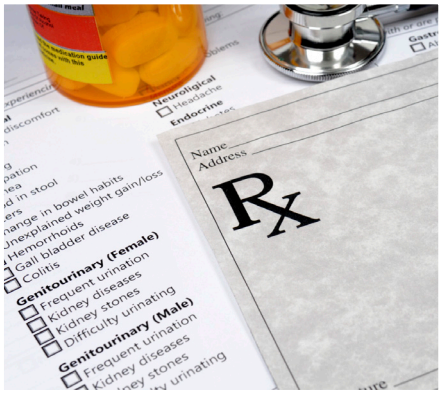
Consensus Recommendations for National and State Poisoning Surveillance



REPORT FROM THE INJURY SURVEILLANCE WORKGROUP (ISW7)

April 2012

SAFE STATES

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Methodology for this report:
The Injury Surveillance Workgroup 7 worked from July 2009 through April 2012 using monthly conference calls, and more frequently through small subgroup calls, to develop this report. A full list of workgroup members can be seen in Appendix D.

Disclaimer:
The findings and conclusion in this report are those of the Workgroup and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Foreword

Faced with a growing epidemic of fatal poisonings in the United States, primarily due to prescription drugs, the Safe States Injury Surveillance Workgroup on Poisoning (ISW7) initiated its work in the summer of 2009. Its goal was developing more comprehensive conceptual and operational definitions of poisoning and recommendations for improving poisoning surveillance. This report, and the surveillance tools contained herein, was designed to assist state injury and substance abuse prevention professionals in standardizing their efforts to conduct surveillance on drug and non-drug-related poisonings, with the goal that they will then be better equipped to design and evaluate interventions aimed at prevention. The term "poisoning," used throughout this report, is inclusive of fatal and nonfatal events and is also associated with the more colloquial term "drug overdose." The report has been shared in draft form at several scientific conferences and has gone through dozens of revisions. Much of the discussion focused on the conceptual definition of poisoning.

There is no universally accepted conceptual definition of a poisoning. The conceptual definition put forth by this ISW is deliberately broad and includes conditions resulting from both acute and chronic poisoning as well as conditions that are traditionally not thought of as poisoning. This document's usefulness to public health agencies was maximized by establishing a logical and comprehensive definition that focuses on injury and substance use. At the same time, the conceptual definition put forth addresses some inconsistencies and limitations of previous definitions.

In operationalizing this definition for conducting surveillance, the ISW7 also broadened the traditional International Classification of Disease (ICD) based definitions of poisoning used nationally and by states. To be in line with the conceptual definition, the ISW7's ICD-based operational definitions of poisoning events includes other conditions related to the acute and chronic effects of substance abuse (e.g. abuse and dependence as well as diseases resulting from the acute and chronic exposure to a substance), adverse effects of drugs and biologics in therapeutic use, and the chronic disease effects of poisoning.

The operational definitions are laid out in a matrix (row-by-column) format to provide users with the flexibility to include or exclude various categories of acute and chronic poisoning events based on what is needed for their analyses. It is hoped that the Matrices help to clarify the breadth of the conceptual definitions and are used by injury and substance abuse professionals and others to construct new indicators of drug and nondrug-related poisonings. As these new indicators are developed and tested, it is anticipated that shortcomings may surface and point to future definitional work that is still needed to improve these poisoning surveillance tools. Wide adoption of indicators based on these Matrices could help standardize the characterization of the burden of poisonings and lead to new intervention strategies to reduce poisoning – the leading mechanism of injury death in the United States.

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Executive Summary

Poisoning was the leading mechanism of injury mortality and the second leading mechanism of unintentional injury mortality in the United States in 2009 [1]. Poison deaths, mostly due to drugs, have risen sharply over the past 25 years [2]. The 2012 Safe States Injury Surveillance Workgroup Report: Consensus Recommendations for National and State Poisoning Surveillance puts forth:

- A consensus conceptual definition of all poisonings and drug poisonings for public health surveillance purposes;
- A framework or organizational grid within which poisonings can be subcategorized by various poisoning agents and by various circumstances;
- Operational definitions for use with mortality and morbidity data sources based on the International Classification of Diseases 10th Revision (ICD-10), and the 9th Revision, Clinical Modification (ICD-9-CM), respectively;
- A summary of data sources relevant to poisoning surveillance in the U.S., including a description of their strengths and limitations;
- A new set of potential surveillance indicators for fatal and nonfatal poisoning; and
- Recommendations on future work needed to improve poisoning surveillance.

Key products of the ISW7 include:

Conceptual definitions:

- A "poisoning" is an exposure to any extrinsic substance[1] by ingestion, inhalation, injection, or absorption through the skin or mucous membranes that results in at least one related adverse clinical effect[2].
- A "drug" is any chemical compound that is chiefly used by or administered to humans or animals as an aid in the diagnosis, treatment, or prevention of disease or injury, for the relief of pain or suffering, to control or improve any physiologic or pathologic condition, or for the feeling it causes.

The ICD-10 and ICD-9-CM poison matrices:

- The poison Matrices group ICD codes for different agents or classes of agents (both drug and nondrug agents) in a row format and group ICD codes for different general categories of poisoning in a column format. These Matrices are based on the ISW7's conceptual definition of poisoning and operationalize this definition for use when analyzing ICD-based data sets. (Appendix B1 and C1)

The inventory of poison data sources:

- Over 25 databases containing information on poisoning events in the U.S. were identified. The inventory provides a basic description of these databases, geographic scope, and contact information, and details their strength and limitations for poison surveillance. This inventory can be found at: (Appendix A)

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1 Extrinsic substances can include solids, liquids, or gases and natural or synthetic chemicals.
2 A sign, symptom, or laboratory abnormality

Recommendations for further development and testing of five new fatal and nonfatal poisoning surveillance indicators for state and local jurisdictions, based upon the ISW's conceptual and operational definitions. These are:

- Acute or chronic poisonings due to the effects of drugs
- Acute poisonings due to the effects of drugs
- Acute or chronic drug poisonings associated with the effects of opium, heroin, and/or opioid analgesics
- Acute drug poisonings associated with the effects of opium, heroin, and/or opioid analgesics
- Acute drug poisonings associated with the effects of opioid analgesics

Recommendations for improving poisoning surveillance at the state and local level. These include:

- Increase the specificity of ICD coding to minimize the use of nonspecific ICD-10 poison codes in morbidity and mortality databases
- Supplement state vital records data with medical examiner/coroner databases
- Examine methods for counting cases in hospital and emergency department databases
- Create special data systems and use nontraditional health data to capture nonfatal poisonings

Recommendations for surveillance improvements to be made at the national level. These include:

- Standardize death certification for poisoning
- Review the ascertainment of events due to the acute and chronic effects of poisoning in the NCHS drug-induced death definition

Overall, the intent of the ISW7 is that these tools and recommendations will strengthen the ability of state health departments and other agencies and groups to conduct surveillance on a diverse range of poisoning events improve the comparability of poisoning data across jurisdictions, enhance abilities to test and evaluate poison prevention interventions, and in the long run, effectively reduce the national health burden of poisoning.

Introduction

In the past two decades, poisoning, particularly drug poisoning, has emerged as an area of significant public health concern in the US [2-5]. Poisoning affects individuals across their lifespan and encompasses events that represent a wide array of causes, intents, and substances. The causes of poisoning include overdoses due to illicit drug use, environmental toxin exposures, suicides and suicide attempts, homicides, unintended medication misuse, unintended ingestion of household products, and many others.

Poisoning surveillance faces challenges that can hamper poisoning prevention and evaluation efforts [6-8]. These include a lack of formal standardized definitions for surveillance of poisonings due to specific agents or groups of agents, variable quality of toxicology information, and changes in the ICD classifications of poisonings over time. Historically, tracking of fatal and nonfatal poisonings in the population has often been limited to the use of International Classification of Diseases (ICD) external-cause-of-injury coded data and exposure data from poison centers. A conceptual definition of poisoning and a framework are needed that both:

1. Accommodate a broader range of circumstances and poison agents; and
2. Enable surveillance of subcategories of poisonings (e.g., opioid analgesics) that are indicative of emerging poisoning problems in the population.

This report provides a new, broader conceptual definition of poisoning, an expanded framework for categorizing poisonings, and standardized operational definitions using ICD-9-CM and ICD-10 codes. The aim is to improve the available poisoning surveillance tools not only for injury prevention research and practice, but also for the control and prevention of substance use disorders.

Safe States Alliance is a non-governmental membership association, whose mission is to serve as the national voice in support of state and local injury and violence prevention professionals engaged in building a safer, healthier America, convened the Injury Surveillance Workgroup on Poisoning (ISW7) to improve the surveillance of fatal and non-fatal poisonings. Representation on the ISW7 included individuals from the National Center for Injury Prevention and Control (NCIPC), the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention (CDC), the Substance Abuse and Mental Health Services Administration (SAMSHA), the Council of State and Territorial Epidemiologists (CSTE), the American Association of Poison Control Centers (AAPCC), the Association of State and Territorial Health Officials (ASTHO), the Society for the Advancement of Injury Research (SAVIR), state health departments, academic centers, the occupational health research community, and private research organizations. The group met regularly from August 2009 – January 2012 to:

1. Develop a consensus conceptual definition of all poisonings and drug poisonings for public health surveillance purposes;
2. Expand the framework within which poisonings can be subcategorized;
3. Develop operational definitions for each new poisoning subcategory that reflect the ISW7 conceptual definition for use with mortality and morbidity data sources based on the International Classification of Diseases10th Revision (ICD-10), and the 9th Revision, Clinical Modification (ICD-9-CM), respectively;
4. Develop a summary of data sources relevant to poisoning surveillance in the U.S., including a description of their strengths and limitations (Appendix A); and
5. Provide recommendations on future work needed to improve poisoning surveillance.

The tools described in this report are intended to be used by public health and medical care providers, practitioners and researchers involved in the collection, analysis and interpretation of poisoning

surveillance data. Their use may improve cross-jurisdictional comparisons of data for a broader range of poisoning subcategories. It is also hoped that they will provide a standard but flexible approach to presenting poisoning surveillance data that will meet many of the diverse needs of injury and substance abuse prevention practitioners, occupational and environmental health professionals, policy makers, drug enforcement, police and public safety officials, toxicologists, clinicians, educators, and researchers and improve the overall effectiveness of prevention efforts.

Public Health Burden of Poisoning[1]

Rank among Leading Causes of Injury

Poisoning is the leading mechanism of injury mortality and the second leading mechanism of unintentional injury mortality in the United States (as of 2009). Among people 25-64 years old, poisoning is the leading cause of unintentional injury death, surpassing even motor vehicle crash deaths. Poisoning accounts for 8.0% of all years of potential life lost (YPLL) before age 65 and 26.2% of all YPLL before age 65 because of injury (as of 2009). Unintentional poisoning accounts for 34.7% of all YPLL before age 65 because of unintentional injury [1]. More than three quarters of the poisoning deaths and YPLL are now caused by drug poisoning. Drug poisoning mortality has increased dramatically in recent years. The drug poisoning death rate in 2009 was four times the rate in 1999 [3].

Unintentional poisoning is the tenth leading mechanism of nonfatal injuries seen in emergency departments (ED) (as of 2009). Among injury related ED visits leading to admission to a hospital or transfer for specialized medical care, it is the fourth leading cause. Among these more serious ED visits, unintentional poisoning is the second leading cause in the 1-4 years age group, and self-harm poisoning is the leading cause in the 25-34 years age group [1].

Mortality

Poisoning was the underlying cause of death for 41,592 Americans in 2009, an age-adjusted rate of 13.4/100,000 population. Among these poisoning deaths, 76.4% were unintentional, 15.4% were suicides, 8.1% were of undetermined intent, and less than 1% were homicides or the result of legal intervention. Males accounted for 62.4% of poisoning deaths. Poisoning death rates among children <14 years were highest among those less than two years old. Poisoning death rates increase gradually among teens, rise to a peak in the 45-49 years age group, and then decline in older age groups [1].

Hospitalizations

In the US in 2009, there were an estimated 310,708 poisoning ED visits that led to admission to a hospital or transfer for specialized medical care, an age-adjusted rate of 101.0/100,000 population [1]. Direct admissions bypassing the ED are not included in this figure.

ED Visits

In 2009, poisoning led to an estimated 919,582 ED visits in the US, an age-adjusted rate of 299.5/100,000 population. Of these, 708,318 (77%) were unintentional; 209,977 (23%) were self-harm; and 1,287 (0.1%) were assaults or the result of legal intervention. ED visit rates peaked in the 20-24 years and 45-49 years age groups. Males accounted for 55.5% of poisoning visits [1].

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1 In this section, "poisoning" deaths, hospitalizations and Emergency Department (ED) visits are defined according to the 2010? definition used by the National Center for Health Statistics.

Contacts with Poison Centers

In 2009, 4,280,391 calls were captured by the National Poison Data System (NPDS), including 2,479,355 calls about exposures to putatively toxic substances. The top five substance classes involved in all human exposures were analgesics (11.7%), cosmetics/personal care products (7.7%), household cleaning substances (7.4%), sedatives/hypnotics/anti-psychotics (5.8%), and foreign bodies/toys/miscellaneous (4.3%). Analgesic exposures as a class increased the most rapidly (12,494 calls per year on average) over the last decade. NPDS documented 1,158 exposure-related fatalities in 2009. Sedatives/hypnotics/antipsychotics, cardiovascular drugs, and opioids were the top three drug classes among fatalities[10].

Economic costs

In 2005, poisonings led to $3.2 billion in total lifetime medical costs and made up 5.0% of the total lifetime medical costs ($63.5 billion) of all injuries in the United States [1}. Males accounted for about 71.1% ($29.9 billion) of the total lifetime medical and lifetime work loss costs of poisonings ($42 billion) [1].

Currently, poisoning surveillance faces serious challenges due in part to the different definitions of poisoning in use and the limitations in the classifications of types of poisons. The goal of the ISW7 was to create a more comprehensive framework for poisoning surveillance that would be inclusive of the major existing poisoning definitions and would allow for explicit clarification of what was included and excluded in the operational definitions which follow. The starting point for this effort was the creation of the following conceptual definitions of the terms “poisoning” and “drug.”

Conceptual Definitions of Poisoning and Drug

Poisoning

The consensus definition of a poisoning was the following:

> ***A poisoning is an exposure to any extrinsic substance[2] by ingestion, inhalation, injection, or absorption through the skin or mucous membranes that results in at least one related adverse clinical effect[3].***

This definition specifically includes:

- Acute and chronic exposures;
- Adverse drug reactions (ADR)[4];
- Other adverse drug events (ADE)[5];
- Exposures to venoms and other preformed biological toxins (Toxin exposures include bacterial foodborne intoxications, e.g. staphylococcal food poisoning and botulism, as well as seafood "poisoning," (e.g. ciguatera and scombroid fish poisoning); and
- Exposures to radioactive substances incorporated into the body (ingested polonium).

This definition specifically excludes:

- Bites and stings without envenomation;
- Infections (e.g. food and waterborne infections such as hepatitis A, cryptosporidiosis, and salmonella, and infections resulting from the injection of drugs); and
- Exposure to radiation where the radiation source remains external to the body.

Both a "poison" and a "poisoning" are difficult concepts to define. No universally accepted definitions of poisoning exist, as noted by the 2004 Institute of Medicine report, "Forging a Poison Prevention and Control System" [10]. The definition proposed here is the ISW7 consensus definition designed for use in public health surveillance. Other definitions might be more useful or preferred for other fields of specialization.

The simplest approach, defining "poisonous" as an inherent characteristic of a substance, is not helpful given that any substance can be toxic if given consumed in a high enough dose. A quotation from Paracelsus is frequently cited to support this fact: "All things are poison and not without poison; only the dose makes a thing not a poison" [11].

Therefore, a poison is best defined not by what it is, but by what it has done in certain circumstances. From this perspective then, a poisoning is an outcome rather than an event. Defining poisoning as an outcome also removes any restrictions on the characteristics or purpose of the substance to which a person is exposed. Thus a poisoning can result from solids, liquids, or gases, natural or synthetic substances, substances intended to improve health such as pharmaceuticals as well as substances

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2 Extrinsic substances can include solids, liquids, or gases and natural or synthetic chemicals.
3 A sign, symptom, or laboratory abnormality
4 An ADR is a harm directly caused by the correct drug properly administered in therapeutic, prophylactic, or diagnostic dosage. ADRs are also commonly referred to as "side effects" or "adverse effects" of drugs.
5 An ADE is a harm caused by any use of a drug. ADEs include harms resulting from drug misuse or abuse, accidental exposure to a drug, and wrong drugs given or taken in error. ADEs do not include medication errors that did not result in harm.

designed to disrupt biological processes such as pesticides. In the special case of pharmaceuticals, unwanted clinical effects from taking a drug as directed have been previously defined by others not as a poisoning but as adverse drug reactions or effects [12]. However, despite the fact that the primary purpose of a pharmaceutical is beneficial, any undesirable effects still meet the ISW7 definition of poisoning.

Infection, the invasion and multiplication of microorganisms in body tissues, is not a poisoning. If the clinical effect depends on the actions of microorganisms after invasion, the event is not considered a poisoning by the ISW7 or by most previous attempts at poisoning definition. Therefore, many gastrointestinal infections are not poisoning by the definition, despite the fact that they are commonly referred to as "food poisoning" in the vernacular. In contrast, exposures to preformed toxins or noxious food agents, (e.g. staphylococcal food "poisoning" and intoxication from mushrooms or berries), do meet the ISW7 consensus definition.

As defined here, a poisoning is the result of an exposure to any extrinsic substance. By definition then, the substance that leads to the poisoning is external to the person. Therefore, physiologic events are not considered a poisoning (such as the clinical effects of excess production of thyroid hormone).

Also, a premise of the definition of a poisoning is that the exposure is to a "substance" or physical agent rather than to a form of energy. Therefore, the effects of external irradiation whether infrared (thermal burns), ultraviolet (sunburn) or ionizing (X-ray burn) are not included. Exposure to mechanical energy such as occurs when struck by or cut by external objects is also not included. Bites and stings without envenomation are considered exposures to mechanical energy and are therefore not included. These distinctions are consistent with the most widely accepted classification of diseases and injury, the International Classification of Diseases, which places the results of exposure to radiation or mechanical energy in non-poisoning rubrics. This distinction, however, is not made in other settings, such as poison centers, which consider the effects of all sources of radiation, internal or external, within their scope.

Finally, the ISW7 definition includes all types of clinical effects, whether acute or chronic, with no time limit imposed between exposure and effect. Numerous examples exist of chronic poisoning (e.g. the effects of occupational exposures to lead or mercury or the cumulative damage to the liver from certain drugs such as acetaminophen). The ISW7 recognized, however, that establishing the connection between exposure and effect in individual cases becomes increasingly difficult with longer latency periods following exposure, especially in circumstances when the exposure was one of many possible triggers for a sequence of physiological events that might only occur under the right circumstances; e.g. a genetic predisposition for a disease. Therefore, the ISW7 definition includes only those effects that are always and explicitly the result of an exposure (e.g. alcohol-induced cirrhosis rather than unspecified cirrhosis, or cardiomyopathy due to drugs rather than unspecified cardiomyopathy).

Drug

Monitoring the subset of poisoning involving drugs (i.e. drug poisoning) as a public health concern also requires a conceptual definition of a "drug." The ISW7 consensus definition of a drug is as follows:

> ***A drug is any chemical compound that is chiefly used by or administered to humans or animals as an aid in the diagnosis, treatment, or prevention of disease or injury, for the relief of pain or suffering, to control or improve any physiologic or pathologic condition, or for the feeling it causes.***

This definition specifically includes:

- Street drugs such as heroin, cocaine, and hallucinogens;
- Prescription drugs;

- Over-the-counter drugs;
- Biological substances such as vaccinations;
- Veterinary drugs;
- Dietary supplements; and
- Non-medicinal substances used primarily for the feeling they cause.

This definition specifically excludes:

- Alcohol;
- Tobacco; and
- Chemicals that are deliberately inhaled for the feeling they cause but are chiefly used for other purposes (i.e. organic solvents and halogen derivatives of aliphatic and aromatic hydrocarbons).

A drug belongs to one of two categories: substances used chiefly for medicinal purposes or substances used chiefly for the feeling they cause. The medicinal category is relatively easy to define by its therapeutic purpose. The other category is more difficult to define because many substances are produced for non-medicinal purposes but are often employed for the feeling they cause, such as organic solvents. Others, like heroin, are employed for the feeling they cause and have limited alternative uses. The ISW7 defined non-medicinal substances whose primary use was for the feeling they caused as drugs. Non-medicinal substances chiefly used for other purposes, such as glue and solvents, were not defined as drugs, even though they might also be used for the feeling they cause. This distinction is similar to that made by the International Classification of Disease coding systems.

Similarly, the ISW7 did not include alcohol and tobacco in their conceptual definition of a drug, although alcohol and tobacco are included as potential poisons in the broader poisoning definition. It might be argued that these substances should be included in the conceptual definition of drug because they are often consumed for the feeling they cause and have psychoactive properties similar to some other non-medicinal drugs. In fact, SAMHSA incorporates “alcohol and other drugs” within its framework of substance use disorders [13]. However, in this case the ISW7 chose to be consistent with the major coding schemes for morbidity and mortality in the US, where alcohol and tobacco are classified separately from drugs. For example, they are not included in the category of “drug-induced death” employed by the NCHS [14]. Alcohol is also not classified as a drug in the World Health Organization’s ICD-10, where drug poisoning external cause codes (i.e. X40-X44) precede a separate code for alcohol (i.e. X45). Similarly, in the ICD-9-CM, the alcohol poisoning code is included in the “Other solid and liquid substances” category rather than in the “Drugs, medicinal substances, and biological” category.

Operational Definitions of Poisoning and Drug Poisoning

Based on the conceptual definitions above, the ISW7 created two row–by-column Matrices to display operational definitions of poisoning (i.e. drug, non-drug, unspecified, and all types of poisonings) for the two major U.S. morbidity and mortality data classification systems: ICD-9-CM and ICD-10, respectively. The purpose of developing these Matrices was to provide a framework for displaying the diagnosis and external cause-of-injury codes making up subcategories of poisoning events (e.g. grouped by intent or other circumstance, or by poison agent) within the context of the ISW7's broad conceptual definition of a poisoning. Subcategories were identified based on their utility for surveillance and their feasibility given the limitations of these coding systems. Both Matrices provide users with the flexibility to identify columns, rows or cells that are useful to their surveillance efforts.

It is important to recognize that the Matrices reflect the broader ISW7 conceptual definition for poisoning. These Matrices therefore include a much larger spectrum of events than is included in the external cause-of-injury Matrix which is used to generate the State Injury Indicators by the CDC-funded Core Violence and Injury Prevention Programs and others [15]. Specifically, these ISW7 Matrices include codes not traditionally included in injury research (e.g., drug- and alcohol-induced diseases, mental health conditions involving abuse and dependence, adverse drug reactions) in addition to codes included in the traditional range.

Another important consideration is that the Matrices cannot overcome limitations in the data collected on mortality or morbidity and in the ICD classification system. For example, hospital discharge data often are not external cause coded, so this limits the utility of these data. For mortality data, the specific drugs involved in the death is not recorded on the death certificate, so this limits the ability to describe drug-specific mortality rates. The recommendation section includes suggestions for improving these limitations in data collection.

Description of the Poisoning Matrix for ICD-9-CM Coded Morbidity Data

Purpose

The Poisoning Matrix for ICD-9-CM Coded Morbidity Data is based on the broad ISW7 conceptual definition of poisoning and provides a framework for categorizing relevant ICD-9-CM codes. This Matrix, which is found in Appendix C1, was developed as a tool to help state and national groups standardize the poisoning categories for morbidity data based on ICD-9-CM codes for public health surveillance purposes (e.g. monitoring trends, comparing findings across populations of interest). It can also serve as a guide for examining the differences among the wide range of existing approaches to defining and operationalizing "poisoning" indicators for surveillance, and for developing or refining a number of new poisoning-related indicators.

The Poisoning Matrix for ICD-9-CM Coded Morbidity Data:

- Organizes poisoning by type of poison (i.e. drug-related, non-drug-related and unspecified) in the rows and categories of causes of morbidity (i.e. intent, envenomation) in the columns;
- Displays each ICD-9-CM external cause-of-injury/diagnosis code meeting the conceptual definition of poisoning within the Matrix;
- Provides a structure to display poisoning morbidity counts and rates;
- Allows users to compare existing operational definitions and indicators, and to create their own operational definitions based on subsets of the Matrix to meet their specific policy or programmatic needs.

The Matrix can be used to analyze and categorize poisoning events using national or state-based hospital discharge or ED data sources, and for ICD-coded survey data as well. Using the Matrix requires a basic understanding of the ICD coding system. If unfamiliar with the ICD coding system, users should refer to the ICD manual and seek guidance from an epidemiologist, statistician, or data analyst familiar with the ICD, the data sources, and the appropriate use of analytic methods. This section provides general guidance and examples for how to use the Matrix with either hospital or emergency department data.

How to Use the Poisoning Matrix for ICD-9-CM Coded Morbidity Data

Case selection and analysis using principal diagnosis or any diagnosis.
The simplest approach to case selection and analysis of hospital discharge or ED data is to select one diagnosis to analyze. This is often the principal diagnosis or in the case when primacy is not determined, the first-list diagnosis. In cases where external cause codes are also included in case definitions, such as the ISW7 poisoning operational definition, the principal or first listed external cause codes should also be used. The principal diagnosis generally represents the primary reason for the health care contact. For hospitalizations, the principal or primary diagnosis is the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care. In the case of ED visits, the principal or primary diagnosis code is that diagnosis established to be chiefly responsible for occasioning the visit to the ED. Selection of poisoning cases based on the principal diagnostic code only, therefore, is a more traditional way to capture hospitalizations or ED visits due primarily to poisoning, and may underestimate the true prevalence of poisonings requiring medical care within an ED or hospital.

Depending on the purpose of the poisoning surveillance, the analyst may want to cast a wider net to quantify a fuller range of poisoning in hospital and ED data sets. For example, the analyst can use all available diagnosis codes and external cause-of-injury-codes (E codes) to identify records that are associated with a poisoning. This is sometimes referred to as “any mention” or “at least one mention.” The use of any mention of poisoning codes in any coding field produces a much different and larger subset of data than those created using only the principal diagnosis and E code field codes. This approach may be used to identify the overall burden of hospitalization or ED utilization associated with any type of poison diagnosis, which may be useful for resource allocation or program planning and evaluation.

The use of all available ICD-9-CM diagnosis or E codes to identify records associated with poisoning requires caution due to the complexity of including multiple codes per hospital or ED case. In particular, care must be taken when attempting to create a total unduplicated count of total encounters related to poisoning. Tabulating poisonings based on all cases in which there was “any mention” of a particular poisoning category provides a total count of encounters associated with specific types of poisoning, but can result in double counting of hospital and ED cases when more than one type of poison code exists. For instance, hospital discharge and ED visit databases often have separate fields for the principal diagnostic code and for E codes for each record. Therefore, it is possible to double count cases in which there is both a principal diagnostic code (e.g., 965.01- unintentional heroin poisoning) and a first-listed E code (e.g., E860.0 – unintentional alcohol poisoning) for two different types of poisonings (drug and non-drug) that were associated with the same health encounter. To tabulate total poisoning encounters, steps should be taken to minimize double counting.

In addition, analyses of poisoning encounters using the any mention approach can create potential problems when making comparisons across jurisdictions (e.g. states) that collect different numbers of ICD-9-CM diagnosis codes and E-codes per hospitalization or ED visit. In general, more cases will be identified as the number of available diagnosis and/or E-code fields increases. Therefore, the number of diagnosis and designated E-code fields to be searched for these ICD-9-CM codes should be the same

across jurisdictions and over time. Analysts that intend to compare indicators across jurisdictions should restrict their analyses to the lowest number of diagnostic fields and dedicated E-code fields in use among all the jurisdictions for which comparisons are planned.

How to Use the Poisoning Matrix for Morbidity Data

Once the decision is made on whether to use the principal/first-listed diagnosis only or any mention approaches for identifying potential poisoning cases, users can begin by creating poisoning data sets from the hospital and/or emergency department data sources using the full range of ICD-9-CM codes in the Matrix (these codes are listed in the cell at bottom right corner of the Matrix). These initial poisoning data sets provide the basis for further analyses and can be used to create numerous poisoning indicators. Generalized SAS programs designed to operationalize the Matrix and create poisoning data sets are provided in Appendix C1.

For morbidity analyses, the Matrix is designed as a row-by-column spreadsheet of ICD-9-CM codes. The rows in the Matrix list the poison agents under three broad categories (Drug; Non-drug; and Unspecified type of poison), and a total row for all types of poisons. Only selected agents or their broader classes are listed on separate rows in the Matrix. The selection was based on a combination of the public health importance and the availability of specific ICD-9-CM codes of the agents or classes of drugs and non-drugs. For example, the two broad categories of analgesics are displayed in the Matrix: (1) Nonopioid analgesics/Antipyretics and Antirheumatics and (2) Opiates/Opioids. Under the row for non-opioid analgesics, there is a separate listing for 4-aminophenol derivatives because it includes acetaminophen -- a drug that is known to be frequently implicated in poisonings but for which there isn't a specific ICD-9-CM code. Likewise, three subcategories of drugs are listed under the row for Opiates/Opioids: heroin, pharmaceutical opioids, and methadone as a subset of pharmaceutical opioids. Methadone is the only pharmaceutical opioid for which there is a specific ICD-9-CM code. Counts of poisonings due to the other specific pharmaceutical opioids such as hydrocodone and oxycodone are included in the more general row category "pharmaceutical opioids".

The columns organize ICD-9-CM codes by categories of poisoning. The columns are divided into three broad categories by cause of poisoning event – External causes; Drug and alcohol induced diseases; and Poisoning classified by nature (or diagnostic codes) of the poisoning. There is also a total column – "All poisoning" - containing the list of all the ICD-9-CM codes for causes of poisoning. Two of the three categories are further broken down into sub-categories. External causes are divided into the standard intent groups (e.g. unintentional, assault, self-harm, undetermined intent) and envenomation, and adverse drug effects. The Poisoning classified by nature column also has the following sub-categories: Non-venom, Non-foodborne poisoning; Envenomation; and Foodborne Illness.

The Matrix can be used to produce counts and rates of poisoning morbidity using hospital or ED discharge records. For example, the Matrix allows a user to:

- Produce a count of cases based on an individual code or set of codes within the Matrix structure. For example, the codes for unintentional poisoning due to non-opioid analgesics (E850.3-.8) can be found at the intersection of the row for "Non-opioid analgesics" and the column for "Unintentional Intent"). It is important to note the extent to which one can locate specific groups of codes within the Matrix structure is dependent upon their existence in the ICD-9-CM coding schema. For example, there are no specific ICD-9-CM codes for self-inflicted poisoning due to non-opioid analgesics. These events are coded to a broader category/row.
- Create marginal total counts based on the codes included in the separate rows and columns (e.g. "All types of poison" (Row) by "Unintentional poisoning" (Column) corresponds to the codes E850-E869).

To generate a total count of poisoning morbidity events based on all ICD-9-CM codes for all types of poisons, the user would use the marginal grand total cell containing all the ICD-9-CM poisoning codes (i.e. Row:- All Types of Poisons & Column : All Poisoning). However as mentioned above, the user should take steps in the analysis to provide an unduplicated count of cases. The marginal (unduplicated) grand total reflects the number of cases meeting the ISW7's conceptual definition of poisoning and can be used as a broad morbidity indicator for hospital discharge or ED visit poisonings encounters (not individual patients) identified within hospital discharge or ED visit records.

The Matrix can also be applied to generate counts using existing poisoning definitions and indicators that are based on ICD-9-CM codes (e.g. NCHS drug-induced indicator, NCIPC's core injury core indicators, adverse effects, etc.), explore current poisoning issues of interest (e.g. drug poisonings and opioid-specific drug poisoning), and create other case definitions to meet specific purposes. For example, users can produce an indicator for "drug poisoning" morbidity data based on the explicit subset of poisoning categories captured in the Matrix cell at the intersection of the Drug row by the All Poisoning column (e.g. all ICD-9-CM codes for drug poisoning morbidity only). Use of explicit case definitions based on the Matrix maintains the overall standardized approach to public health surveillance (e.g. use of a single overall Morbidity Poisoning Indicator) for comparison purposes, while also allowing the creation of additional subset indicators. Use of the Matrix can also help avoid inappropriate comparisons by making explicit what codes are included in any subindicator created.

Description of Poisoning Matrix for ICD-10 Coded Mortality Data

Purpose

The Poisoning Matrix for Mortality Data is also based on the broad ISW7 conceptual poisoning definition and provides a framework which categorizes all relevant poisoning ICD-10 codes. This Matrix, which can be found in Appendix B1 was developed as a tool to help state and national groups standardize the ICD-10 categories of mortality poisonings for public health surveillance purposes. It can also serve as a guide for examining the differences among the wide range of existing approaches to defining and operationalizing "poisoning" indicators for surveillance, and for developing or refining a number of new surveillance indicators.

The Matrix:

- Organizes poisoning by type of poison (Rows) and underlying and contributory causes of death (Columns) based on the ISW7 conceptual poisoning definition;
- Displays each poisoning ICD-10 code within this conceptual structure;
- Provides a structure to display poisoning death counts and rates; and
- Allows users to compare existing operational definitions and indicators, and to create their own operational definitions based on subsets of the Matrix to meet their specific policy or programmatic needs.

How to Use the Poisoning Matrix for ICD-10 Coded Mortality Data

The Matrix can be used to analyze both underlying cause of death (UCOD) and multiple cause of death (MCOD) data. Most users will be able to access mortality data sets containing UCOD. Some users may have access to files containing both the UCOD and the MCOD data. Using the Matrix with either UCOD or MCOD is valuable, but each application has strengths and challenges. This section provides some general guidance and examples of how to use the Matrix with both data sets.

The ISW7 recommends the use of files that contain both the UCOD and MCOD files for the most complete surveillance, because these data provide the best overview and greatest specificity of poisoning deaths. However, use of the MCOD data must be undertaken with caution due to the

complexity of the data and should be done under the guidance of an epidemiologist, statistician, or data analyst familiar with both the structure of the data files and the appropriate use of analytic methods. Using the Matrix requires a basic understanding of the ICD-10 coding scheme. The use of ICD-10 began with the 1999 mortality data in the US. Before 1999 data, mortality data were coded using the ICD-9. Caution must be taken in making any comparisons of mortality data prior to 1999 with later years.

The UCOD of death data and the MCOD death data can be accessed using the interactive on-line data access system, called WONDER http://wonder.cdc.gov/mcd.htm. WONDER has a MCOD application which is capable of producing the counts and rates of deaths for the Matrix. The application can produce state-based estimates. For those with programming skills, SAS programs are provided in a link (Appendix B2) to this report for use in generating poisoning death counts using the poisoning data at the national, state, or local level.

The Matrix can be used to examine existing poisoning definitions and indicators that are based on ICD-10 codes (e.g. NCHS drug induced indicator, NCIPC's core injury indicators, adverse effects), explore current poisoning issues of interest (e.g. drug poisonings and drug opioid poisonings), and to develop case definitions to meet specific purposes. For example, users can produce drug poisoning mortality data based on the explicit subset of poisoning categories captured in the Matrix cell at the intersection of the Drug row by the All Codes column (e.g. all UCOD codes for drug poisoning deaths only). This flexibility is a strength of the Matrix because it allows users to identify what codes are included in existing poisoning indicators and create their own explicit case definitions (i.e. ICD-10 codes to be included/excluded) in a standard way. Use of explicit case definitions based on the Matrix maintains the overall standardized approach to public health surveillance (e.g. use of a single overall Mortality Poisoning Indicator) for comparison purposes, while also allowing the creation of additional subset indicators.

Using the Matrix for Underlying Cause of Death Data Only

The Matrix is designed to highlight the use of UCOD codes as a way to identify and count poisoning deaths. UCOD data are generally available and are more straightforward to analyze because each death is assigned a single ICD-10 code as the underlying cause of death. In the ICD, the underlying cause of death is the disease or injury that initiated the chain of events leading directly to death. Users will note that the range of UCOD codes representing poison deaths in the ICD-10 Matrix includes not only the traditional external cause-of-injury codes for poisoning (X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2, U01(.6-.7) categorized by intent) but also codes for foodborne intoxications, evenomation, substance abuse and chronic disease conditions induced by poisoning. Given that each death is assigned only one underlying cause code, UCOD data provides unduplicated counts of various types of poisoning.

For UCOD analyses, the Matrix is designed as a row-by-column spreadsheet of ICD-10 codes. The Matrix lists the types of poisons in the rows based on the categorizations developed by the ISW7. The columns display the categories of poisonings available in ICD-10 that can be used to indicate the UCOD. (NOTE: The grey columns to the right include the ICD-10 categories of poisoning available from the MCOD file and are not relevant to analyses limited to UCOD data.) The Matrix allows a user to:

- Locate an individual code or set of codes within the Matrix structure; e.g. the code for death due to unintentional poisoning by nonopioid analgesics (X40) can be found at the intersection of the row for Nonopioid analgesics and the column for Unintentional intent;
- Create marginal totals for separate columns and rows; e.g. "Unintentional poisoning" (column) by "All types of poison" (row) corresponds to the codes X40-49; and
- Create a single overall count for all types and categories of poisoning deaths meeting the ISW's conceptual definition of a "poison death"; i.e., the codes for all underlying causes due to all types of poisons can be found in the cell at the intersection of the "All types of poison" row and the "All codes" column .

Using the Matrix for both Underlying and Multiple Cause of Death Data

MCOD data reflects the fact that deaths are complex and may have multiple causal factors. ICD-10 poisoning codes which describe the "nature of injury," (as opposed to the ICD-10 poisoning codes which describe the cause-of-injury) are only found in the MCOD data, are laid out in the final three columns of the Matrix. These codes generally provide additional specificity about the type of poison (e.g. methadone, carbon monoxide) involved in the death and are described below. These columns should be used to supplement the analyses conducted with the UCOD data. For example, using the subset of UCOD codes for drug poisonings, the MCOD diagnostic codes can provide a breakdown of the specific drugs included. Thus, MCOD data significantly improves the ability to identify and count specific substances involved in poisoning deaths. However, because each death may involve more than one ICD-10 code, the MCOD files are more difficult to analyze than UCOD data.

National MCOD data are available on CDC interactive data system WONDER in the MCOD application http://wonder.cdc.gov/mcd.htm. SAS programs for use with the micro data are available in Appendix B2. The public-use MCOD file for the United States is available for download at the following website (http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm). From 2005 onward the public-use MCOD files do not contain state or county identifiers. However, these may be had by request by submitting a proposal (see http://www.cdc.gov/nchs/nvss/dvs_data_release.htm). Other items such as birth dates and death dates can be accessed via NCHS' Research Data Center.

The national MCOD file contains all the relevant data needed for analysis using the Matrix. However, some state files are available prior to the release of the national file and these may be useful for surveillance. At the state level the MCOD data are not always part of the standard death files and accessing them may also require a special request. Each state vital statistics office will normally be able to tell users if they have the MCOD files and how they can access them. Seeking expert assistance to assure their proper use is strongly suggested given the complexity of these files.

The MCOD data file includes fields for both the UCOD and other causes of death. Because of this structure, each individual death may contain multiple codes to describe the death. There are two types of multiple cause of death codes, entity axis and record axis codes. The entity axis codes include the ICD coded conditions from the death certificate and information about the location of the condition of the certificate (e.g. Part I or Part II, Line number). The entity axis codes are edited for consistency and duplicative information (e.g. two of the same code) by the suite of software for coding the causes of death. The resulting codes are referred to as record axis codes. Because the record axis codes are edited, the ISW-7 recommends using these codes with the Matrix.

As described above, ICD-10 codes in the range T36-T65, which describe drugs and toxic substances, cannot be an underlying cause of death but are included in the MCOD fields to provide additional detail on the substances involved in poisoning deaths. For example, a death caused by a heroin overdose may contain both X42, unintentional poisoning by narcotics, and T40.1, poisoning by heroin; but only the external cause code, X42, can be the UCOD. However, the MCOD fields may also contain other causes of death (including other external causes) that were involved in the death but were not the underlying cause.

In addition, more than one drug might be reported as a cause of death. If both oxycodone and a benzodiazepine are recorded on the death certificate, there will be at least three ICD-10 codes: X42 and two ICD diagnostic codes (T40.1 and T42.4) listed in the MCOD data. There are other considerations when interpreting MCOD data. For example, individual MCOD codes can't appear twice in one record, even if the code refers to two different drugs, because duplicate codes are deleted in the editing process for record axis MCOD files. For example, poisoning by fentanyl and poisoning by meperidine would both be coded as T40.4. However T40.4 would be only included once in the record axis MCOD data.

One additional factor to consider when analyzing the MCOD data is that codes in the T36-T65 range might sometimes appear in the list of multiple contributory causes for a death whose UCOD is not considered a poisoning by the ISW7 definition. For example, drug intoxication might contribute to a death whose underlying cause is a motor vehicle crash. For most purposes, the ISW7 recommends analyzing MCOD data only for deaths whose UCOD was included in the poisoning Matrix.

Operational Definitions for Other Major Data Sources

Description of the National Poison Data System (NPDS)

Currently, there are 57 Poison Centers (PCs) in the US providing poison emergency services to the entire population of the 50 states, American Samoa, the District of Columbia, Federated States of Micronesia, Guam, Puerto Rico, and the U.S. Virgin Islands. The American Association of Poison Centers (AAPCC) and the National Center for Environmental Health, Health Studies Branch at CDC have combined efforts to help local PCs detect and record chemical exposure events and ensure effective responses. The focus of these efforts is the use of the near real-time NPDS database to improve public health surveillance of chemical exposures and other potential health hazards. Every PC uploads their case data continuously (mean time to upload 19.9 minutes) to the NPDS. Operational since 1985, the NPDS captures 99.8% of all poison exposures reported to PC's nationwide. CDC and AAPCC have developed methods to use NPDS data for real-time automated alerting that generate more immediate and effective responses to public health threats related to toxins or chemicals in the environment.

All U.S. residents can access a PC toll free 24/7 by phoning 1.800.222.1222. Encounter information is documented contemporaneously into their case management system. Calls are managed by healthcare professionals who have received specialized training in clinical toxicology and managing exposure emergencies. These providers include medical and clinical toxicologists, registered nurses, doctors of pharmacy (PharmDs), pharmacists, chemists, hazardous materials specialists, and epidemiologists. Centers are accredited by the AAPCC based on strict standards and must be reaccredited every 5 years. The PCs represent a unique system in that health care professionals can always speak with a physician or clinical toxicologist.

Many of the exposure encounters captured in the NPDS would be considered poisoning according to the ISW7 conceptual definition. However, NPDS does not use the ICD coding systems (ICD-9-CM and ICD-10) to define and classify encounters. Instead PCs use the Poisindex® poison information and management system [16]. This system has a comprehensive products database that lists the active and inactive ingredients in over 390,000 household, chemical, and pharmaceutical products. Each product has a unique identification number and is classified into one of 975 generic codes. These product and generic codes allow for precise searching and data retrieval, which provides for a richer level of detail than is available in IDC-9-CM codes for instance.

Thus, no attempt is made to create or cross walk the poison center operational definition of poisoning with the ISW7 system presented in this report. The ISW7 recommends care must be exercised in comparing results generated from the NPDS system and the ISW7 operational definition provided for the ICD coding systems.

Description of the Drug Abuse Warning Network (DAWN) for ED data

DAWN is a public health surveillance system administered by the Substance Abuse and Mental Health Administration that continuously monitors drug-related ED visits for the Nation and for selected metropolitan areas.

A DAWN drug case is any ED visit involving recent drug use. DAWN does not capture information on

non-drug poisoning visits. The criteria for inclusion encompass all types of drug-related visits, including accidental ingestion, intentional ingestion (e.g. self harm) and adverse reaction, as well as drug misuse or abuse. DAWN also includes ED visits for underage persons involving alcohol only and alcohol in combination with other drug(s).

Most of the ED visits included in DAWN are considered poisoning according to the ISW7 conceptual definition. However, currently the number of visits meeting the definition is unknown as the data are not ICD coded. In DAWN, drug cases are identified by the systematic review of ED medical records in participating hospitals and provide for greater specificity in the classification of drugs than in other data systems based on administrative health care provider data. In addition, DAWN includes a broader range of ED visit types than are encompassed by the ISW7 operational definition of drug poisoning based on principal diagnosis only; namely, 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. An example would be a person who consumed drugs and alcohol, and crashed his car, and then was taken to the ED. Using the DAWN protocol, the immediate cause of this ED visit would be identified as injuries sustained in the car crash, but it would be noted that drugs contributed to the crash.

Due to the complexity of the task and time limitations, the ISW7 was unable to create or cross walk an operational definition of drug poisoning with the ISW7 conceptual definition of poisoning. The ISW7 recommends that care be exercised in comparing estimates of drug related poisoning generated from the DAWN system and estimates from other ED data systems which use the ISW7 operational definition for ICD coded data.

General information about DAWN is currently available at http://DAWNinfo.samhsa.gov/, including detail on the DAWN data program and the methodologies used to collect, process, and report data. DAWN publications are available at the SAMHSA website at http://www.samhsa.gov/data/. See the data source summary of DAWN in Appendix A.

Inventory of Poisoning Data Sources

The ISW7 compiled and summarized a list of twenty-eight poison surveillance data systems/sources in the U.S. that may be useful for public health surveillance, which are listed in Appendix A. Although fairly comprehensive, this inventory is not meant to be exhaustive. These data sources have been grouped into the following broad categories according to their primary usefulness: mortality, morbidity, medication, surveys, and workplace or occupational sources. Many data sources can fit into more than one category. For each data source, a summary table is provided in Appendix A with the following information:

- Name the of data source or system;
- Contact information (website, address or phone number if applicable);
- Data type and purpose;
- Geographical range covered by the data;
- Frequency of data collection;
- Whether data are available on-line;
- Whether data are free to the public;
- Data collection methodology;
- What is included in the data including details on demographic information;
- Years of data availability;
- Specific information about poison data available including codes if relevant;
- Strengths and weaknesses of the data source; and
- Other relevant information that may help the reader to determine the utility of the data source.

The summary tables in Appendix A are intended as a quick snapshot to give the reader highlights about the data sources and help them make an initial determination about the usefulness of the sources to their poison surveillance. They have not been rated on their importance to a particular field or type of poisoning. For further information, the website/phone number of the agency or organization administrating the database is provided for the reader. The websites were current as of October 2011.

General Considerations and Recommendations for Improving Poisoning Surveillance

General considerations

- The ISW7 conceptual definition of poisoning includes both the acute and chronic health effects of poisoning. As a result, the proposed indicators below include some health conditions not traditionally classified in the rubrics reserved for injuries and poisonings. For example, in the ICD, many of the health conditions resulting from poisonings occur immediately after exposure to a poisonous substance, and these are generally classified using ICD external cause codes. However, poisonings can also occur from chronic exposure occurring over many years. In these cases, poisonings (whether from drugs or other agents) are generally classified as diseases or chronic conditions associated with long term exposure to a drug or nondrug agent and are therefore, classified under the ICD chapters reserved for diseases rather than injuries.
- While the ICD-9-CM and ICD-10 poison Matrices presented earlier do not have labels that distinguish which ICD codes relate to acute or chronic poisonings, the Matrices do display all of the codes identified by ISW7 as fitting the broad conceptual definition of poisoning. The proposed indicators specify code ranges either taken directly in total or using selected individual codes from the appropriate cells of the Matrix.
- In the US, most health events meeting the ISW7 definition of poisoning are due to drugs, whether in reference to fatal or nonfatal events. Nondrug-related poisonings are due to a variety of agents, both environmental and occupational. Measures of total poisoning are not good substitutes for drug poisoning, and vice-versa. Therefore, the recommended indicators presented by the ISW7 are limited to a set of specific drug poisoning indicators.
- Death and other health events (e.g. hospitalizations and ED-visits) resulting directly or indirectly from the chronic use or abuse of drugs may not be recorded consistently by health care providers and medical examiners/coroners (ME/Cs). Differences in language used on hospital discharge records or death certificates, for example, can lead to different principal diagnosis or underlying cause of death (UCOD) codes. In addition, some jurisdictions are more specific than others in the recording of drug types involved because of differences in documentation or toxicological testing practices. These variations can result in artificial differences in poisoning rates. No consensus has been established on indicators for surveillance of drug poisoning, and the indicators proposed below have not been fully evaluated. Evaluation of the indicators using formal criteria (e.g. those available at http://ipru3.otago.ac.nz/ipru/ReportsPDFs/OR070.pdf) is needed to test their usefulness for state poisoning surveillance [17].

Recommendations for proposed drug poisoning indicators for surveillance for state and local jurisdictions

To use the Matrices to create the ISW7 proposed indicators, health agencies and other users are advised to create mortality and morbidity datasets inclusive of all records that have any of the ICD codes (i.e. ICD-9-CM codes in any coding fields; ICD-10 codes among the underlying or multiple causes of deaths) contained in the ISW7 Matrices in this report. These datasets can then be used to derive any of the indicators proposed below or other specified indicators constructed from code sets within the rows and columns in these Matrices.

For morbidity data coded with ICD-9-CM, two options are provided for working with multiple diagnoses. Option A is recommended if a conservative measure of health encounters more likely to be the direct result of acute or chronic drug poisoning is desired. Option B is recommended if a more inclusive measure of hospital encounters to which an acute or chronic drug poisoning contributed or was associated is desired. Option B might include some encounters where the adverse clinical effects of drugs were a result of them being used for treatment of a disease or injury in the hospital or where the poisoning is a co-morbid condition (e.g., a result of substance abuse or dependence) and not the principal reason for the encounter. The sensitivity, specificity and positive predictive value of these options for drug poisoning have not been measured.

ACUTE OR CHRONIC POISONINGS DUE TO THE EFFECTS OF DRUGS

ICD-10 definition of deaths:

Deaths with an underlying cause of death code of D52.1, D59 (.0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, F11-F16, F19, G21.1, G24.0, G25 (.1, .4, 6), G44.4, G62.0, G72.0, I95.2, J70 (.2-.4), K85.3, L10.5, L27 (.0, .1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2, X40-X44, X60-X64, X85, Y10-Y14, or Y40-Y59

ICD-9-CM definition of hospitalizations or ED visits:

Option A: Events with an ICD-9-CM code in the principal diagnosis field of 244 (.2,.3), 275.02, 288.03, 289.84, 292, 304 (.00-.02,.10-.12), [304-305] (.20-.22,.30-.32,.40-.42,.50-.52,.60-.62,.70-.72,.80-.82,.90-.92), 332.1, 333.85, 336.8, 357.6, 359.24, 648.3, 655.5, 692.3, 693.0, 760 (.72-.78), 779 (.4,.5), 909 (.0,.5), 960-979, 995 (.2,.4,.86,.89), 999 (.4-.7); or E850-E858, E930-E949, [E950, E980] (.0-.5), or E962.0 as the first-listed external cause-of-injury code.

Option B[6] : Events with any of these ICD-9-CM codes in any diagnosis or dedicated E-code fields.

ACUTE* POISONINGS DUE TO THE EFFECTS OF DRUGS

ICD-10 definition of deaths:

Deaths with an underlying cause of death code of [F11 - F16] (.0), F19.0, X40-X44, X60-X64, X85, or Y10-Y14

ICD-9-CM definition of hospitalizations or ED visits:

Option A: Events with 960-979 in the principal diagnosis field; or E850-E858, [E950, E980] (.0-.5); or E962.0 as the first-listed external cause-of-injury code.

Option B: Events with any of these ICD9-CM codes in any diagnosis or dedicated E-code fields.

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6 The use of any-mention diagnosis is potentially a problem when comparisons across jurisdictions that collect different numbers of ICD-9-CM diagnoses codes per hospitalization or ED visits in hospital discharge or emergency department data systems, respectively. In general, more cases will be identified as the number of available diagnosis codes increases, so the number of diagnosis fields considered in the analysis may confound such comparisons. The sensitivity of searching varying numbers of fields is not known for drug poisoning. Where such variation across jurisdictions or over time exists, the number of diagnosis and designated E-code fields to be searched for these ICD-9-CM codes should be specified. Analysts that intend to compare indicators across jurisdictions should restrict their scope to the lowest number of diagnostic fields and dedicated E-code fields in use among all the jurisdictions.

**Excludes late effects and adverse effects of drugs.*

ACUTE OR CHRONIC DRUG POISONINGS ASSOCIATED WITH THE EFFECTS OF OPIUM, HEROIN, AND/OR OPIOID ANALGESICS

ICD-10 definition of deaths:

Deaths with an underlying cause of death code of F11 or Y45.0

OR

[Deaths with an underlying cause of death code of D52.1, D59 (.0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, F12-F16, F19, G21.1, G24.0, G25 (.1, .4, 6), G44.4, G62.0, G72.0, I95.2, J70 (.2-.4), K85.3, L10.5, L27 (.0, .1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2, X40-X44, X60-X64, X85, Y10-Y14, Y40-Y44, or Y46-Y59

AND

One or more of the following codes in any multiple cause of death field: F11, T40.0, T40.1, T40.2, T40.3, T40.4, T40.6 (See footnote in Matrix to determine the inclusion or exclusion of T40.6.)

ICD-9-CM definition of hospitalizations or ED visits:

Option A: Events with 304 (.00-.02, .70, .71, .72), 305 (.50-.52), 965.0 in the principal diagnosis field; or E850 (.0-.2), E935 (.0-.2) as the first-listed external cause-of-injury code.
Option B: Events with any of these ICD9-CM codes in any diagnosis or dedicated E-code fields.

ACUTE DRUG POISONINGS ASSOCIATED WITH THE EFFECTS OF OPIUM, HEROIN, AND/OR OPIOID ANALGESICS

ICD-10 definition of deaths:

Deaths with an underlying cause of death code of [F11 - F16] (.0), F19.0,
X40-X44, X60-X64, X85, or Y10-Y14

AND

One or more of the following codes in any multiple cause of death field: F11.0, T40.0, T40.1, T40.2, T40.3, T40.4, T40.6 (See footnote in Matrix to determine the inclusion or exclusion of T40.6)

ICD-9-CM definition of hospitalizations or ED visits:

Option A: Events with 965.0 in the principal diagnosis field, or E850 (.0-.2) as the first-listed external cause-of-injury code.
Option B: Events with any of these ICD-9-CM codes in any diagnosis or dedicated E-code fields.

ACUTE DRUG POISONINGS ASSOCIATED WITH THE EFFECTS OF OPIOID ANALGESICS

ICD-10 definition of deaths:

Deaths with an underlying cause of death code of [F11 - F16] (.0), F19.0
X40-X44, X60-X64, X85, or Y10-Y14

AND

One or more of the following codes in any multiple cause of death field: T40.2, T40.3, T40.4

ICD-9-CM definition of hospitalizations or ED visits:

Option A: Events with 965 (.02-.09) in the principal diagnosis field, or E850 (.1-.2) as the first-listed external cause-of-injury code.
Option B: Events with any of these ICD9-CM codes in any diagnosis or dedicated E-code fields.

Considerations for further sub-categorizations of indicators

Many states can stratify the annual poisoning mortality indicator rates by sex and age and maintain stable rates; other states may need to combine data across years. Rates for unintentional poisoning and suicidal poisoning will also typically be stable. Mortality rates for homicidal poisoning are typically much lower. Rates of deaths of undetermined intent vary widely be jurisdiction. Therefore, some local and national publications report all drug poisoning by combining all intents, to alleviate the problem of differing reporting of intent in some jurisdictions.

For hospital or ED data, indicators can be broken down by demographic variables such as age, sex, and race (if collection of race is mandated), as well as intent. Categorization by intent might be difficult, however, if the rate of E-coding of records is low or if the specificity of the poisoning agent is not consistent across intent categories (e.g. opiates in ICD-9-CM). Categorization by source of payment is also recommended to determine the fraction of medical care for drug poisoning paid by public insurers.

Recommendations to Improve Surveillance at the State or Local Level

Mortality surveillance

Increase the specificity of ICD coding to minimize the use of nonspecific ICD-10 codes.

Codes such as T40.6 ("other and unspecified narcotics") and T50.9 ("other and unspecified drugs") are uninformative for measuring rates of specific drug types. They result when the language used on death certificates is nonspecific or the death investigation was not thorough enough to identify specific drugs. The frequency of use of such codes varies widely across and within states, thus impairing geographic comparisons for deaths due to specific drug types and substantially undercounting the contribution of specific drugs to the overall drug poisoning problem. State agencies can demonstrate these disparities statistically to their ME/Cs as a way of motivating better death investigation and certification. State agencies might also be able to work with ME/Cs to determine what types of drugs or drug combinations typically receive a nonspecific code such as T40.6.

Supplement vital records with medical examiner/coroner databases.

ME/C databases are population-based and will usually contain more detail than can be captured on the standard death certificate such as the specific types of drugs, the routes of administration (e.g. injection), comorbidities, and sources of drugs. Such data might be available from the local ME/C offices. In addition, this data has been captured through 2010 in multiple metropolitan areas and states by the DAWN Medical Examiner Component and included in reports produced by SAMHSA and available at http://DAWNinfo.samhsa.gov/pubs/mepubs/default.asp.

Morbidity surveillance

Examine various approaches to counting cases.

Use of the principal diagnosis, first-listed diagnosis, or any diagnosis to identify poisoning cases needs to be examined with state data to determine the limitations and biases of the different case-selection approaches. There is some evidence that use of the first-listed diagnosis may be insensitive to serious cases [18].

Create special systems and use nontraditional health data to capture nonfatal poisonings.

Some states have established surveillance systems specifically to capture nonfatal poisonings in a more timely way. For example, New Mexico and Utah have required the reporting of drug overdoses to their state health departments [19, 20]. Once evaluated, the public health impact of these measures and the experience within the states should be considered.

Partner with other state health agencies.

State health agencies should consider partnering with local poison centers, prescription drug monitoring, workers compensation, and Medicaid programs, all of which have databases that might be used to monitor nonfatal poisonings and the behaviors that contribute to them.

Improve external cause coding in hospital discharge data and ED data

The use of ICD-9-CM poisoning data from state-based hospital discharge and ED data systems depends on the completeness and specificity of external cause of injury codes. Effects have been underway for over two decades to improve external cause coding in these data systems. These efforts should continue. Two Healthy People 2020 Objectives have been established to track improvements in external cause coding in state-based hospital discharge and ED data systems (see Injury and Violence Objectives IVP-6 and IVP-7 at http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=24). Data used to track these objectives suggest that many states are now reporting external cause codes for 90% or more of their injury-related hospital discharges and ED visits.

Recommendations to Improve Surveillance at the National Level

STANDARDIZE DEATH CERTIFICATION FOR POISONING

The investigation of poisoning deaths in the US is characterized by wide variations in the use of toxicology testing, case definitions, and specificity of language on death certificates. National associations of ME/Cs and toxicologists should promulgate standard methods for documenting the poisoning event, poisoning agents, and other associated circumstances during investigations and provide appropriate training. There is a need to document the variation within and across states in the way death investigation and certification for poisoning are completed, which results in variations in the codes applied, the degree of detail in specification of drugs, and the use of drug testing and autopsy.

REVIEW THE ASCERTAINMENT OF EVENTS DUE TO ACUTE AND CHRONIC EFFECTS OF DRUG POISONING IN THE NCHS DRUG-INDUCED INDICATOR DEFINITION.

This report used the set of ICD codes for drug-induced deaths developed by the NCHS to define acute and chronic effects of drugs. The NCHS drug-induced causes exclude accidents, homicides, and other causes indirectly related to drug use. It also excludes newborn deaths associated with the mother's drug use and some of the more uncommon causes of death that are due to drugs (e.g. N14.1, nephropathy induced drugs, medicaments, and biological substances). The ISW7 recommends that NCHS review the drug-induced death category and update it if necessary.

ASSEMBLE A SET OF CODES TO ASCERTAIN EVENTS DUE TO ACUTE AND CHRONIC EFFECTS OF NON-DRUG POISONING.

No equivalent set of codes exists that defines the effects of chronic nondrug poisoning in ICD-10. A list of ICD-9-CM and ICD-10 codes that represent diseases and injury due to nondrug poisons, presumably mostly the result of occupational and/or environmental exposure, should be assembled.

DEVELOP A DRUG-ATTRIBUTABLE MORTALITY MEASURE

NCHS has a list of alcohol-induced disease codes that identify outcomes entirely attributable to alcohol [21]. A larger list of codes of alcohol-related diseases has been compiled (http://apps.nccd.cdc.gov/DACH_ARDI/Info/ICDCodes.aspx). It identifies diseases and injuries that are either entirely or partially caused by alcohol and makes use of attributable fractions. A similar compilation might be created for drug-attributable mortality.

DEVELOP A FRAMEWORK FOR ICD-10-CM COMPARABLE TO THE ICD-9-CM FRAMEWORK PROVIDED IN THIS REPORT.

ICD-10-CM is scheduled to be implemented in the United States on October 1, 2013 (http://www.cdc.gov/nchs/icd/icd10cm.htm). In ICD-10-CM poisonings are classified entirely by the diagnosis codes (i.e. T36-T65), and there are no external cause codes for poisonings. The classification of intent of poisoning (e.g. unintentional, self-harm, assault, and undetermined intent) in ICD-10-CM is indicated in the 6th digit of the appropriate diagnosis code (i.e. T36-T65). In general, the ICD-10-CM represents a significant improvement over ICD-9-CM and ICD-10 and includes the ability to classify many more conditions.

General equivalence mappings between ICD-9-CM and ICD-10-CM are available so users can review the poisoning codes. However, a framework comparable to the ICD-9-CM framework provided in this report should be constructed for ICD-10-CM. The new ICD-10-CM framework is needed in the near future to facilitate analysis and presentation of state-based injury morbidity data to monitor temporal trends and demographic patterns in injury rates by mechanism (e.g. poisoning) and intent of injury, especially during the transition period from use of ICD-9-CM to ICD-10-CM.

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Appendices

Appendix B

Appendix B1: Poisoning Matrix for ICD-10 Coded Mortality Data

Appendix B2: SAS Programs for Poisoning Matrix for ICD-10 Coded Mortality Data

Appendix B1: Poisoning Matrix for ICD-10 Coded Mortality Data

Appendix B1: Poisoning Matrix for ICD-10 Coded Mortality Data

Type of Poison†	Underlying Cause Codes*				
	Poisoning by Intent			Poisoning by Intent	
	Unintentional	Self harm/ suicide	Assault/ homicide	Legal Intervention/ Operation of War	Undetermined Intent
DRUG	X40-X44	X60-X64	X85	--	Y10-Y14
Nonopioid analgesics	X40	X60	--	--	Y10
4-Aminophenol derivatives	--	--	--	--	--
Antiepileptic, sedative-hypnotic, anti-Parkinsonism, antidepressant, and other psychotropic drugs, not elsewhere classified	X41	X61	--	--	Y11
Benzodiazepines	--	--	--	--	--
Methamphetamines and other psychostimulants with abuse potential	--	--	--	--	--
Anticoagulants	--	--	--	--	--
Narcotics and psychodysleptics not elsewhere classified****	X42	X62	--	--	Y12
Opiates/opioids	--	--	--	--	--
Heroin	--	--	--	--	--
Pharmaceutical opioids	--	--	--	--	--
Methadone	--	--	--	--	--
Cocaine	--	--	--	--	--
Other and unspecified narcotics*****	--	--	--	--	--
Other drugs acting on the autonomic nervous system	X43	X63	--	--	Y13
Drugs not elsewhere classified or unspecified	X44	X64	X85	--	Y14
NON-DRUG	X45-X49	X65-X69	X86-X90	--	Y15-Y19
Alcohol	X45	X65	--	--	Y15
Ethanol	--	--	--	--	--
Organic solvents, and halogen derivatives of aliphatic and aromatic hydrocarbons	X46	X66	--	--	Y16
Other gases and vapors (including carbon monoxide)	X47	X67	--	--	Y17
Carbon monoxide	--	--	--	--	--
Other specified non-drugs	X48	X68	X86-X89	--	Y18
Other nondrugs not elsewhere classified or unspecified	X49	X69	X90	--	Y19
UNSPECIFIED TYPE OF POISON	--	--	*U01.7	Y35.2	--
ALL TYPES OF POISON	X40-X49	X60-X69	X85-X90, *U01.7	Y35.2	Y10-Y19

Appendix B1: Poisoning Matrix for ICD-10 Coded Mortality Data

	Underlying Cause Codes*			
Type of Poison†	Poisoning by Envenomation	Poisoning by Adverse Effect of Drug in Therapeutic Use	Poisoning Secondary to Foodborne Illness: Intoxication	Poisoning Secondary to Mental/ behavior disorder: Acute
DRUG		Y40-Y59		[F11 - F16] (.0), F19.0
Nonopioid analgesics		Y45.5		--
4-Aminophenol derivatives		Y45.5		--
Antiepileptic, sedative-hypnotic, anti-Parkinsonism, antidepressant, and other psychotropic drugs, not elsewhere classified		Y46, Y47, Y49 (.0-.5, .7-.9)		--
Benzodiazepines		Y47.1		F13.0†
Methamphetamines and other psychostimulants with abuse potential		Y49.7		F15.0
Anticoagulants		Y44.2		
Narcotics and psychodysleptics not elsewhere classified****		Y45.0, Y49.6		F11.0, F14.0, F16.0
Opiates/opioids		Y45.0		F11.0
Heroin		--		--
Pharmaceutical opioids		Y45.0		--
Methadone		--		--
Cocaine		--		F14.0
Other and unspecified narcotics*****		--		--
Other drugs acting on the autonomic nervous system		--		--
Drugs not elsewhere classified or unspecified		Y40-Y44.1, Y44 (.3-.9), Y45 (.1 .4, .8,.9), Y46, Y50 Y59		F12.0, F19.0
NON-DRUG	X20-X29		A05 (.0-.2, .4-.9)	F10.0, F17.0, F18.0
Alcohol			--	F10.0
Ethanol			--	--
Organic solvents, and halogen derivatives of aliphatic and aromatic hydrocarbons			--	F18.0
Other gases and vapors (including carbon monoxide)			--	--
Carbon monoxide			--	--
Other specified non-drugs	X20-X28		A05 (.0-.2, .4-.9)	F17.0
Other nondrugs not elsewhere classified or unspecified	X29		--	--
UNSPECIFIED TYPE OF POISON	--		--	--
ALL TYPES OF POISON	X20-X29	Y40-Y59	A05 (.0-.2, .4-.9)	[F10-F19] (.0)

Type of Poison†	Underlying Cause Codes*	
	Diseases induced by drugs and other substances	All codes
DRUG	D52.1, D59 (.0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, [F11 F16] (.1 .9), F19 (.1-.9), G21.1, G24.0, G25 (.1, .4,.6), G44.4, G62.0, G72.0, I95.2, J70 (.2-.4), K85.3, L10.5, L27 (.0, .1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2	X40-X44, X60-X64, X85, Y10-Y14, Y40-Y59, D52.1, D59 (.0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, F11-F16, F19, G21.1, G24.0, G25 (.1, .4, 6), G44.4, G62.0, G72.0, I95.2, J70 (.2-.4), K85.3, L10.5, L27 (.0, .1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2
Nonopioid analgesics	--	X40, X60, Y10, Y45.5
4-Aminophenol derivatives	--	Y45.5
Antiepileptic, sedative-hypnotic, anti-Parkinsonism, antidepressant, and other psychotropic drugs, not elsewhere classified	--	X41, X61, Y11, Y46, Y47, Y49 (.0-.5, .7-.9)
Benzodiazepines	F13‡ (.1-.9)	Y47.1, F13‡
Methamphetamines and other psychostimulants with abuse potential	F15(.1-.9)	F15, Y49.7
Anticoagulants	--	Y44.2
Narcotics and psychodysleptics not elsewhere classified****	--	X42, X62, Y12, Y45.0, Y49.6, F11.0, F14.0, F16.0
Opiates/opioids	F11 (.1-.9)	F11, Y45.0
Heroin	--	--
Pharmaceutical opioids	--	Y45.0
Methadone	--	--
Cocaine	F14 (.1-.9)	F14
Other and unspecified narcotics*****	--	--
Other drugs acting on the autonomic nervous system	--	X43, X63, Y13
Drugs not elsewhere classified or unspecified	F12 (.1-.9), F16 (.1-.9), F19 (.1-.9)	X44, X64, X85, Y14, Y40-Y44.1, Y44 (.3-.9), Y45 (.1 .4, .6, .9), Y48, Y50 Y59, F13, F19
NON-DRUG	E24.4, F10 (.1-.9), F17 (.1-.9), F18 (.1-.9), G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0	X20-X29, X45-X49, X65-X69, X86-X90, Y15-Y19, A05, E24.4, F10, F17, F18, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0
Alcohol	E24.4, F10 (.1-.9), G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0	X45, X65, Y15, E24.4, F10, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0
Ethanol	--	--
Organic solvents, and halogen derivatives of aliphatic and aromatic hydrocarbons	F18 (.1-.9)	X46, X66, Y16, F18
Other gases and vapors (including carbon monoxide)	--	X47, X67, Y17
Carbon monoxide	--	--
Other specified non-drugs	F17 (.1-.9)	X20-X28, X48, X68, X86-X89, Y18, A05, F17
Other nondrugs not elsewhere classified or unspecified	--	X49, X69, X90,Y19, X29
UNSPECIFIED TYPE OF POISON	--	Y35.2, *U01.7
ALL TYPES OF POISON	D52.1, D59.(0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24 (.2, .4), E27.3, E66.1, [F10-F19] (.1-.9), G21.1, G24.0, G25 (.1, .4, .6), G31.2, G44.4, G62 (.0, .1), G62.1, G72 (.0, .1), I42.6, I95.2, J70 (.2-.4), K29.2, K70, K85 (.2, .3), K86.0, L10.5, L27 (.0,.1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2	X20-X29, X40-X49, X60-X69, X85-X90, Y35.2, Y10-Y19, Y40-Y59, *U01.7, A05 (.0-.2, .4-.9), D52.1, D59 (.0, .2), D61.1, D64.2, E06.4, E16.0, E23.1, E24 (.2, .4), E27.3, E66.1, F10-F19, G21.1, G24.0, G25 (.1, 4, .6), G31.2, G44.4, G62 (.0, .1), G72 (.0, .1), I42.6, I95.2, J70 (.2-.4), K29.2, K70, K85 (.2, .3), K86.0, L10.5, L27 (.0,.1), M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R50.2

Type of Poison†	Contributing Cause Codes**		
	Drug and Other Non-venom, Non-foodborne Poisoning	Envenom-ation	Foodborne Illness: Intoxication
DRUG	T36-T50.9		
Nonopioid analgesics	T39		
4-Aminophenol derivatives	T39.1		
Antiepileptic, sedative-hypnotic, anti-Parkinsonism, antidepressant, and other psychotropic drugs, not elsewhere classified	T42, T43		
Benzodiazepines	T42.4		
Methamphetamines and other psychostimulants with abuse potential	T43.6		
Anticoagulants	T45.5		
Narcotics and psychodysleptics not elsewhere classified****	T36-T38.9, T40 (.0-.9), T41, T44, T45 (.0-.4), T45 (.6-.9), T46-T50.8		
Opiates/opioids	T40(.0-.4)		
Heroin	T40.1		
Pharmaceutical opioids	T40.0, T40 (.2-.4)		
Methadone	T40.3		
Cocaine	T40.5		
Other and unspecified narcotics*****	T40.6		
Other drugs acting on the autonomic nervous system	--		
Drugs not elsewhere classified or unspecified	T50.9		
NON-DRUG	T51-T60, T65	T63	T61, T62, T64
Alcohol	T51		--
Ethanol	T51.0		--
Organic solvents, and halogen derivatives of aliphatic and aromatic hydrocarbons	T52, T53		--
Other gases and vapors (including carbon monoxide)	T58, T59		--
Carbon monoxide	T58		--
Other specified non-drugs	T54-T57,T60, T65(.0-.8)	T63	T61-T62, T64
Other nondrugs not elsewhere classified or unspecified	T65.9	--	--
UNSPECIFIED TYPE OF POISON		--	--
	T36-T60, T65	T63	T61, T62, T64

Appendix B1: Poisoning Matrix for ICD-10 Coded Mortality Data

Footnotes

† **Type of Poison**
Only selected classes of drugs and nondrugs are shown in the table. Classes were chosen based on their public health importance. For example, 4-aminophenol derivatives such as acetaminophen are not the only class of nonopioid analgesics in use, but the other classes are involved in fatal poisonings less frequently. Similarly, many classes of gases and vapors are involved in poisoning deaths, but none so frequently as carbon monoxide. ICD codes associated with radiation exposure and disease are not included as they lack information as to whether the source of the radiation is incorporated into the body.

* **Underlying cause codes**
This set of columns includes only the ICD codes that are used to code the underlying cause of death. These codes can be used to identify deaths of all types caused by each poison type.

Some of these codes and codes from the lists of multiple cause codes may be included on death certificates without being the underlying cause of death.

To identify deaths that may be drug-related but not necessarily drug-caused, selecting for deaths with codes in this column or in the contributing cause column would be valid.

** **Contributing cause codes**
Codes that may be used for any diagnoses included in Part I or Part II of the death certificate. These codes are used to identify the type of poison involved but not the intent of the poisoning. They cannot be used to identify the underlying cause of death.

*** **Poisoning Secondary to Mental/ behavior disorder: Acute intoxication**
Acute intoxication codes in this column, [F10-F19].[0], have been discontinued. Beginning in 2007, NCHS decided that acute intoxication that was fatal should be coded as an external cause of mortality (injury) rather than a mental or behavioral disorder. F10.0 was discontinued in 2007 data. F11-F19 [.0] were discontinued in 2008 data.

**** **Narcotics and psychodysleptics not elsewhere classified**
The subcategories listed do not represent the full range of agents included in this code category.

***** **Other and unspecified narcotics (F55.0)**
This category is intended for other and unspecified drugs classified pharmacologically as narcotics (opioids/opiates). However, in practice it may also be used for drugs classified legally as narcotics such as cocaine.
The proportion of this category made up by opioids/opiates varies by jurisdiction, so inclusion of this code in any compilation of opioid deaths depends on more detailed analysis of death certificate text and/or medical examiner/coroner records in the jurisdiction.

‡ **Benzodiazepines are not the only class of drug in this code category.**

¶ **Diseases induced by drugs and other substances**
The set of drug-induced disease codes here differs from the drug-induced codes set developed by NCHS by the absence of the F17 codes for mental and behavioral disorders from the use of tobacco and the R78 codes for findings of drugs and other substances in the blood. The F17 codes are found in the "Non-Drug" row of this column because tobacco is not considered a drug by the ICD definition. The R78 codes do not meet the ICD poisoning definition.

A comprehensive list of all ICD-10 codes meeting our conceptual definition of poisoning (eg, including chronic pesticide exposure) has not been developed to date. No development was considered beyond the scope of this project.

Notes

1. When a set of additional digits are required for International Classification of Diseases codes, the additional digits are in parentheses () and apply to the preceding code or preceding range of codes in brackets [ ].
2. Empty cells in the matrix indicate that the Tenth Revision of the ICD does not specify that particular type of poisoning for that type of poison. In other words, that category does not apply. Some poison types may be specified only by the contributing cause codes and have no correspondingly specific underlying cause codes.

Appendix B2: SAS Programs for Poisoning Matrix for ICD-10 Coded Mortality Data

Program is not included in the package

Appendix C

Appendix C1: Poisoning Matrix for ICD-9-CM Coded Morbidity Data

Appendix C2: SAS Programs for Poisoning Matrix for ICD-9-CM Coded Morbidity Data

Appendix C1: Poisoning Matrix for ICD-9-CM Morbidity Data

Appendix C1: Poisoning Matrix for ICD-9-CM Morbidity Data

Type of Poison††††	Poisonings classified by external cause categories†				
	Poisoning by intent				
	Unintentional	Self Harm	Assault	Legal Intervention/ Operation of War	Undetermined
DRUG	E850-E858	E950 (.0-.5)	E962.0	--	E980 (.0-.5)
Nonopioid analgesics, Antipyretics, and Antirheumatics	E850 (.3-.8)	--	--	--	--
4-Aminophenol derivatives	E850.4	--	--	--	--
Opiates/opioids	E850 (.0-.2)	--	--	--	--
Heroin	E850.0	--	--	--	--
Pharmaceutical opioids**	E850 (.1-.2)	--	--	--	--
Methadone	E850.1	--	--	--	--
Cocaine	E854.3*, E855.2*	--	--	--	--
Other and unspecified narcotics	--	--	--	--	--
Antidepressants, barbiturates and other antiepileptics, sedative-hypnotics, and psychotropic drugs not elsewhere classified	E851-E853, E854 (.0-.2, .8), E855.0	E950 (.1-.3)	--	--	E980 (.1-.3)
Benzodiazepines	E853.2	--	--	--	--
Psychostimulants with abuse potential incl methamphetamine, MDMA (Ecstasy)	E854.2	--	--	--	--
Anticoagulants	--	--	--	--	--
Other specified and unspecified drugs	E850 (.9), E855 (.1, .3-.9), E856-E858	E950 (.0, .4, .5)	E962.0	--	E980 (.0, .4, .5)
NON-DRUG	E860-E869	E950 (.6-.8), E961-E952	E962 (.1, .2)	E972, E997.2	E980 (.6-.8), E981, E982 (.0, .1)
Alcohol	E860	--	--	--	--
Ethanol	E860 (.0-.1)	--	--	--	--
Carbon monoxide	E868 (.2-.9)	E952 (.0, .1)	--	--	E982 (.0, .1)
Petroleum products and other solvents and their vapors	E862	--	--	--	E981
Other specified and unspecified non-drugs	E861, E863-E867, E868 (.0-.1), E869	E950 (.6-.8), E961, E952 (.8, .9)	E962 (.1-.2)	E972, E997.2	E980 (.6-.8)
UNSPECIFIED TYPE OF POISON	--	E950.9	E962.9, E979.7	--	E980.9, E982 (.8, .9)
ALL TYPES OF POISON	E850-E869	E950-E952	E962, E979.7	E972, E997.2	E980-E982

Appendix C1: Poisoning Matrix for ICD-9-CM Morbidity Data

Type of Poison††††	Poisonings classified by external cause categories†		Drug and alcohol induced diseases††
	Enven-omation	Adverse Drug Effect	Drug and alcohol induced diseases
DRUG		E930-E949	244 (.2,.3), 275.02, 288.03, 289.84, 292, 304 (.00-.02,.10-.12), [304-305] (.20-.22,.30-.32,.40-.42,.50-.52,.60-.62,.70-.72,.80-.82,.90-.92), 332.1, 333.85, 336.8, 357.6, 359.24, 648.3, 655.5, 692.3, 693.0, 760 (.72-.78), 779 (.4,.5)
Nonopioid analgesics, Antipyretics, and Antirheumatics		E935 (.3-.8)	--
4-Aminophenol derivatives		E935.4	--
Opiates/opioids		E935 (.0-.2)	304 (.00-.02, .70*, .71*, .72*), 305 (.50-.52)
Heroin		E935.0	--
Pharmaceutical opioids**		E935 (.1-.2)	--
Methadone		E935.1	--
Cocaine		E938.5*	304 (.20-.22), 305 (.60-.62), 760.75
Other and unspecified narcotics		--	760.72
Antidepressants, barbiturates and other antiepileptics, sedative-hypnotics, and psychotropic drugs not elsewhere classified		E936-E937, E939-E940	304 (.10-.12), 305 (.40-.42)
Benzodiazepines		E939.4	--
Psychostimulants with abuse potential incl methamphetamine, MDMA (Ecstasy)		E939.7	304 (.40-.42), 305 (.70-.72)
Anticoagulants		E934.2	--
Other specified and unspecified drugs		E930-E933, E934 (.1,.3-.9), E935.9, E938 (.0-.4,.6-.9), E941-E949	304 (.30-.32, .50-.52, .60-.62, .80-.82, .90-.92), 305 (.20-.22, .30-.32, .80-.82, .90-.92), 760 (.73,.74,.76-.78)
NON-DRUG	E905		291 (.0-.5,.8,.9), 303 (.00-.02,.90-.92), 305 (.00-.02, .1), 357.5, 425.5, 535.3, 571 (.0-.3), 760.71
Alcohol			291 (.0-.5,.8,.9), 303 (.00-.02,.90-.92), 305 (.00-.02), 357.5, 425.5, 535.3, 571 (.0-.3), 760.71
Ethanol			--
Carbon monoxide			--
Petroleum products and other solvents and their vapors			--
Other specified and unspecified non-drugs	E905		305.1
UNSPECIFIED TYPE OF POISON			760 (.70,.79)
ALL TYPES OF POISON	E905	E930-E949	244 (.2,.3), 275.02, 288.03, 289.84, 291 (.0-.5,.8,.9), 292, 303 (.00-.02,.90-.92), 304 (.00-.02,.10-.12), 305 (.00-.02,.1), [304-305] (.20-.22,.30-.32,.40-.42,.50-.52,.60-.62,.70-.72,.80-.82,.90-.92), 332.1, 333.85, 336.8, 357 (.5,.6), 359.24, 425.5, 535.3, 571 (.0-.3), 648.3, 655.5, 692.3, 693.0, 760 (.7), 779 (.4,.5)

Appendix C1: Poisoning Matrix for ICD-9-CM Morbidity Data

Type of Poison††††	Poisonings classifed by nature (or diagnostic category) of the poisoning†††		
	Non-venom, Non-foodborne Poisoning	Envenomation	Foodborne illness: intoxication
DRUG	969 (.0,.5), 960-979, 995 (.2,.4,.86,.89), 999 (.4-.7)		
Nonopioid analgesics, Antipyretics, and Antirheumatics	965 (.1-.8)		
4-Aminophenol derivatives	965.4		
Opiates/opioids	965.0		
Heroin	965.01		
Pharmaceutical opioids**	965 (.00, .02-.09)		
Methadone	965.02		
Cocaine	968.5*, 970.81		
Other and unspecified narcotics	–		
Antidepressants, barbiturates and other antiepileptics, sedative-hypnotics, and psychotropic drugs not elsewhere classified	966, 967, 969, 970 (.0,.1,.89)		
Benzodiazepines	969.4		
Psychostimulants with abuse potential incl methamphetamine, MDMA (Ecstasy)	969.7		
Anticoagulants	964.2		
Other specified and unspecified drugs	969 (.0, .5), 960-963, 964 (.0, .1,.3-.9), 965.9, 968 (.0-.4, .6-.9), 970 (.9), 971-979, 995 (.2, .4, .86, .89), 999 (.4-.7)		
NON-DRUG	980-989	989.5	988, 989.7, 005 (.0-.3, .89)
Alcohol	980		
Ethanol	980.0		
Carbon monoxide	986		
Petroleum products and other solvents and their vapors	981-982		
Other specified and unspecified non-drugs	983-985, 987, 989 (.0-.4, .6), 989.81-989.9	989.5	988, 989.7, 005 (.0-.3, .89)
UNSPECIFIED TYPE OF POISON	–	–	–
ALL TYPES OF POISON	960-989, 999 (.4-.7)	989.5	988, 989.7, 005 (.0-.3, .89)

Appendix C1: Poisoning Matrix for ICD-9-CM Morbidity Data

Type of Poison††††	All Poisoning
DRUG	244 (.2,.3), 275.02, 288.03, 289.84, 292, 304 (.00-.02,.10-.12), [304-305] (.20-.22,.30-.32,.40-.42,.50-.52,.60-.62,.70-.72,.80-.82,.90-.92), 332.1, 333.85, 336.8, 357.6, 359.24, 648.3, 655.5, 692.3, 693.0, 760 (.72-.78), 779 (.4,.5), 969 (.0,.5), 980-989, 995 (.2,.4,.86,.89), 999 (.4-.7), E850-E858, E930-E949, [E950, E980] (.0-.5), E962.0
Nonopioid analgesics, Antipyretics, and Antirheumatics	965 (.1-.8), E850 (.3-.8), E935 (.3-.8)
4-Aminophenol derivatives	965.4, E850.4, E935.4
Opiates/opioids	304 (.00-.02, .70*, .71*, .72*), 305 (.50-.52), 965.0, E850 (.0-.2), E935 (.0-.2),
Heroin	965.01, E850.0, E935.0
Pharmaceutical opioids**	965 (.00,.02-.09), E850 (.1-.2), E935 (.1-.2)
Methadone	965.02, E850.1, E935.1
Cocaine	304 (.20-.22), 305 (.60-.62), 760.75, 968.5*, 970.81, E854.3*, E855.2*, E938.5*
Other and unspecified narcotics	760.72
Antidepressants, barbiturates and other antiepileptics, sedative-hypnotics, and psychotropic drugs not elsewhere classified	304 (.10-.12), 305 (.40-.42), 966, 967, 969, 970 (.0,.1,.89), E851-E853, E854 (.0,.1,.2,.8), E855.0, E936-E937, E939-E940, E950 (.1-.3), E980 (.1-.3)
Benzodiazepines	969.4, E853.2, E939.4
Psychostimulants with abuse potential incl methamphetamine, MDMA (Ecstasy)	304 (.40-.42), 305 (.70-.72), 969.7, E854.2, E939.7,
Anticoagulants	964.2, E934.2
Other specified and unspecified drugs	304 (.30-.32, .50-.52, .60-.62, .80-.82, .90-.92), 305 (.20, -.22, .30-.32, .80-.82, .90-.92), 760 (.73,.74,.76-.78), 909 (.0, .5), 960-963, 964 (.0, .1,.3-.9), 965.9, 968 (.0-.4, .6-.9), 970 (.9), 971-979, 995 (.2, .4, .86, .89), 999 (.4-.7), E850 (.9), E855 (.1,.3-.9), E856-E858, E950 (.0, .4, .5), E962.0, E980 (.0, .4, .5), E930-E933, E934 (.1,.3-.9), E935.9, E938 (.0-.4,.6-.9), E941-E949
NON-DRUG	005 (.0-.3, .89), 291 (.0-.5,.8,.9), 303 (.00-.02,.90-.92), 305 (.00-.02, .1), 357.5, 425.5, 535.3, 571 (.0-.3), 760.71, 980-989, E860-E869, E905, E950 (.6-.8), E951-E952 , E962 (.1-.2), E972, E980 (.6-.8), E981, E982 (.0,.1), E997.2
Alcohol	291 (.0-.5,.8,.9), 303 (.00-.02,.90-.92), 305 (.00-.02), 357.5, 425.5, 535.3, 571 (.0-.3), 760.71, 980, E860
Ethanol	980.0, E860 (.0-.1)
Carbon monoxide	986, E868 (.2-.9) ,E952 (.0,.1), E982 (.0,.1)
Petroleum products and other solvents and their vapors	981-982, E862, E981
Other specified and unspecified non-drugs	005 (.0-.3,.89), 305.1, 983-985, 987-989, E861, E863-E867, E868 (.0,.1), E869, E905, E950 (.6-.8), E951, E952 (.8-.9), E962 (.1-.2), E972, E980(.6-.8) , E997.2
UNSPECIFIED TYPE OF POISON	760 (.70,.79), E950.9, E962.9, E980.9, E979.7, E982 (.8,.9)
ALL TYPES OF POISON	005 (.0-.3,.89), 244 (.2,.3), 275.02, 288.03, 289.84, 291 (.0-.5,.8,.9), 292, 303 (.00-.02,.90-.92), 304 (.00-.02,.10-.12), 305 (.00-.02, .1), [304-305] (.20-.22,.30-.32,.40-.42,.50-.52,.60-.62,.70-.72,.80-.82,.90-.92), 332.1, 333.85, 336.8, 357 (.5,.6), 359.24, 425.5, 535.3, 571 (.0-.3), 648.3, 655.5, 692.3, 693.0, 760 (.7), 779 (.4,.5), 960-989, 999 (.4-.7), E850-E869, E905, E930-E952, E962, E972, E980-E982, E979.7, E997.2

Appendix C2: SAS Programs for Poisoning Matrix for ICD-9-CM Coded Morbidity Data

Program is not included in the package

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