above, and
- race/ethnicity undocumented.

### 2.3.2 Visit characteristics

DAWN collects detailed information about each visit. The data items include

- date and time of visit;
- type of visit (e.g., suicide attempt, seeking detox, adverse reaction);
- up to 22 drugs or substances for every visit;
- diagnoses reflecting one or more conditions for which the patient was treated, as determined by the clinician after evaluation in the ED; and
- disposition, or the location or facility to which an ED patient was referred, transferred, or released at the conclusion of the ED visit.

DAWN Reporters also provide a brief description of the visit, drawn directly from the ED record, which includes the reason for the visit and any other information necessary to document that the visit is a DAWN case.

### 2.3.3 Drugs and drug categories

For the purpose of DAWN, a drug is any substance that is (a) used as a medication or in the preparation of medication; (b) an illicit substance that causes addiction, habituation, or a marked change in consciousness; or (c) both. Substances reportable to DAWN include illicit drugs (e.g., club drugs, cocaine, heroin, marijuana, stimulants, and alcohol when used by a minor[7]), nonpharmaceutical inhalants,[8] prescription drugs (e.g., drugs for attention deficit hyperactivity

[7] Alcohol use by a minor with no other drug involvement is eligible for DAWN. Alcohol use by an adult must be accompanied by another drug to be eligible for DAWN.

[8] To be reportable as an illicit drug, a nonpharmaceutical substance must be intentionally consumed by inhalation, sniffing, or snorting, and it must have a psychoactive effect when inhaled. Carbon monoxide is

disorder, antibiotics, antidepressants, antipsychotics, anticoagulants, beta blockers, birth control pills, hormone replacement, insulin, muscle relaxants, pain relievers, sleeping aids), drugs used in treatment of medical conditions (e.g., respiratory therapy, chemotherapy, radiation therapy), vaccines, dietary supplements, vitamins, and other over-the-counter pharmaceutical products.

Using the DAWN Drug Reference Vocabulary (DAWN DRV), DAWN is able to identify more than 3,300 individual drugs (which map to more than 19,000 individual brands and street names). The DAWN DRV is a comprehensive drug vocabulary and classification system based on the Multum *Lexicon* that has been modified to meet DAWN's unique requirements. The DRV includes codes for brand (trade) names; generic names; chemical names; metabolites; nonspecific drug terms; and street terms for legal and illegal substances, including prescription and over-the-counter pharmaceuticals and selected nonpharmaceuticals that are abused by inhalation.

DAWN Reporters collect the most specific information about each drug that is available in the ED record. Up to 22 drugs implicated in a visit are assigned a code using the DRV. Because multiple substances can be reported for each DAWN case, the total number of drugs exceeds the total number of DAWN cases reported.

The DRV provides the flexibility needed to accommodate the varying level of drug detail provided in ED records. A drug might be recorded in the ED records by its brand name (e.g., OxyContin®), a generic name (e.g., oxycodone), or by the class it belongs to (e.g., an unspecified narcotic pain reliever). Each of these has a code in the DRV. Narcotic pain relievers are mapped to the larger grouping "Opioid/opiate Pain Relievers," which is part of the broader category "Pain Relievers," which is one of the categories among "Central Nervous System Agents." Illicit drugs and other DAWN-reportable substances are maintained in a similar tiered structure in the DRV.

The Multum *Lexicon* is updated every 2 months to incorporate new products and occasionally introduce new drug categories; the DAWN DRV is updated at the same time. In addition, DAWN continually modifies the DRV to include any drugs reported by EDs that are not in the Multum *Lexicon* (e.g., imported drugs, new combinations of illicit drugs). At the end of each data year, all the drug data received from EDs—the current year's data and data from all previous years—are coded using the most recent DRV. This process ensures that estimates of visits by drug across years are comparable.

Readers interested in exploring the DRV and the manner in which it classifies drugs may obtain the full set of DAWN DRV tables from DAWN's Web site in the relational database named "DAWN_DRV.mdb." Queries are used to join tables and display relationships between different drugs and drug groupings. The DRV is also available as a spreadsheet named "DAWN__Final_Table.xls." Additional information on the Multum *Lexicon*, the DAWN DRV, and

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excluded from the inhalants. Cases involving accidental exposures to inhalants (e.g., exposure to paint fumes while one is painting a closet) are excluded.

the Multum Licensing Agreement governing use of the *Lexicon* can be found on the DAWN Web site.[9]

### 2.3.4 Visit disposition

The visit disposition records where the patient went after leaving the ED. There are three major categories: treated and released, admitted to this hospital, and other dispositions. Additional detail is provided with subcategories.

*Treated and released* includes three subcategories:

- *Discharged home*—"Home" is used as a broad category to mean the patient's residence. Home is generally used for persons who live locally; however, for students at nearby universities, home means their university; for travelers who get sick on the road, it may mean their hotel or wherever they are staying; and so on.
- *Released to police/jail*—Patients that are released to police/jail were usually brought to the ED by the police for treatment of an acute medical problem or for medical clearance before being placed in the jail population.
- *Referred to detox/treatment*—The chart indicates that the patient was referred to a substance abuse treatment or detoxification program, facility, or provider.

*Admitted to this hospital* includes five subcategories:

- intensive or critical care unit,
- surgery,
- chemical dependency/detox unit,
- psychiatric unit, and
- other inpatient units.

*Other disposition* includes five subcategories:

- *Transferred*—The patient was transferred to another health care facility.
- *Left against medical advice*—The patient left the treatment setting without a physician's approval.
- *Died*—The patient died after arriving in the ED but before being discharged, admitted, or transferred.
- *Other*—The discharge status is documented in the patient's chart but does not fit into any of the preceding categories.
- *Not documented*—The patient's discharge status was not documented in the medical chart.

[9] http://dawninfo.samhsa.gov/drug_vocab/.

Although visit dispositions may be reported using the 13 subcategories or the three major categories, a third way that often appears in DAWN reports and tables is to group ED visits based on whether there is any indication in the ED record that the patient received some type of follow-up treatment. “Evidence of follow-up” includes patients who were referred to detox/treatment, admitted to the hospital (any unit), or transferred. “No evidence of follow-up” includes patients with any other disposition.

# 3. DEVELOPMENT OF THE ED COMPONENT OF DAWN

## 3.1 DAWN ED sample design

The redesign of the Drug Abuse Warning Network (DAWN) system introduced in 2003 gave DAWN the capability to make statistically valid annual estimates of drug-related ED visits for the Nation and selected metropolitan areas. A new sample of hospitals was drawn through stratified simple random sampling from among the universe of eligible hospitals in the Nation; oversampling was conducted in selected metropolitan areas.[10] Each year, days of the month are systematically selected for each hospital, and all ED visits for these days are reviewed for eligibility as DAWN cases. Data collection following the new sampling plan was fully implemented for the first time in the 2004 data collection year, and the original sample of hospitals has been followed longitudinally since then. Each year, new hospitals are given the opportunity to be sampled into the longitudinal panel of hospitals.

### 3.1.1 Sample frame of hospitals

After a thorough investigation of alternatives, DAWN chose to use the American Hospital Association (AHA) Annual Survey Database (ASDB) to identify all hospitals in the United States. A sampling frame was built from among all hospitals on the 2001 AHA ASDB meeting the DAWN criteria for eligible hospitals—non-Federal, short-stay, general medical and surgical hospitals in the United States that have one or more EDs open 24 hours a day, 7 days a week.[11] A probability sample proportionate to the number of ED visits in each facility was drawn from among eligible hospitals.

### 3.1.2 Metropolitan areas represented in DAWN

As part of the redesign, samples were drawn to provide the capability to make estimates for the Nation and selected metropolitan areas. These areas are referred to as oversampled areas (OS areas) or DAWN metropolitan areas. Two goals guided the selection of the DAWN metropolitan areas. The first was to preserve the ability to represent the 21 areas that had been part of DAWN since its inception. The second was to improve population and geographic coverage beyond the 21 legacy areas. Accordingly, the design ensured representation of the original 21 legacy areas plus the 5 most populous Metropolitan Statistical Areas (MSAs) in each of the 9 census divisions. Oversamples were selected in a total of 48 MSAs; in 4 of those 48 MSAs, additional oversamples were drawn to allow reporting for subareas within those MSAs. Resources available to DAWN have allowed for data collection in only a portion of the OS areas. During data collection year

[10] The redesign of the DAWN ED component is described in detail in *DAWN: Development of a New Design*, which is available at https://dawninfo.samhsa.gov/pubs/methodology/.

[11] The 24-hour status of hospitals is not contained on the AHA file and is determined by contacting otherwise eligible hospitals directly.

2009, data were collected from a representative sample of hospitals in the Nation and 15 OS areas. Table 1 lists the OS areas that had sufficient participation in 2009 to allow DAWN to publish reliable estimates of drug-related ED visits.

**Table 1. Metropolitan areas with published DAWN estimates of drug-related emergency department visits for 2009**

| DAWN metropolitan areas |
|---|
| Boston-Cambridge-Quincy, MA-NH MSA |
| Chicago-Naperville-Joliet, IL-IN-WI MSA |
| Denver-Aurora, CO MSA |
| Detroit-Warren-Livonia, MI MSA |
| Houston-Baytown-Sugar Land, TX MSA |
| Dade County Division (1) of Miami-Fort Lauderdale, FL MSA |
| Fort Lauderdale Divisions (2) of Miami-Fort Lauderdale, FL MSA |
| Minneapolis-St. Paul-Bloomington, MN-WI MSA |
| New York—5 Boroughs (3) (part of New York-Newark-Edison, NY-NJ-PA MSA) |
| Phoenix-Mesa-Scottsdale, AZ MSA |
| San Francisco Division of San Francisco-Oakland, CA MSA |
| Seattle-Tacoma-Bellevue, WA |

(1) Unless otherwise noted, DAWN defines metropolitan areas using the MSA and Division definitions issued by the Office of Management and Budget in June 2003 (available at http:/www.whitehouse.gov/omb/bulletins/b03-04.html).

(2) Miami-Miami Beach-Kendall, FL Division.

(3) Fort Lauderdale-Pompano Beach-Deerfield Beach, FL and West Palm Beach-Boca Raton-Boynton Beach, FL Divisions.

(4) Bronx, Kings, New York, Queens, and Richmond Counties, NY.

**NOTE:** MSA, Metropolitan Statistical Area.

### 3.1.3 Metropolitan-level stratification

The DAWN sample design was conceived to provide the statistical infrastructure to produce reliable and representative estimates for the Nation and a portion of DAWN metropolitan areas (OS areas), depending on available resources and interest. To accomplish this objective, a subset of the hospitals within each OS area was identified *a priori* as having a dual purpose in estimation. Referred to as dual-purpose hospitals, these designated hospitals can contribute either to an estimate for the OS area in which they are located or to the estimate for the remainder area outside of OS areas. Dual-purpose hospitals carry two probabilities of selection (POS) and two stratum identifiers. One POS/stratum is associated with membership in an OS-area oversample, and the other is associated with membership in the remainder-area sample.[12]

[12] Hospitals in the four MSAs with subMSA oversampling can have up to three nonzero POS/strata: (1) a POS/stratum for membership in the MSA, (2) a POS/stratum for membership in the submetropolitan area, and (3) a POS/stratum for membership in the remainder area.

Each data year, the response rates and nonresponse patterns for each OS area are reviewed to determine data quality. Those OS areas with acceptable data quality are allowed to stand on their own as the basis for separate estimates; they are referred to as stand-alone OS areas. If it is determined on the basis of response rates and bias analyses that an OS area cannot stand alone, the design provides that the OS area is eliminated as a separate area but becomes part of the remainder area.

DAWN national-level estimates are the sum of the estimates for stand-alone OS areas plus the remainder area. The formula for the national estimate is

$$\left( \sum_{i=1}^{N} a_i \right) + b$$

where $a_i$ is the estimate for stand-alone OS area $i$, $N$ is the number of stand-alone OS areas, and $b$ is the remainder area estimate inclusive of dual-purpose hospitals in OS areas that do not stand alone.

### 3.1.4 Hospital size and ownership stratification

Sampled hospitals in each of the OS areas were stratified by hospital size (up to four categories,[13] on the basis of the number of ED visits) and ownership type (public and private). The stratification plan included an additional geographic construct to represent the remainder of the United States outside the OS areas. Hospitals in the remainder area were divided into 24 strata on the basis of four regions (Northeast, South, Midwest, West), three size categories, and ownership type.

### 3.1.5 Sample size and sample allocation

Each hospital in the DAWN sample was selected through a random process, which theoretically could have been repeated many times, resulting in many hypothetical samples. Sampling variance, or the margin of error, refers to the extent to which these samples were likely to have varied. Two measures of this variability are the standard error (SE) and the relative standard error (RSE), which is defined as the SE of the estimate divided by the estimate itself. The precision of an estimate is inversely related to the sampling variance, as measured by the RSE. The greater the RSE value, the lower the precision. DAWN is designed to have estimates for major drug categories (i.e., all drug-related ED visits plus ED visits for cocaine, heroin, and marijuana) wherein the RSEs are less than or equal to 10 percent for metropolitan-area estimates and less than or equal to 15 percent for national estimates. Sample sizes for each metropolitan area and the Nation were set using these targeted precision levels in combination with the theory of optimal allocation for stratified samples.

[13] In DAWN metropolitan areas, size categories were determined independently for each OS area. The number of hospitals determined the unique size categories: fewer than four hospitals were placed in one size category; four to seven hospitals were placed in two size categories; and eight or more hospitals were placed in four size categories. Areas outside of DAWN metropolitan areas were organized into three size categories.

## 3.2 Data collection procedures

This section documents the methodologies used to collect DAWN data. The DAWN operations contractor (DOC) is responsible for collecting DAWN data. Additional detail on data collection methodology is available in the *ED Reference Guide*.[14]

### 3.2.1 Review of ED medical records

DAWN ED data are collected directly from the medical records of patients treated in the ED. The review is done after the ED visit is completed. Patients, their families, and clinical staff are never interviewed. The data are collected by trained DAWN Reporters who review ED medical records to identify ED visits related to recent drug use. For each DAWN case, an electronic case report is completed (Figure 2, in Section 2, depicts the data elements collected). Case reports are submitted electronically using the Electronic Hospital Emergency Reporting System (eHERS), a customized system developed specifically for DAWN. DAWN Reporters also submit an activity report detailing their progress in reviewing the ED charts, and they report the monthly census of all ED visits made to the hospital. Data collection is ongoing.

The majority of DAWN ED data are collected on site at hospitals by a DAWN Reporter who reviews paper or electronic records. A growing number of hospitals have centralized electronic medical records systems that can be accessed from the outside. In these cases, DAWN Reporters access the systems via remote access from the DOC's headquarters. A secured transmission line is maintained for this purpose by the DOC.

### 3.2.2 Selection of ED medical records

The original DAWN redesign protocol called for direct review of all available ED records. After careful review and testing, however, it was established that a sample of ED visits could be used to produce sufficiently precise estimates in comparison to a census of visits provided that the cost savings be redirected toward recruiting additional hospitals. In 2008, a protocol was developed for drawing a systematic sample of each ED's medical records based on the date of the ED visit. In those EDs with sampling, the DAWN Reporter is sent a list each month of designated dates for chart review, and the charts for all the ED visits occurring on the designated dates are reviewed for drug-related visits. By 2010, sampling of ED records had been introduced in all larger hospitals. Unintentional gaps in chart review also occur. Gaps in record review may be due to such factors as a DAWN Reporter's unexpected absence or circumstances at the hospital that preclude review of all ED records (e.g., limitations on the hours or days that a DAWN Reporter may access ED records). A similar method of within-hospital visit weighting is used to compensate for both intentional sampling of ED records as well as unintentional gaps in record review (see Section 3.4.3).

[14] The *ED Reference Guide* is available for download from the DAWN Web site, https://dawninfo.samhsa.gov/collect/. The direct link for the document is https://dawninfo.samhsa.gov/files/collect_2009-2011/ed_reference_guide_2009-2011.pdf.

## 3.3 Data preparation

The DOC performs numerous reviews that begin at the point of entry and continue through the final delivery of the data to SAMHSA. Automated systems check DAWN case data to confirm eligibility of cases submitted and for case type discrepancies. In addition, edit programs are run to identify range and consistency errors. "Unknown" drugs entered by the DAWN Reporter are reviewed and new drugs added to the DRV, when appropriate. At the end of every data collection year, an extensive data review is conducted. Statistical process control (SPC) is used to evaluate the monthly counts of ED visits, charts reviewed, and cases reported for each ED. If any monthly count of visits, charts, or cases is identified as inconsistent by SPC, that count is investigated via communication with contacts from the ED. The results of the investigation are documented and sent along with the final delivery. As a final step, the SPC results and monthly counts for each ED are reviewed by the DOC, the Data Analysis Contractor (DAC), and representatives from SAMHSA.

## 3.4 ED data and statistical processing

The DOC prepares the database as described in Section 3.3, at which point the annual data files and the current DRV are transferred to the DAC. The DAC performs a number of data quality and data processing steps to prepare the file for weighting and for developing estimates (see Section 3.4.1). Sample maintenance is then performed (Section 3.4.2). Weights and adjustments are then developed (Section 3.4.3). Section 3.4.4 describes the sequential processing steps for developing and applying weights and adjustments.

### 3.4.1 ED data processing

Because up to 22 drugs may be reported for each visit, the DAC begins its processing by ensuring that no duplicate drugs are recorded for a visit. The DRV, the database that defines how drugs are classified and mapped to drugs, is applied to the microdata[15] received from the DOC to derive drug IDs and the standard drug list (SDL) classification associated with each drug. The resulting drug IDs for a visit are compared with one another to ensure that a drug appears only once for a visit.[16] After the initial deduplication, mouthwash and alcohol drug IDs are also deduplicated. Last, a check is run to eliminate cases that are alcohol-only for respondents aged 21 or older. The data are classified originally on a brand level, then processed to a drug ID level; a final step is to flatten the data file to a visit level. Discrepancies or irregularities are resolved through discussion among the DOC, the DAC, and the DAWN team at the Center for Behavioral Health Statistics and Quality (CBHSQ).

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[15] This version of the annual data is referred to as the "microdata" because it includes one record for every brand of drug mentioned in a visit. There are up to 22 records for each visit.

[16] Identical drug IDs can result when different brand codes map to the same drug ID. When the duplicate drug ID is removed, the brand code associated with it will be lost because only one brand is retained for each unique drug ID in the visit-level file. The detailed information on all brands is retained in the brand-level file and can be retrieved if needed.

### 3.4.2 DAWN sample maintenance

As noted above, the initial DAWN sample was selected from a sampling frame created from the 2001 AHA ASDB. Because DAWN is a longitudinal survey, maintenance is conducted every year to ensure that the sample remains representative of the target population of eligible hospitals. Over time, new hospitals will be "born," some will close, some will merge with other hospitals, and some will "demerge" to form two or more smaller hospitals. Some hospitals no longer maintain 24-hour EDs and become ineligible; others open them and become eligible. Each year the sampling frame is updated to reflect new, closed, merged, and demerged hospitals on the basis of information in the most current AHA ASDB. Since 2004, a master file has been maintained of the changes to the frame and originally sampled hospitals, plus information on all new frame and sampled hospitals. All variables in the AHA master file are assigned consistent names from year to year, even if there are variable name changes in later AHA ASDBs. Conversely, documentation accompanying the AHA ASDB each year is carefully reviewed to ensure that variables with the same name still mean what they did in earlier years.

Newly eligible hospitals identified on the most current ASA ASDB, and confirmed for having a 24-hour ED, are provided the opportunity to be selected into the sample on the basis of the sampling fraction of the stratum in which each newly eligible hospital is located.

### 3.4.3 Weights and adjustments

Each year, weights and adjustments are calculated and applied to the collected data to ensure that the survey results represent the target population. Sampling weights are first calculated as the inverse of the probability of selection and then adjusted for variable nonresponse by a procedure known as poststratification, or benchmark adjustment. For steps involving within-hospital adjustments, the processing is carried out at the facility/month level; that is, adjustments are made to data for each month within each facility within each hospital. The derivation of weights to adjust for unequal POS, nonresponse, and other sources of bias is processed at the hospital/stratum/region level.

**Probabilities of selection.** The DAWN hospitals are selected using stratified simple random sampling with oversampling in DAWN metropolitan areas. A hospital can have up to three POSs: a remainder-level POS, a division-level POS, and an OS-area-level POS (see Section 3.1.4). Decisions about which POS to use are made after an analysis of response rate and nonresponse bias is conducted for each OS area.

**Within-hospital weighting adjustment.** Charts may be intentionally sampled or there may be unintentional gaps due to problems in collecting data or obtaining access to records (see Section 3.2.2). To compensate for within-hospital nonresponse, the DAWN weighting plan includes a nonresponse adjustment factor for each month of data collection within each facility; it is equal to the number of ED visits divided by the number of charts reviewed for each of 12 months in the data collection year. The within-hospital weights are applied to the by-month

count of visits. That is, the visit counts for a given facility-month are first summed for each drug and then multiplied by the corresponding within-hospital adjustment factor for that facility-month. The weighted totals are then summed over all facilities and months to give a total weighted visit count for each drug for each hospital.

**Weighting adjustment for hospital nonresponse.** Hospital-level nonresponse occurs when hospitals fail to provide enough valid data. To minimize the impact of hospital nonresponse, the DAWN weighting plan includes nonresponse adjustment factors that are developed and applied within each weighting class. Weighting classes are formed on the basis of the aforementioned sampling stratification schemes. Within each weighting class, the nonresponse adjustment factor is calculated as the sum of the sampled hospital weights divided by the sum of the weights of the responding hospitals. The hospital nonresponse adjustment factors are checked to make sure the adjustments are within reasonable bounds. If a nonresponse adjustment factor is too large, adjacent weighting classes are collapsed and new nonresponse adjustment factors are calculated.

When the hospital-level nonresponse adjustment factors are considered final, a nonresponse-adjusted sampling weight is then calculated as the product of the nonresponse adjustment factor and the sampling weight. For each weighting class, a verification check is conducted to ensure that the sum of the nonresponse-adjusted sampling weights is equal to the sum of the sampled hospital weights.

**Weighting adjustment for population benchmarks (poststratification).** The DAWN weighting plan also includes a poststratification adjustment factor that reconciles the weighted number of total visits for responding hospitals with the number of total visits from the most recent AHA ASDB. DAWN uses a ratio adjustment within strata to implement this adjustment.

Within each stratum, the adjustment factor is calculated as the ratio of the AHA count of total visits to the weighted sum of total visits for responding hospitals. The factors are verified to ensure they are within reasonable bounds. If they are out of bounds (either too small or too large), adjacent poststratification strata are collapsed and new poststratification adjustment factors are calculated.

When the poststratification adjustment factors are considered final, a poststratified weight is then calculated. The final weight is calculated as the product of the poststratification adjustment factor and the nonresponse-adjusted sampling weight. For each poststratification stratum, a validity check is conducted to ensure that the sum of the poststratified weighted total visits is equal to the corresponding AHA count of total visits from each stratum.

Estimates for the entire universe of DAWN-eligible hospitals in the United States are produced by applying poststratified weights to the data received from the sampled hospitals. Thus, for 2009, 380,125 submitted cases were extrapolated to an estimate of 4,595,263 drug-related ED visits. Considering the margin of error, this estimate may range from 4,161,740 to 5,028,786 drug-related ED visits, out of approximately 121 million total ED visits estimated for the United States in 2009.

### 3.4.4 Sequential process of developing and applying weights and adjustments

The order of processing the weights and adjustments is as follows:

1. Identify the design strata. Variance estimation strata are formed on the same basis as the design strata, where selected strata are collapsed to ensure that there are at least two hospitals in each estimation stratum.
2. Compute hospital-level, design-based weights on the basis of design-based selection probabilities.
3. Apply an initial weight adjustment to correct for minor discrepancies in the selection probabilities.
4. Define variance estimation strata.
5. Define weighting classes that are sufficiently large and internally homogeneous for nonresponse adjustment. These usually are combinations of variance estimation strata.
6. Compute nonresponse adjustments within weighting class.
7. Define poststratification classes (may be similar to nonresponse weighting classes).
8. Compute poststratification adjustment factors on the basis of reported visits for responding hospitals and poststratum totals from the AHA frame.
9. Prepare an output file with each of the hospital-level weights and weight adjustment factors listed individually for quality control (QC) review.
10. Compute the final case weights.
11. Conduct QC of weights.
12. Perform QC review.

Additional information on the specific characteristics of the sample, response rates, and estimates is provided in the annual report that is issued at the conclusion of each data collection year.[17]

[17] https://dawninfo.samhsa.gov/pubs/edpubs/.

# 4. DAWN PUBLICATIONS AND DATA DISSEMINATION

The Drug Abuse Warning Network (DAWN) issues both regular and ad hoc reports, tables, and related data products. This section describes the characteristics of these data products and the standards DAWN uses to compile and present estimates.

## 4.1 Analytic groups

For the purpose of analysis, DAWN developed a set of categories to use when reporting on emergency department (ED) visits. Referred to as "analytic groups," these categories combine visits with similar characteristics to produce summary statistics. The DAWN analytic groups and their definitions are provided in Table 2. The analytic groups fall into one of three types: all visits (regardless of intent), visits where there is an indication of some type of drug misuse or abuse, and visits where there is no indication of misuse or abuse.

Because of DAWN's focus on drug misuse and abuse, this topic is addressed by several analytic groups, including all drug misuse or abuse, all visits involving illicit drugs, visits involving nonmedical use of pharmaceuticals, visits involving alcohol for patients of all ages, and visits involving alcohol for patients under the age of 21. Also isolated for analysis are visits involving drug-related suicide attempts and visits made by patients seeking detoxification services. The subgroups under "Drug misuse or abuse" in Table 2 are not mutually exclusive because a single visit can involve multiple types of drugs. For example, an ED visit involving marijuana and oxycodone would be grouped with other visits involving illicit drugs, as well as with visits involving nonmedical use of pharmaceuticals.

Annually DAWN produces comprehensive sets of tables, the *DAWN Trend Tables,* that provide estimates of drug-related ED visits by type of drug, patient gender and age, visit disposition, and other characteristics for the current year and all prior years. A complete set of tables is produced for each analytic group listed in Table 2. Each set is reproduced for the Nation and for metropolitan areas with sufficiently high levels of participation (see Table 1). A more detailed description of the *DAWN Trend Tables* is provided in the *Guide to Drug Abuse Warning Network Trend Tables, 2009,* which is available at the DAWN Web site.[18]

## 4.2 Drug lists

In addition to being a coding system that accommodates different levels of drug detail, the DAWN Drug Reference Vocabulary (DRV) provides a method for aggregating drugs into meaningful higher-level groupings. DAWN currently collects drug information on thousands of individual products. The individual products are mapped to their generic drug name; currently, approximately

[18] https://dawninfo.samhsa.gov/pubs/methodology/.

3,300 generic drugs are reported on. Estimates are prepared using a shorter list of approximately 500 drugs, known as the "standard drug list," in the *DAWN Trend Tables*. The DAWN annual reports provide tables with approximately 100 highlighted drugs from the standard drug list for each analytic group.

**Table 2. DAWN analytic groups**

| Analytic group | Description |
|---|---|
| All visits | This group includes all visits that are reportable to DAWN without regard for the reason for the visit or the specific drugs involved. It includes visits involving all forms of drug misuse or abuse plus visits resulting from adverse reaction, accidental ingestion, suicide attempts, and visits seeking detoxification services. These estimates are useful for looking at overall levels of drug involvement in ED visits. |
| **Drug misuse or abuse** | **—** |
| Overall drug misuse or abuse | This analytic category includes visits that involve all forms of drug abuse or misuse as defined by DAWN. This is the combination of visits from the following four analytic groups: illicit drug visits, nonmedical use of pharmaceuticals, alcohol-related visits, and underage drinking. A visit may appear in more than one of those subgroups, but it will appear only once in this overall group. Suicide attempt visits and seeking detox visits are included in this category if illicit drugs were involved. |
| Illicit drugs | This analytic category includes visits that involve the use of drugs that have limited or no therapeutic value and are generally illegal if taken without a prescription. These substances include cocaine, heroin, marijuana, methamphetamine, MDMA (Ecstasy), GHB (4-hydroxybutanoic acid), flunitrazepam (Rohypnol), ketamine, LSD, PCP, and hallucinogens. Visits involving the inhalation of substances for their psychotherapeutic properties (e.g., sniffing model airplane glue) are included. |
| Nonmedical use of pharmaceuticals | This analytic category includes visits that involve nonmedical use of pharmaceuticals: patients who took a higher than prescribed or recommended dose of their own medication, patients who took a pharmaceutical prescribed for another person, malicious poisoning of the patient by another individual, and documented substance abuse involving pharmaceuticals. |
| All alcohol | This analytic category includes visits for patients of all ages when alcohol is used in combination with other drugs, plus visits involving alcohol use with no other drugs for patients under the age of 21. |
| Underage drinking | This analytic category includes ED visits that involve alcohol use (alone or with other drugs) for patients under the age of 21. |
| Drug-related suicide attempts | This analytic category includes ED visits that involve drug-related suicide attempts. It includes visits for drug overdoses, as well as suicide attempts by other means, e.g., using a firearm, if drugs were involved or related to the suicide attempt. Inclusion in this analytic category has no restrictions on the type of drug used. |
| Seeking detox services | This analytic category includes various situations such as nonemergency requests for admission for detoxification services, visits to obtain medical clearance before entry to a detox program, and acute emergencies in which an individual is in distress (i.e., displaying active withdrawal symptoms) and is seeking detox. These estimates do not include patients who seek or enter the hospital's detox unit through other avenues. |
| **Other** | **—** |
| Adverse reactions to pharmaceuticals | This analytic category includes ED visits in which an adverse health consequence (such as side effects or an allergic reaction) resulted when taking prescription drugs, over-the-counter medications, or dietary supplements as prescribed or recommended. |
| Accidental ingestion of drugs | This analytic category includes ED visits in which an individual accidentally or unknowingly used a prescription drug, over-the-counter medication, or dietary supplement. Drug-related accidental ingestion typically involves patients aged 5 and under. |

## 4.3 Estimates of visits and drugs

All estimates provided in DAWN publications and tables are calculated using data that have been weighted as described in Section 3.4. Estimates for any variable of interest are determined by first summing the case totals within facility-month, applying the within-hospital weight, summing to the hospital level, applying the final hospital weight, and summing over all hospitals.

The DAWN annual report, short reports, and the *DAWN Trend Tables* include predominantly estimates at the ED visit level—that is, how many visits involved a certain drug. Another measure is the total number of drugs reported. Because most ED visits involve more than one drug, the total drug reports will always exceed the total drug-related ED visits. To illustrate the difference, consider a visit involving oxycodone and aspirin. Both drugs are pain relievers. This visit will count as one visit involving oxycodone and one visit involving aspirin. When reporting the number of visits involving pain relievers in general, this visit will be counted just once even though two types of pain relievers were involved. Table 3 illustrates the difference between estimates of visits and estimates of drugs for the illicit drug category "stimulants."

**Table 3. Estimates of visits compared with estimates of drugs involved, 2009**

| Illicit drug category | Estimates of ED visits | Frequency of drugs reported |
|---|---|---|
| Stimulants | 93,562 | 101,547 |
| Amphetamines | 37,430 | 37,430 |
| Methamphetamine | 64,117 | 64,117 |

## 4.4 Standardized rates

DAWN annual reports and the *DAWN Trend Tables* include population-based rates as well as estimates. Rates are standardized measures that are helpful when comparing levels of drug-related ED visits for different age groups and genders. For age in particular, the size of the underlying population differs considerably across age groups; for example, the number of individuals aged 18 to 20 in the United States is much lower than the number of individuals aged 35 to 44. All other factors being the same, a higher estimate of the *number* of ED visits would be expected to occur naturally for the group that is larger in the population.

*Rates*, however, are calculated as the number of ED visits per 100,000 persons. The rate is calculated by dividing the estimate for a particular group by the population of that group and then multiplying by 100,000. Because they are reported as percentages, the relative standard errors (RSEs) provided in DAWN tables apply equally to the estimates and the rates.

For data collection years 2004 through 2009, rates were calculated using population data from the U.S. Census Bureau based on the 2000 decennial census. Population estimates used to generate rates are as of July in the data collection year. National-level population estimates for intercensal years are obtained from the U.S. Census Bureau Postcensal Resident Population National Population Dataset, National Estimates by Demographic Characteristics—Single Year of Age,

Sex, Race, and Hispanic Origin, Monthly Population Estimates. Estimates at the metropolitan-area level are drawn from the U.S. Census Bureau Postcensal Resident Population County Population Datasets, County Estimates by Demographic Characteristics—Age, Sex, Race, and Hispanic Origin, State Datasets. Data from the 2010 decennial will be used as they become available.

Every year, DAWN recalculates estimates and rates for all years (2004 through current data collection year) using the current DAWN DRV and the U.S. Census Bureau's most recent population estimates for all years.[19]

## 4.5 Measures of precision and error

Each hospital in the DAWN sample was selected through a random process, which theoretically could have been repeated many times, resulting in many hypothetical samples. Sampling error refers to the extent to which these samples vary. Two measures of this variability are the standard error (SE) and the RSE, which is defined as the SE of the estimate divided by the estimate itself. The precision of an estimate is inversely related to the sampling variance, as measured by the RSE. The greater the RSE value, the lower the precision.

For example, if 10,000 estimated visits involve a given drug, and this estimate has an SE of 500 visits, then the RSE value is 5 percent:

$$RSE = SE/Estimate$$

$$RSE = 500/10{,}000$$

$$RSE = 0.050$$

$$RSE\% = 5.0\% \ (RSE*100\%)$$

In addition to RSEs, confidence intervals (CIs) are often included in tables published by DAWN. The 95 percent CI is calculated as

$$CI = Estimate \pm (1.96 \times RSE \times Estimate),$$

where 1.96 comes from the table of normal distribution *z*-values and means that 95 percent of the normal distribution lies within 1.96 standard deviations of the mean.

[19] The U.S. Census Bureau issues population estimates for each year between decennial censuses. Each year, the estimates for the current year are issued, and estimates for all years since the decennial are reissued. Each year's estimates are referred to as "Vintage 20xx." DAWN uses the most current vintage estimates.

Applying the formula to the example above, the 95 percent CI would be

$$10{,}000 \pm (1.96 \times 0.05 \times 10{,}000) = 10{,}000 \pm 980.0$$

Lower limit: 10,000 - 980 = 9,020

Upper limit: 10,000 + 980 = 10,980

95% CI: 9,020 to 10,980.

If repeated samples were drawn from the same population of hospitals, using the same sampling and data collection procedures, then 95 percent of the time the true population values would fall between 9,020 and 10,980.

Both between- and within-hospital variance components are accounted for in the variance estimation process. Within-hospital variance is estimated using a replication strategy by which two random replicates are created within each hospital, and the variance between the two replicates represents the within-hospital contribution. Typically, this component is considerably smaller than the between-hospital variance, which is calculated as the variance between weighted hospital totals within each stratum.

Variance estimates reported in the *DAWN Trend Tables* are determined using the Taylor series linearization variance estimation method available in SUDAAN® software. This method is particularly appropriate for analyzing cluster data, such as those that are generated by the DAWN sampling plan.

## 4.6 Suppression

DAWN uses a set of criteria to determine whether estimates can be released to the public. Data may be suppressed to protect patient confidentiality or to ensure that published findings meet statistical standards of reliability for survey results. In all published materials, estimates are suppressed according to the following rules:

- *The RSE of the estimate is greater than 50 percent*—When the RSE is greater than 50 percent, the lower bound of the 95 percent CI approaches or includes the value zero. A CI that includes zero means that the estimate is not statistically different from zero at this precision level.
- *The estimate is based on fewer than 30 ED visits*—Estimates based on a small number of cases are typically suppressed because the RSE is greater than 50 percent. Estimates that do meet RSE criteria for publication but are based on fewer than 30 ED visits (weighted or unweighted) are deemed too unreliable for publication. Such estimates are also suppressed to protect patient privacy.

It is mathematically possible that an estimate could have no sampling error and an RSE of zero. This occurs when the number of ED visits being estimated is small, all the hospitals contributing to

that estimate were selected with certainty, and the absence of any sampled hospital is due to nonresponse. In most cases, an estimate with an RSE of zero is suppressed on the basis of the small number of cases. In the unlikely event that an estimate is published with an RSE of zero, it is most appropriate to interpret the RSE as signifying that the necessary data were not available to approximate the sampling error.

## 4.7 Cross-year comparisons

In DAWN annual reports and *DAWN Trend Tables*, comparisons in the estimates of ED visits between years are presented in the form of percentage differences, calculated as the current estimate minus an earlier year's estimate divided by that estimate. For shorter-term comparisons, percent changes are calculated for the current year compared with last year and the current year compared with 2 years ago. For longer-term comparisons, estimates for the current year are compared with those for 2004.[20] The percent change is reported only if the difference is statistically significant at the $p < 0.05$ level.

Tests for the significance of differences between 2 years consider the variance of each year's estimate and the covariance between the two. Hospitals that appear in both samples and provide data in both years will contribute to the covariance and thus decrease the overall sampling variance beyond the combined contribution of the two samples. That is, the variance estimation process used to establish significance takes into account any overlap between hospitals that participated in both years.

[20] Due to data limitations in 2004, long-term comparisons for ED visits resulting from adverse reactions are made between 2005 and the current year.

# 5. QUALITY ASSURANCE/QUALITY CONTROL

Survey error, also referred to as bias, is the extent to which findings from the survey sample differ from those of the population of interest. Error can be introduced at any stage in the survey process, from building the sample frame to reporting estimates. This section documents methodologies employed by the Drug Abuse Warning Network (DAWN) to help ensure that published estimates are representative, accurate, and reliable.

## 5.1 Minimization of nonsampling error

To control the nonsampling error components and produce data of high quality, DAWN has a well-defined data quality assurance program and a continuous data quality control (QC) program. The two primary components of the data QC program are (1) the extensive and continuous monitoring of data quality during data collection and processing and (2) an annual data quality review (DQR) meeting that assesses data quality from a broad perspective (i.e., a review of the annual data for each of the individual emergency departments [EDs] and in relation to other EDs).

### 5.1.1 Maintaining data quality during data collection and data preparation

Measures used to monitor data quality during data collection include but are not limited to onsite quality audit reviews and quarterly standardized error feedback reports. In addition to those measures, DAWN employs a custom-built software system (eHERS) to collect DAWN data. eHERS, which provides automated prompts to ensure that DAWN Reporters collect complete data, is populated with the detailed codes that are used to record drugs, race/ethnicity, visit disposition, and other codified variables. It performs real-time data validation checks to ensure that the data are within valid ranges and consistent with other information collected for the visit. eHERS also checks across visits to ensure that visits are not entered multiple times and follows a procedure to resolve conflicts if multiple entries are detected.

### 5.1.2 End-of-year data quality review

Before data are weighted, researchers responsible for the collection (the DAWN operations contractor) and analysis (data analysis contractor) of DAWN data meet with staff from the Substance Abuse and Mental Health Services Administration's Center for Behavioral Health Statistics and Quality to review the quality of the data. This process is referred to as the DQR.

Before the DQR meeting, the DAWN operations contractor prepares an electronic file that summarizes what is known about the quality of the data that was collected in the prior year. The DQR spreadsheet contains descriptive information including facility ID, facility name, oversampled area name, stratum, eligibility, subsampling information, and participation status. In addition, the DQR spreadsheet includes summary data for each of the fields for each ED by month, as shown in Table 4. Review of these data items reveals what portion of ED visits in each hospital for each month were evaluated for inclusion in DAWN. Depending on the pattern of missing data for an ED,

the group comes to a consensus about whether to delete, adjust, or impute the count of eligible ED visits, the count of medical charts reviewed, and the count of identified DAWN cases in each month of each ED for the reporting year. These counts are vital to developing accurate within-facility adjustment factors for each month for each facility.

**Table 4. Data items in the data quality review spreadsheet**

| Field | Month 1 | Month 2 | … | Month 12 |
|---|---|---|---|---|
| Visits | — | — | — | — |
| Charts | — | — | — | — |
| Cases | — | — | — | — |
| Cases/charts | — | — | — | — |
| Subsampling rate | — | — | — | — |
| Left without being seen | — | — | — | — |
| Delete code | — | — | — | — |
| Adjust code | — | — | — | — |
| Impute code | — | — | — | — |
| Hard delete code | — | — | — | — |
| Donor code | — | — | — | — |

## 5.2 Minimization of sampling error

The statistical methodologies described in Section 3.4 reflect efforts to minimize sampling error. For example, the DAWN statistical methodology provides for clearly defined criteria to construct the initial hospital sampling frame. Coverage error is minimized by using a sampling frame that has virtually 100 percent coverage of the target population. Weighting is introduced to account for the probability of selection, within-hospital nonresponse, hospital-level nonresponse, and the total number of visits in the sample frame as independently established by the American Hospital Association Annual Survey Database. Validity checks are made at each stage of weighting to ensure that the sum of weights at that stage equaled the relevant reference point.

## 5.3 QC on released reports and tables

All publications and tables issued by DAWN are subject to multi-tiered data QC measures. Tables are produced and independently verified by a separate statistician/programmer. Estimates are verified against other tables to ensure cross-table consistencies. Tables in reports are verified against source files. Text descriptions of findings are verified against report tables by three separate and independent readers. All observations in respect to the similarity or differences between estimates are established through statistical testing that is independently recomputed and verified.

# 6. DATA LIMITATIONS

## 6.1 Limitations of survey data

Information on drug-related emergency department (ED) visits in the Drug Abuse Warning Network (DAWN) is based on a sample and is, therefore, subject to sampling variability. The standard error measurements and confidence intervals provided for all estimates reflect the sampling variability that occurs (1) by chance because only a sample rather than the entire universe is surveyed and (2) by nonresponse.

## 6.2 Limitations of using extant medical records

Although every effort is made during the data collection phase to collect data accurately and precisely, extant medical records vary in specificity and detail. Factors that may affect the reliability and accuracy of the findings include the following:

- DAWN data collectors attempt to identify with a high degree of specificity the exact drugs involved in an ED visit. If extant medical records include only a general description of a drug (e.g., "benzodiazepines," "narcotic pain reliever"), the drug is grouped in a general category (e.g., benzodiazepines not otherwise specified).
- Many drug-related ED visits involve multiple drugs. In these instances, it may be difficult or impossible to determine whether a single drug is responsible for the visit, or if the visit was the result of the interaction between the drugs. Similarly, when multiple drugs are involved, it should not be assumed that they are all taken for the same reason; a patient may misuse one type of prescription medication while taking another medication as prescribed.
- DAWN seeks to include only the drugs that are related to the ED visit. Any drugs or medications that the patient may be taking regularly are excluded, unless the medical chart indicates that they were implicated in the ED visit. If the ED record is not clear on this point, drugs that were not implicated in the visit may be included in the DAWN data. Conversely, it is also possible that involvement of current medications is underreported if their involvement in the ED visit is not recognized or documented by the clinician.
- DAWN does not produce rates (visits per 100,000 population) for race/ethnicity groups. Information on race and ethnicity is often poorly documented in extant ED records. In addition, some hospitals consider race/ethnicity to be private information and will not make it available to DAWN Reporters. As a result, about 15 percent of visits each year do not contain race/ethnicity information. These missing data result in the systematic understatement of visits by race/ethnicity category.

## 6.3 Limitations on toxicology test finding

Although DAWN documents whether a drug was positively confirmed by toxicology testing, DAWN does not require that all drugs reported for the ED visit be confirmed by laboratory testing. This is because information about the drugs involved in the ED visit is often available from other sources

(for example, the medication may be brought to the ED). Toxicology tests are not used consistently across EDs, and some toxicology tests are not specific enough to identify particular drugs. Furthermore, a positive toxicology test is not necessarily evidence of recent drug involvement in an ED visit if it is a current medication or a drug that persists in the system long after it was used. For this reason, DAWN requires that the involvement of drugs be mentioned in the ED record, not just in the toxicology testing results, for the visit to be considered a DAWN case.

# APPENDIX A

# HISTORY OF DAWN

The Drug Abuse Warning Network (DAWN) is a public health surveillance system that has monitored drug-related emergency department (ED) visits to hospitals since the early 1970s. DAWN was initially established by the Drug Enforcement Administration. DAWN was transferred to the U.S. Department of Health and Human Services in 1980. Within Health and Human Services, the National Institute on Drug Abuse conducted DAWN from 1980 to 1992. Since 1992, the Center for Behavioral Health Statistics and Quality (formerly the Office of Applied Studies) of the Substance Abuse and Mental Health Services Administration has been responsible for DAWN operations and reporting.

Since its inception, DAWN has relied on data collected from a sample of hospitals. However, over the years, the exact survey methodology has been adjusted to improve the quality, reliability, and generalizability of the information produced by DAWN. When the National Institute on Drug Abuse assumed responsibility for DAWN in 1980, implementation of a sample of hospitals to produce representative estimates for the Nation and for selected metropolitan areas became a priority. This sample, refreshed with annual maintenance, continued to support DAWN estimates for the contiguous United States and 21 metropolitan areas until 2002. Major population shifts and changes in the hospital industry between 1980 and 2002 made apparent the need for a redesign of the sample of hospitals. Many other features of DAWN (e.g., definition of a DAWN visit to include all drug-related medical emergencies and not merely those involving misuse or abuse) were also redesigned at that time.[21]

In the redesign in 2003, DAWN's goal remained to produce national as well as metropolitan area-level estimates. Retention of the original 21 metropolitan areas was important because of the ongoing demand for DAWN estimates by public health professionals in those areas. In addition, inclusion of major population centers in each of the nine census divisions was deemed important to improve DAWN's geographic and population coverage. A total of 48 metropolitan areas were identified for inclusion in DAWN. The composition of these metropolitan areas was based on the definitions issued by the Office of Management and Budget in June 2003. For consistency, DAWN has maintained the 2003 definitions, even if counties were added in subsequent years.

Between 1980 and 2003, the Office of Management and Budget had substantially enlarged the coverage areas for 4 of the original 21 metropolitan areas. Users of DAWN statistics in these 4

[21] Additional detail on the 2003 redesign is available in the following publication: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. (2002). *Drug Abuse Warning Network: Development of a new design (methodology report*) (DAWN Series M-4, DHHS Publication No. SMA 02-3754). Rockville, MD: Author.

areas—Los Angeles, Miami, New York, and San Francisco—remained interested in obtaining estimates for the areas covered by the original 21 metropolitan areas. To address the needs of these users, DAWN subdivided these metropolitan areas according to their earlier composition and planned oversamples in the subdivided portions. That is, for each of these areas, there was an oversample for the metropolitan area as defined in 2003 and additional oversampling in the submetropolitan areas. When participation is high enough, separate estimates are made for the subdivided areas as well as the entire metropolitan area.

In 2000, DAWN adopted the Multum *Lexicon*, a drug vocabulary and classification tool developed and maintained by Multum Information Services, Inc., a private firm. Multum distributes the *Lexicon* and regular updates through its Web site. Multum permits the use of its *Lexicon* free of charge; a license agreement specifies the terms required of users. In accordance with the license agreement, DAWN publications, tabulations, and software applications cite the Multum *Lexicon* as the source and basis for the system DAWN uses to code drugs.

The DAWN survey relies on a longitudinal probability sample of hospitals located throughout the United States. To be eligible for selection into the DAWN sample, a hospital must be a non-Federal, short-stay, general surgical and medical hospital located in the United States, with at least one 24-hour ED. This sampling strategy was first implemented in the 2004 data collection year and has been followed since.

# APPENDIX B

# GLOSSARY OF DAWN TERMS, 2009 UPDATE

This glossary defines terms used in data collection activities, analyses, and publications associated with the emergency department (ED) component of the Drug Abuse Warning Network (DAWN).

**Accidental ingestion:** This category of drug-related ED visits includes those involving the accidental ingestion of a drug, for example, childhood drug poisonings and individuals who take the wrong medication by mistake. It includes a caregiver administering the wrong medicine by mistake. It does not include a patient taking more medicine than directed because the patient forgot to take it earlier.

**Adverse reaction:** This category of drug-related ED visits represents the consequences of using a prescription or over-the-counter pharmaceutical for therapeutic purposes and includes visits related to adverse drug reactions, side effects, drug-drug interactions, and drug-alcohol interactions. Although adverse reactions are typically limited to pharmaceuticals, a small number of adverse reaction visits involve illicit drugs (a) for which there are legitimate pharmaceutical versions and (b) pharmaceutical inhalants (such as anesthetic gases).

**Alcohol use:** DAWN notes whether alcohol was involved in addition to other drug(s) for patients of all ages. Because alcohol is considered an illicit drug for minors, alcohol without the involvement of other drugs is considered a drug-related ED visit for patients under the age of 21. (See **Drug misuse or abuse** and **Underage drinking**.)

**Case description:** A description of how the drug or drugs were related to the patient's ED visit. The case description, in conjunction with other documentation in the ED medical record, is used to determine whether the ED visit is reportable to DAWN. It is copied verbatim from the patient's chart when possible.

**Case type:** See **Type of case**.

**Case type other:** See **Drug misuse or abuse**.

**Confidence interval (CI):** An interval estimate, that is, a range of values around a point estimate that takes sampling error into account. The accepted standard of confidence is 95 percent. Technically, a 95 percent CI means that, if repeated samples were drawn from the same population of hospitals using the same sampling and data collection procedures, the true population value would fall within the confidence interval 95 percent of the time. Practically, a 95 percent CI summarizes both the estimate and its margin of error in a straightforward way with a reasonable degree of confidence.

**Diagnosis:** The condition(s) for which the patient was treated as determined by the clinician after evaluation.

**Disposition:** The location or facility to which an ED patient was referred, transferred, or released.

*Treated and released* includes three categories:

- *Discharged home*—"Home" is used as a broad category to mean the patient's residence. Home is generally used for persons who live locally; however, for students at nearby universities, home means their university; for travelers who get sick on the road, it may mean their hotel or wherever they are staying; and so on.
- *Released to police/jail*—Patients that are released to police/jail were usually brought to the ED by the police for treatment of an acute medical problem or for medical clearance before being placed in the jail population.
- *Referred to detox/treatment*—The chart indicates that the patient was referred to a substance abuse treatment or detox program, facility, or provider.

*Admitted to this hospital* includes five categories of inpatient units:

- intensive or critical care unit,
- surgery,
- chemical dependency/detox unit,
- psychiatric unit, and
- other inpatient units (the inpatient unit was not specified or does not match one of the preceding units).

*Other disposition* includes five categories:

- *Transferred*—The patient was transferred to another health care facility.
- *Left against medical advice*—The patient left the treatment setting without a physician's approval.
- *Died*—The patient died after arriving in the ED but before being discharged, admitted, or transferred.
- *Other*—The discharge status is documented in the patient's chart but does not fit into any of the preceding categories.
- *Not documented*—The patient's discharge status was not documented in the medical chart.

**Drug:** A substance that is (a) used as a medication or in the preparation of medication; (b) an illicit substance that causes addiction, habituation, or a marked change in consciousness; or (c) both. Substances reportable to DAWN include alcohol, illicit drugs (e.g., club drugs, cocaine, heroin, marijuana, stimulants), nonpharmaceutical inhalants, prescription drugs (e.g., drugs for attention deficit hyperactivity disorder, antibiotics, antidepressants, antipsychotics, anticoagulants, beta blockers, birth control pills, hormone replacement, insulin, muscle relaxants, pain relievers,

sleeping aids), drugs used in treatment of medical conditions (e.g., respiratory therapy, chemotherapy, radiation therapy), vaccines, dietary supplements, vitamins, and other over-the-counter pharmaceutical products. DAWN publications use the term "drug" to refer to any of these substances. Multiple substances can be reported for each DAWN case. Therefore, the total number of drugs exceeds the total number of DAWN cases reported.

**Drug category:** A generic grouping of related pharmaceuticals or other substances reported to DAWN, based on the classification system developed by Multum Information Services, a subsidiary of the Cerner Corporation, and modified for use with DAWN. The Multum *Lexicon* is available at http://www.multum.com/. In general, the Multum drug categories reflect the therapeutic uses for prescription and over-the-counter pharmaceuticals.

Additional clarification is provided for the following drug categories, because these are unique to DAWN:

- *Alcohol alone*—DAWN treats alcohol as an illicit drug for minors. Therefore, DAWN collects data on ED visits involving alcohol and no other drugs if the patient is under the age of 21.
- *Alcohol-in-combination*—DAWN records whether alcohol was involved in all drug-related ED visits for patients of all ages.

**Drug misuse or abuse:** A group of ED visits defined broadly to include all visits associated with illicit drugs, alcohol use in combination with other drugs, alcohol use alone among those younger than 21 years, and nonmedical use of pharmaceuticals. (See also **Alcohol use, Illicit drug use, Nonmedical use of pharmaceuticals,** and **Underage drinking**.)

**Drug-related ED visit:** This category includes any ED visit related to recent drug use. To be a DAWN case, the ED visit must have involved a drug, either as the direct cause of the visit or as a contributing factor. (See also **Single-drug case**.) One patient may make repeated visits to an ED or to several EDs, thus producing a number of visits. The number of unique patients involved in the reported drug-related ED visits cannot be estimated because no direct patient identifiers are collected by DAWN.

There are some circumstances in which ED visits are not reviewed for DAWN. These include persons who left before being seen by a physician, visits for suture removal, and direct admission to the hospital through the ED for women in labor.

**Estimate:** A statistical estimate is the value of a parameter (such as the number of drug-related ED visits) for the universe that is derived by applying sampling weights and other adjustments to data from a sample. Estimates of drug-related ED visits are calculated by applying weights and adjustments to the data provided by the sampled hospitals participating in DAWN. The sampling weights reflect the probability of selection; separate adjustment factors account for nonresponse, data quality, and the known total of ED visits delivered by the universe of eligible hospitals as

identified by the American Hospital Association (AHA) Annual Survey Database (ASDB) for the relevant time period.

**GHB:** Gamma hydroxybutyrate, a hallucinogen and depressant frequently combined with alcohol and other beverages. Also used by bodybuilders to aid in fat reduction and muscle building. For further information, see http://www.drugabuse.gov/infofacts/infofactsindex.html.

**Hospital emergency department (ED):** An emergency department (ED) (also known as an emergency room) is a medical treatment facility, specializing in acute care of patients who present without prior appointment, either by their own means or by ambulance. EDs are usually found in hospitals or other primary care centers. Only EDs in hospitals that meet DAWN's eligibility criteria may participate in DAWN. For information on drug-related ED visits, DAWN relies exclusively on medical records maintained by EDs. No patients, ED staff, or other records are consulted. DAWN is based on a sample of hospitals; in the cases where there are multiple EDs in a hospital, records from all the EDs are reviewed to identify drug-related cases. (See **Universe**.)

**Illicit drug use:** This category of drug-related ED visits includes all visits related to the use of illicit or illegal drugs. Illicit drugs include

- cocaine,
- heroin,
- marijuana,
- stimulants (including amphetamines and methamphetamine),
- MDMA,
- GHB,
- flunitrazepam (Rohypnol),
- ketamine,
- LSD,
- PCP,
- other hallucinogens,
- nonpharmaceutical inhalants,
- combinations of illicit drugs, and
- alcohol when used by patients under the age of 21.

Additional clarification is provided for the following drug categories:

- *Stimulants*—This drug category includes amphetamines, methamphetamine, and other illicit stimulants and excludes central nervous system stimulant medications, such as methylphenidate. Amphetamines and methamphetamine are combined for analysis because medical records and toxicology tests often generically refer to either drug as "amphetamines."
- *Amphetamines*—Although there are nonillicit (pharmaceutical) amphetamines, the whole of the amphetamine class of substances is grouped with illicit stimulants because it is

considered a major substance of abuse. See **Illicit drug use** for the list of drugs reported individually by DAWN as major substances of abuse.

- *Inhalants*—This category includes (1) anesthetic gases and (2) any nonpharmaceutical substance that has psychoactive effects when inhaled, sniffed, or snorted. Excluded from the inhalant category are carbon monoxide and nonpharmaceutical inhalants if the exposure was accidental (e.g., inhaling paint fumes while painting a closet).

  (1) *Anesthetic gases*—Anesthetic gases are presumed to have been inhaled. Included in this category are, for example, nitrous oxide, ether, and chloroform.

  (2) *Nonpharmaceuticals*—The route of administration for psychoactive nonpharmaceuticals is not assumed and must be documented in ED records specifically as inhalation. Psychoactive nonpharmaceuticals, when inhaled, fall into three main categories: volatile solvents, nitrites, and chlorofluorohydrocarbons. Examples of substances in each of these three categories include the following:

  - **Volatile solvents**—This category of inhalants includes adhesives (model airplane glue, rubber cement, household glue), aerosols (spray paint, hairspray, air freshener, deodorant, fabric protector), solvents and gases (nail polish remover, paint thinner, correction fluid and thinner, toxic markers, pure toluene, lighter fluid, gasoline, carburetor cleaner, octane booster), cleaning agents (dry cleaning fluid, spot remover, degreaser), food products (vegetable cooking spray; dessert topping spray such as whipped cream or "whippets"), and gases (butane, propane, helium).

  - **Nitrites**—This category of inhalants includes amyl nitrites ("poppers," "snappers") and butyl nitrites ("rush," "locker room," "bolt," "climax," video head cleaner).

  - **Chlorofluorohydrocarbons**—Freons are an example of this category of inhalants.

- *Combinations not tabulated above (NTA)*—This category includes combinations composed of two or more major substances of abuse that are mixed and taken together. For example, "speedball," which usually refers to the combination of heroin and cocaine taken at once, would be classified as a "Combination NTA," whereas heroin and cocaine used separately would be classified separately in the categories heroin and cocaine. Combinations consisting of a major substance of abuse and another substance are classified in the category of the major substance (e.g., heroin with scopolamine is classified as heroin).

**LSD:** d-lysergic acid diethylamide, a hallucinogen usually taken orally. For further information, see http://www.drugabuse.gov/infofacts/infofactsindex.html.

**Malicious poisoning:** See **Nonmedical use of pharmaceuticals**.

**MDMA:** Methylenedioxymethamphetamine, a hallucinogen with stimulant effects, usually taken orally. For further information, see http://www.drugabuse.gov/infofacts/infofactsindex.html

**Metropolitan area:** An area comprising a relatively large core city or cities and the adjacent geographic areas. Conceptually, these areas are integrated economic and social units with a large population center. Unless otherwise noted, DAWN metropolitan areas correspond to Metropolitan Statistical Areas (MSAs) established by the Office of Management and Budget (OMB) based on the 2000 decennial census and updated in 2003. DAWN also prepares estimates for subsections of three of the large MSAs that correspond to MSA Divisions; in a fourth MSA, subsections were established by local users of DAWN data.

**Nonmedical use of pharmaceuticals:** Nonmedical use of pharmaceuticals includes taking more than the prescribed dose of a prescription pharmaceutical or more than the recommended dose of an over-the-counter pharmaceutical or supplement; taking a pharmaceutical prescribed for another individual; deliberate poisoning with a pharmaceutical by another person; and documented misuse or abuse of a prescription drug, an over-the-counter pharmaceutical, or a dietary supplement. Nonmedical use of pharmaceuticals may involve pharmaceuticals alone or pharmaceuticals in combination with illicit drugs or alcohol. Nonmedical use of pharmaceuticals includes prescription and over-the-counter pharmaceuticals in ED visits that are of the following types of cases:

- *Overmedication*—Patient took too much of his/her prescription medication or over-the-counter medication/dietary supplement.
- *Malicious poisoning*—Drug use in which the patient was administered a drug by another person for a malicious purpose (drug-facilitated sexual assault is one type of malicious poisoning, but other types of malicious poisonings, such as product tampering, would be classified in this category as well).
- *Case type other*—All drug-related ED visits that could not be assigned to any of the other seven types (by design, most cases of documented drug abuse will fall into this category).

(See also **Drug misuse or abuse** and **Type of case**.)

**Not otherwise specified (NOS):** This is the catchall category for substances that are not specifically named but are known to be reportable to DAWN. Terms are classified into an NOS category only when assignment to a more specific category is not possible based on the information in the source documentation (ED patient charts).

**Not tabulated above (NTA):** This designation is used when drugs or drug categories are not explicitly listed in a table. Low-incidence drugs (or drug categories) falling under a broader drug classification may be summarized into a single row under that classification and labeled as NTA.

**Overmedication:** See **Nonmedical use of pharmaceuticals**.

**Oversampling:** Without oversampling, one would expect a sample to resemble the population from which it was drawn. Oversampling implies the deliberate selection of a much higher proportion of certain types of sampling units than would normally be obtained in a simple, random sample. The deliberate selection of certain types of sample units is done to improve the precision of estimates of the properties of these types of sampling units. This is a form of stratified sampling. (See also **Sampling**, **Sample frame**, and **Sampling unit**.) In DAWN, selected metropolitan areas are oversampled so that estimates can be produced for those areas.

***p*-value:** A measure of the probability (*p*) that the difference between two estimates could have occurred by chance, if the estimates being compared were really the same. The larger the *p*-value, the more likely the difference could have occurred by chance. For example, if the difference between two DAWN estimates has a *p*-value of 0.05, it means that there is no more than a 5 percent probability that the difference observed could be due to chance alone.

**PCP:** Phencyclidine, a hallucinogenic white crystalline powder that is readily soluble in water or alcohol or may be snorted or smoked. For further information, see http://www.drugabuse.gov/infofacts/infofactsindex.html.

**Population:** See **Universe**.

**Precision:** The extent to which an estimate agrees with its mean value in repeated sampling. The precision of an estimate is measured inversely by its standard error (SE) or relative standard error (RSE). In DAWN publications, estimates with RSEs greater than 50 percent are regarded as too imprecise to be published. ED table cells where such estimates would have appeared contain the asterisk symbol (*). (See also **Relative standard error**.)

**Race/ethnicity:** Race/ethnicity data in DAWN are collected retrospectively from the medical record. This approach involves a single question listing six race/ethnicity groups (plus not documented) and allows for multiple responses.[22] For published reports, DAWN collapses the reported race/ethnicity information into four mutually exclusive categories, plus an unknown category, as follows:

- *White*—A person having origins in any of the original peoples of Europe, the Middle East, or North Africa. Those who are identified as White and Hispanic are classified as Hispanic.
- *Black*—A person having origins in any of the Black racial groups of Africa. Those who are identified as Black or African American and Hispanic are classified as Hispanic.
- *Hispanic*—A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. Those who are identified as Hispanic are classified as Hispanic, regardless of any other race/ethnicity designations.

[22] See Office of Management and Budget, Revisions to the standards for the classification of Federal data on race and ethnicity, 62 Fed. Reg. 58,782 (October 30, 1997).

- *Race/ethnicity not tabulated above*—A person who is an American Indian, Alaska Native, Asian, Native Hawaiian, or Other Pacific Islander, or a person of two or more race/ethnicities.
- *Unknown*—Race/ethnicity is unknown.

Race/ethnicity is missing from ED patient records about 10 to 20 percent of the time, although this varies widely by hospital. In some cases, the race information is ambiguous (e.g., "European"), and detail about multiple races/ethnicities is often missing. Rates of ED visits per 100,000 are not calculated for race/ethnicity categories because of these data limitations.

**Rate:** A measure of the incidence of drug-related ED visits per 100,000 population. A rate can be calculated for the total population or for any subset defined by characteristics such as age and gender.

**Relative standard error (RSE):** A measure of an estimate's relative precision. The RSE of an estimate is equal to the estimate's standard error (SE) divided by the estimate itself. For example, an estimate of 2,000 cocaine visits with an SE of 200 visits has an RSE of 0.1 and is multiplied by 100 to change it to a percentage. This resulting RSE percent value is 10 percent. The larger the RSE, the less precise the estimate. Estimates with an RSE of 50 percent or greater are not published by DAWN. (See also **Precision**.)

**Sample frame:** A list of units from which a sample is drawn. In DAWN, the hospital is the unit used for the ED sample. All members of the sampling frame have a known probability of being selected. A sampling frame is constructed such that there is no duplication and each unit is identifiable. Ideally, the sampling frame and the universe are the same. The sampling frame for the DAWN hospital ED sample is derived from the American Hospital Association (AHA) Annual Survey Database (ASDB). (See also **Universe**.)

**Sampling:** Sampling is the process of selecting a proper subset of elements from the full population so that the subset can be used to make inference to the population as a whole. A probability sample is one in which each element has a known and positive chance (probability) of selection. A simple random sample is one in which each member has the same chance of selection. In DAWN, a sample of hospitals is selected to make inference to all hospitals; DAWN uses simple random sampling within strata.

**Sampling unit:** A member of a sample selected from a sampling frame. For the DAWN sample, the units are hospitals, and data are collected for drug-related ED visits at the responding hospitals selected for the sample.

**Sampling weights:** Numeric coefficients used to derive population estimates from a sample by adjusting for deviations from the original sample design due to unequal probability sampling, variable nonresponse, and other potential sources of bias.

**Seeking detox:** This category of drug-related ED visits reflects patients seeking substance abuse treatment, drug rehabilitation, or medical clearance for admission to a drug treatment or detoxification unit. They are classified separately because they often reflect administrative practices that vary across hospitals and may vary over time within the same hospital. Seeking detox visits tend to be concentrated in those facilities that operate specialized inpatient units providing substance abuse treatment or detoxification services, and the largest numbers are found in facilities that require medical clearance for entry into such treatment to be granted in their EDs.

**Single-drug case:** An ED visit in which only one drug was involved. The single drug may be the direct cause of the visit or a contributing factor as determined by the medical evaluation done in the ED. Because DAWN considers alcohol to be an illicit drug for minors, DAWN includes visits where alcohol is the single drug if the patient is younger than 21 years of age.

**Statistically significant:** A difference between two estimates is said to be statistically significant if the value of the statistic used to test the difference is larger or smaller than would be expected by chance alone. For DAWN ED estimates, a difference is considered statistically significant if the *p*-value is less than 0.05. (See also ***p*-value**.)

**Strata (plural), stratum (singular):** Subgroups of a universe within which separate ED samples are drawn. Stratification is used to increase the precision of estimates for a given sample size, or, conversely, to reduce the sample size required to achieve the desired level of precision. The DAWN ED sample is stratified into metropolitan area cells plus an additional cell for the remainder of the United States. To ensure thorough coverage within metropolitan areas, the universe of hospitals in each is allocated into substrata identified by (1) two types of hospital ownership (public, private) and (2) up to four size categories (measured in terms of the number of ED visits annually). This allocation creates up to eight substrata in each metropolitan area stratum. Hospitals in the stratum that covers the rest of the United States are stratified first by census region, type of ownership, and size (also measured in terms of ED visits). A systematic sample is selected from each of the geographic strata.

**Suicide attempt:** This type of drug-related ED visit captures suicide attempts (e.g., attempted suicide, tried to kill self) that are documented in the medical record and in which a drug was involved. Suicidal gestures, thoughts, or ideation, including attempts to harm oneself, are not included in this category.

**Type of case:** A classification used to define similar DAWN cases for analysis. Each case must be assigned a type and may not be assigned more than one type. Cases are classified into one of the following eight categories: suicide attempt, seeking detox, alcohol only (age younger than 21), adverse reaction, overmedication, malicious poisoning, accidental ingestion, and other. The case is coded into the first group that meets the inclusion criteria for that group.

**Underage drinking:** An ED visit where the patient is under age 21 and alcohol is involved. Because DAWN considers alcohol to be an illicit drug for minors, DAWN includes visits where alcohol is the only drug involved and visits where alcohol is present with other drugs.

**Universe:** The entire set of units for which generalizations are drawn. The universe for the DAWN ED sample is all non-Federal, short-stay, general medical and surgical hospitals in the United States that operate one or more EDs 24 hours a day, 7 days a week. Specialty hospitals, hospital units of institutions, long-term care facilities, pediatric hospitals, hospitals operating part-time EDs, and hospitals operated by the Veterans Health Administration and the Indian Health Service are excluded. The universe of EDs is identified from the American Hospital Association (AHA) Annual Survey Database (ASDB).