

Prepared for the Data Surveillance Work Group of the
CO Safety Coalition by NCOAA



Carbon Monoxide Data Surveillance

September 2022

Topics Covered in This Presentation

- 1. Public Health Surveillance 101**
- 2. CSTE Definitions and Recommendations for Surveillance**
- 3. CDC Draft Message Mapping Guide (MMG)**
- 4. Other CO Surveillance Information and Resources**
- 5. The Role of the CO Safety Coalition by NCOAA Data Surveillance Work Group**

PART 1

Public Health Surveillance 101

A Public Health Approach



Public Health Surveillance Defined

The ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control



Public Health Surveillance Keywords

- Systematic
- Ongoing
- Collection
- Analysis
- Interpretation
- Dissemination
- Health-Related Data
- Linked to Public Health Practice



Goal of Public Health Surveillance

Provide information that can be used for health action by public health personnel, government leaders, and the public to guide public health policy and programs



Uses of Public Health Surveillance

- Identify patients and their contacts for treatment and intervention
- Detect epidemics, health problems, changes in health behaviors
- Estimate magnitude and scope of health problems
- Measure trends and characterize disease
- Monitor changes in infectious and environmental agents
- Assess effectiveness of programs and control measures
- Develop hypotheses and stimulate research

Examples of Public Health Surveillance of Carbon Monoxide Poisoning



450 Deaths Per Year



50,000-90,000
Emergency Room Visits
Per Year



Whether Cases
Increase or
Decrease Over
Time

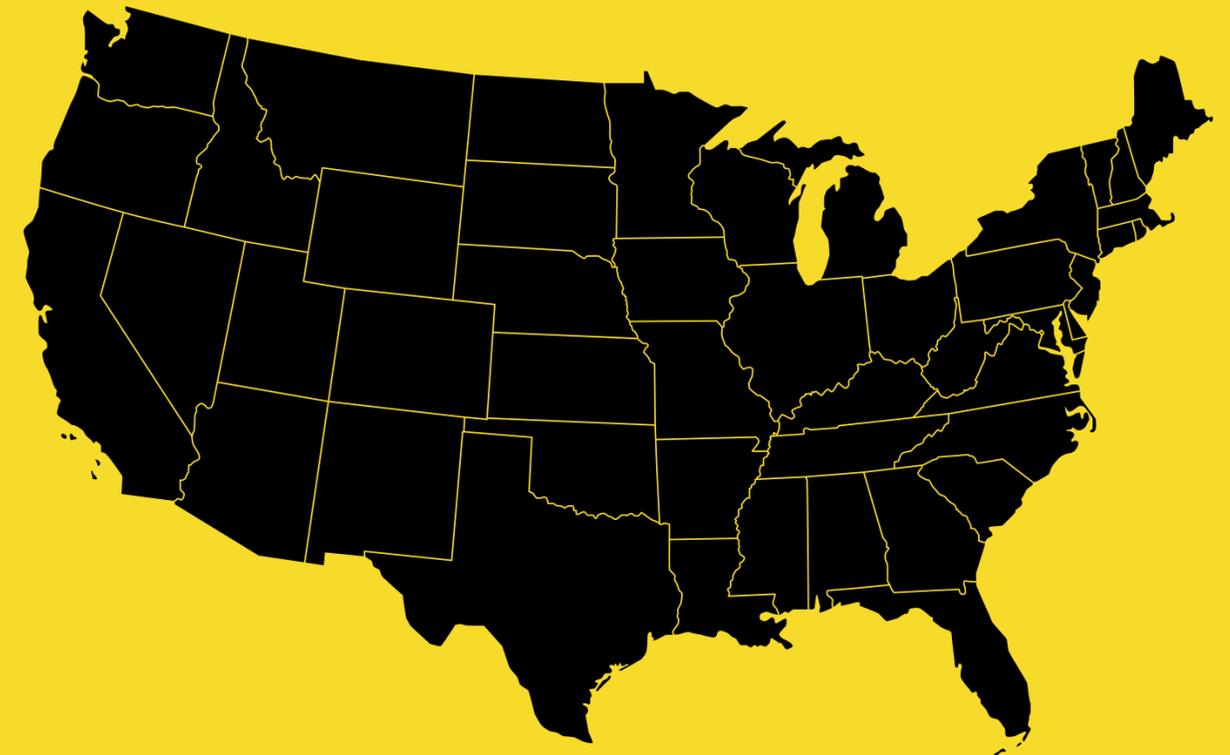
Legal Authority for Conducting Public Health Surveillance

States have authority based on the *U.S. Constitution*

- General Welfare Clause
- Interstate Commerce Clause

CDC (Federal Government) responds when:

- Disease or condition has interstate implications
- Invited by a state



State-Based Notifiable Disease Surveillance Systems

- Mandated by state law or regulation
- Health care providers, hospitals, and laboratories are required to report cases to the local health department (LHD)
- The LHD is usually responsible for case investigation and action
- The LHD forwards the disease report to the state health department
- The state health department assists the LHD as needed



Types of Public Health Surveillance



Passive Surveillance

- Diseases are reported by health care providers
- Simple and inexpensive
- Limited by incompleteness of reporting and variability of quality



Active Surveillance

- Health agencies contact health providers seeking reports
- Ensures more complete reporting of conditions
- Used in conjunction with specific epidemiologic investigation

Other Types of Public Health Surveillance



Sentinel Surveillance

Reporting of health events by health professionals who are selected to represent a geographic area or a specific reporting group.

Can be active or passive.



Syndromic Surveillance

Focuses on one or more symptoms rather than a physician-diagnosed or laboratory-confirmed disease

Data Sources for Public Health Surveillance

- **Reported diseases or syndromes**
- **Electronic health records (e.g., hospital discharge data)**
- **Vital records (e.g., birth and death certificates)**
- **Registries (e.g., cancer, immunization)**
- **Surveys (e.g., National Health and Nutrition Examination Survey [NHANES])**



Nationally Notifiable Disease Surveillance System (NNDSS)

Many diseases on a state list are also nationally notifiable



“The reason for collecting, analyzing, and disseminating information on a disease is to control that disease. Collection and analysis should not be allowed to consume resources if action does not follow.”

—William Foege, 1976



Photo: Kay Hinton, Emory University

CDC Definitions for Public Health Surveillance

In October 1990, CDC published **Case Definitions for Public Health Surveillance**, which, for the first time, provided uniform criteria for reporting cases to increase the specificity of reporting and improve the comparability of diseases reported from different geographic areas.

In 1996, the CDC revised the list of diseases under epidemiological and public health surveillance, and published it as "**Case Definitions for Infectious Conditions Under Public Health Surveillance**" (MMWR 1997;46).

The definition of terms used in this list for case classification is established as follows:

Clinically compatible case: a clinical syndrome generally compatible with the disease, as described in the clinical description.

Confirmed case: a case that is classified as confirmed for reporting purposes.

Epidemiologically linked case: case in which (a) the patient has had contact with one or more persons who either have/had the disease or have been exposed to a point source of infection (i.e., a single source of infection, such as an event leading to a foodborne-disease outbreak, to which all confirmed case-patients were exposed) and (b) transmission of the agent by the usual modes of transmission is plausible. A case may be considered epidemiologically linked to a laboratory-confirmed case if at least one case in the chain of transmission is laboratory confirmed.

Laboratory-confirmed case: a case that is confirmed by one or more of the laboratory methods listed in the case definition under Laboratory Criteria for Diagnosis. Although other laboratory methods can be used in clinical diagnosis, only those listed are accepted as laboratory confirmation for national reporting purposes.

Probable case: a case that is classified as probable for reporting purposes.

Supportive or presumptive laboratory results: specified laboratory results that are consistent with the diagnosis, yet do not meet the criteria for laboratory confirmation.

Suspected case: a case that is classified as suspected for reporting purposes.

CDC Definitions: Categorizing Cases



Incidence: New Cases Only

(Incidence = (New Cases) / (Population x Timeframe))

Definition of incidence

Incidence proportion is the proportion of an initially disease-free population that develops disease, becomes injured, or dies during a specified (usually limited) period of time.

Synonyms include:

- incidence proportion
- attack rate
- risk
- probability of getting disease
- cumulative incidence

Incidence proportion is a proportion because the persons in the numerator, those who develop disease, are all included in the denominator (the entire population).



Prevalence: All Cases

(Prevalence = Prevalent cases / Total population)

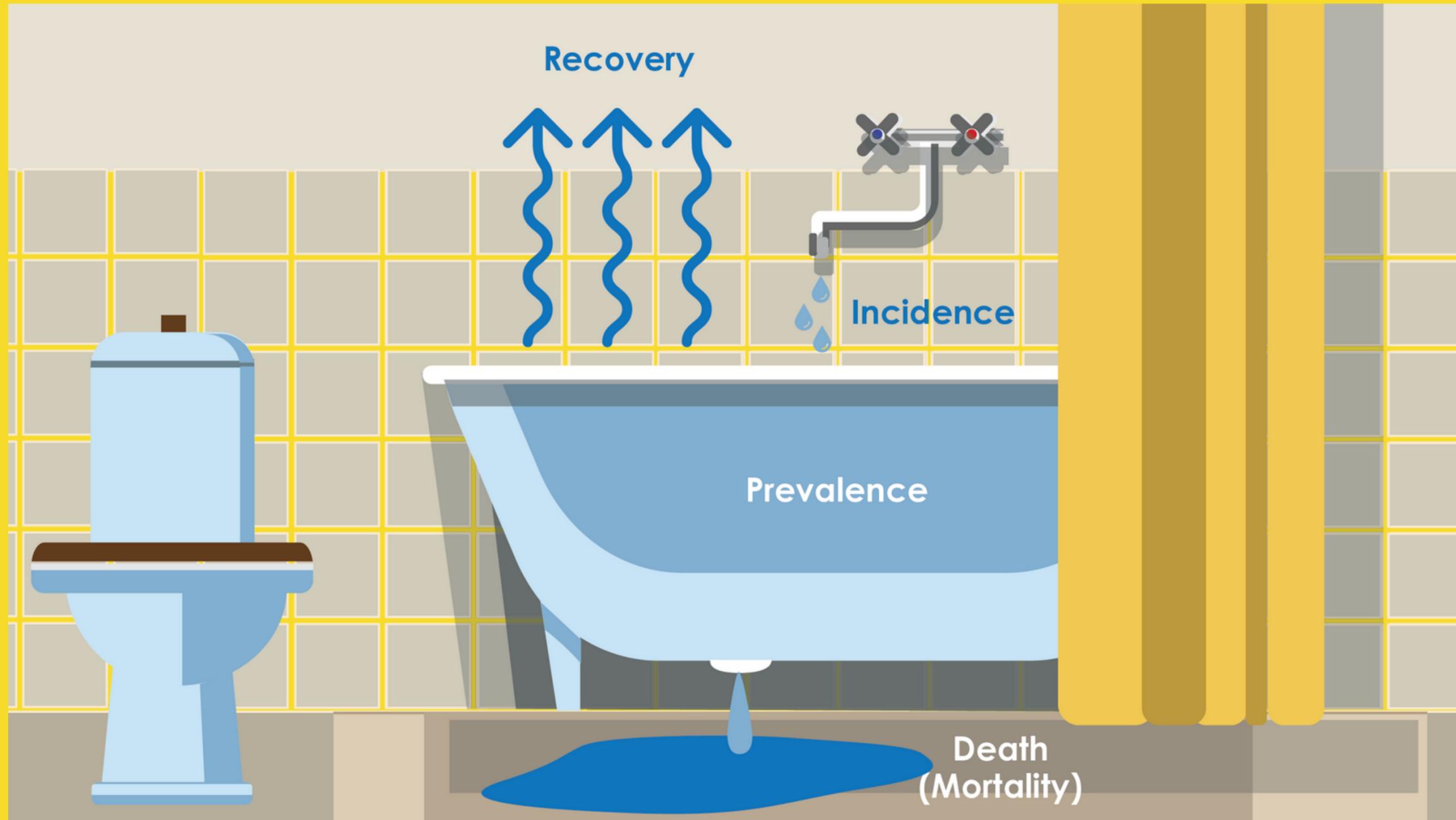
Definition of prevalence

Prevalence, sometimes referred to as prevalence rate, is the proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period of time.

Prevalence differs from incidence in that prevalence includes all cases, both new and preexisting, in the population at the specified time, whereas incidence is limited to new cases only.

- Point prevalence refers to the prevalence measured at a particular point in time. It is the proportion of persons with a particular disease or attribute on a particular date.
- Period prevalence refers to prevalence measured over an interval of time. It is the proportion of persons with a particular disease or attribute at any time during the interval.

Incidence vs. Prevalence: Epidemiologists' Bathtub Analogy



Free Training on Public Health Surveillance 101 Available on CDC Website

<https://www.cdc.gov/training/publichealth101/surveillance.html>



**CENTERS FOR DISEASE
CONTROL AND PREVENTION**

PART 2

Council of State & Territorial Epidemiologists (CSTE) Definitions and Recommendations

Summary of Standardized Surveillance for CO Poisoning: A Position Statement by the Council of State & Territorial Epidemiologists (CSTE)



CSTE Report: Statement of the Problem

CO poisoning is a leading cause of unintentional poisoning deaths in the United States.

Carbon monoxide (CO) is a colorless, odorless, nonirritating gas that is produced through the incomplete combustion of carbon-containing substances.

Sources of CO include:

- boilers
- furnaces
- cars and trucks
- generators and other gasoline or diesel-powered engine
- gas and propane heaters
- woodstoves and gas stoves
- fireplaces
- tobacco smoke
- forklifts
- fire
- Unusual sources include exposure to methylene chloride, which is metabolized to CO and hemolysis, with increased metabolism of hemoglobin.

The most common location of exposures causing CO poisoning are in homes and less commonly in workplaces.

CO poisoning occurs from breathing in elevated air levels of carbon monoxide.

Symptoms are generally non-specific and commonly include

- headache
- dizziness
- weakness
- vomiting
- chest pain
- confusion

Large exposures can result in loss of consciousness, arrhythmias, seizures, or death.

Unintentional, non-fire related CO poisoning is responsible for approximately 450 deaths and 21,000 emergency department (ED) visits each year.

Outbreaks of CO poisoning associated with equipment used during natural disasters have been well documented.

CSTE Report: Background & Justification

This position statement describes two tiers for surveillance of CO poisoning:

(1) case reporting/case ascertainment based on public health legal authorities

and

(2) analysis of administrative data without access to personal identifiers.

Tier 1: Case Reporting Based on Public Health Legal Authorities

The first tier – case reporting based on public health legal authorities – describes traditional public health surveillance practice based on case identification and follow-up investigation.

Reporting includes reports from providers or laboratories.

It also includes identification of potential cases from administrative data (e.g. identified based on discharge diagnosis codes in hospital discharge) or from syndromic surveillance using data from emergency departments, poison control centers, or urgent care centers where individual records are used to conduct additional case investigation in order to have data to complete case classification.

Tier 2: Recommendations for using administrative data

The second tier is a set of recommendations for surveillance using administrative data, without personal identifiers. These activities can be conducted by any agency that has access to de-identified morbidity and mortality data, including agencies such as CDC and the American Association of Poison Control Centers.

It utilizes electronic data and does not generally include additional case investigation as follow-up to individual records in administrative data.

It includes conducting syndromic surveillance using data from emergency departments, poison control centers, or urgent care centers.

CSTE Report: Statement of the Desired Actions to Be Taken

CSTE Recommends the Following Actions:

- Utilize standard sources (e.g. reporting*) for case ascertainment for carbon monoxide (CO) poisoning. Surveillance for CO poisoning should use the following recommended sources of data to the extent of coverage presented in Table III (next slide).
- Utilize standardized criteria for case identification and classification (see on Sections VI and VII and Technical Supplement) for carbon monoxide poisoning and continue to keep carbon monoxide poisoning on the Nationally Notifiable Condition List (as Routinely Notifiable).
- CSTE recommends that all States and Territories enact laws (statue or rule/regulation as appropriate) to make this disease or condition reportable in their jurisdiction. Jurisdictions (e.g. States and Territories) conducting surveillance (according to these methods) should submit case notifications* to CDC.
- CSTE recommends that all jurisdictions (e.g. States or Territories) with legal authority to conduct public health surveillance follow the recommended methods as outlined here and in the accompanying standardized surveillance position statement.
- Expectations for Message Mapping Guide (MMG) development for a newly notifiable condition:
 - NNDSS is transitioning to HL7-based messages for case notifications; the specifications for these messages are presented in MMGs.
 - When CSTE recommends that a new condition be made nationally notifiable, CDC must obtain OMB PRA approval prior to accepting case notifications for the new condition.
 - Under anticipated timelines, notification using the Generic V2 MMG would support transmission of the basic demographic and epidemiologic information common to all cases and could begin with the new MMWR year following the CSTE annual conference.
 - Input from CDC programs and CSTE would prioritize development of a disease-specific MMG for the new condition among other conditions waiting for MMGs.
- CDC should publish data on carbon monoxide poisoning as appropriate (see Section).

CSTE Report: Statement of the Desired Actions to Be Taken

Table III. Recommended sources of data and extent of coverage for ascertainment of cases of CO Poisoning

Source of data for case ascertainment	Coverage	
	Tier 1: Population-wide	Tier 2: Population-wide
Clinician reporting	X	
Laboratory reporting	X	
Reporting by other entities (e.g., hospitals, poison centers, hyperbaric facilities, medical examiners)	X	
Death certificates	X	
Hospital discharge, emergency department, or urgent care	X	X
Extracts from electronic medical records	X	X
Telephone survey		
School-based survey		
Other: Poisoning Control Center (PCC) data without identifiers reported to the American Association of Poison Control Centers for the National Poison Data System (NPDS) or made available to states; state workers compensation data		X

CSTE Report: Goals of Surveillance

- Immediate response, to block the occurrence of further cases
- Planning for prevention programs
 - Estimation of the magnitude of the problem and tracking trends over time
 - Identification of high-risk areas and population sub-groups
- Assessment of the effectiveness of prevention programs
- Investigation of novel exposure pathways and previously unknown determinants/poisoning scenarios.



CSTE Report: Methods for CO Surveillance

- **Data Sources (See Table III in Slide #20)**
- **Hospitals/emergency departments: Population based.** Includes multiple diagnosis codes (ICD10-CM). May include individual identifiers so that case follow-up can take place.
- **PCC: Population based.** Coded information identifies CO poisoning but not exposure source. Access to “notes” fields for information about exposure source, smoking status requires legal authority. Can be very timely.
- **Death certificates: Population-based.** Includes multiple cause of death codes. Limited access to personal identifiers. Typically not timely.
- **Laboratory reports of carboxyhemoglobin: Case investigation** may be required to determine smoking status and whether CO exposure occurred in order to interpret results. Timely.
- **Provider/medical examiner reports:** Compliance with reporting requirements variable across states.

CSTE Report: Criteria for Case Ascertainment - Tier 1

Tier 1 Reporting refers to the process of healthcare providers or institutions (e.g., clinicians, clinical laboratories, hospitals, poison control centers) submitting basic information to governmental public health agencies about cases of carbon monoxide poisoning that meet certain reporting requirements or criteria.

Cases of carbon monoxide poisoning may also be ascertained by the secondary analysis of administrative data or through syndromic surveillance algorithms where individual information is available for follow-up case investigation.

Clinical Presentation Criteria:

A person with signs or symptoms consistent with carbon monoxide poisoning, which may include:

- an elevated pulse CO-oximetry measurement
- non-specific symptoms such as nausea, vomiting, confusion, shortness of breath, chest pain, and loss of consciousness

Laboratory Criteria:

A person with a carboxyhemoglobin (COHb) level of $\geq 2.5\%$ as measured in a blood sample.

CSTE Report: Tier 1 Case Classifications

Case Classifications Using Clinical, Laboratory, Epidemiologic and Exposure Data - Tier 1

Confirmed Case:

- A person with confirmatory laboratory evidence OR
- A person with presumptive or clinical evidence AND with confirmatory exposure evidence

Suspected Case:

- A person with supportive laboratory evidence OR
- A person with supportive clinical criteria AND possible exposure evidence

Probable Case:

- A person with presumptive laboratory evidence, OR
- A person with presumptive clinical evidence AND possible exposure evidence, OR
- A person with presumptive or supportive clinical evidence AND epidemiologic linkage

CSTE Report: Criteria for Case Ascertainment - Tier 2

Criteria for case ascertainment based on secondary analysis of administrative data without access to personal identifiers

- **Healthcare records, including hospital discharge and emergency department records.**
 - A person whose healthcare record includes mention of carbon monoxide poisoning (see Appendix 2 and Appendix 6)
- **Poison Control Records.** A person whose poison control center record indicates an exposure to carbon monoxide (see Appendix 3)
- **Workers Compensation Records.** A person whose workers compensation record contains a finding, problem, diagnosis, or other indication of exposure to carbon monoxide or carbon monoxide poisoning (see Appendix 4)
- **Death Certificates.** A person whose death certificate lists carbon monoxide poisoning, toxic effect of carbon monoxide, or carbon monoxide exposure as a cause of death or a significant condition contributing to death (see Appendix 5)

CSTE Report: Tier 2 Case Classifications

Case Classifications Using Administrative Data - Tier 2

Confirmed Case:

- Healthcare records, including hospital discharge and emergency department records
 - A person whose healthcare record contains an explicit diagnosis of carbon monoxide poisoning (see Appendix 2)
- Death Certificates:
 - A person whose death certificate explicitly lists carbon monoxide poisoning, toxic effect of carbon monoxide, or carbon monoxide exposure as a cause of death or a significant condition contributing to death (see Appendix 5)

Probable Case:

- Healthcare records, including hospital discharge and emergency department records
 - A person whose healthcare record contains a diagnosis of carbon monoxide poisoning by motor vehicle exhaust (see Appendix 2)
- Poison Control Center Records
 - A person whose poison control center record indicates an exposure to carbon monoxide AND a moderate medical outcome, major medical outcome, or death (see Appendix 3)
- Workers Compensation Records
 - A person whose workers compensation paid claim contains a finding, problem, diagnosis, or other indication of exposure to carbon monoxide or carbon monoxide poisoning (see Appendix 4)

Suspected Case:

- Poison Control Center Records
 - A person whose poison control center record indicates an exposure to carbon monoxide AND a minor medical outcome (see Appendix 3)
- Workers compensation records
 - A person whose workers compensation submitted claim contains a finding, problem, diagnosis, or other indication of exposure to carbon monoxide or carbon monoxide poisoning (see Appendix 4)
- Healthcare records, including hospital discharge and emergency department records
 - A person whose healthcare record contains a diagnosis that is inclusive of carbon monoxide poisoning by sources other than motor vehicle exhaust (see Appendix 2)
 - A person whose emergency department record mentions exposure to carbon monoxide in the chief complaint.
- Death Certificates
 - A person whose death certificate lists a cause of death that is inclusive of carbon monoxide poisoning, toxic effect of carbon monoxide, or carbon monoxide exposure as a cause of death or a significant condition contributing to death (see Appendix 5)

CSTE Report: Categorizing Cases

Criteria to distinguish a new case of this disease or condition from reports or notifications which should not be enumerated as a new case for surveillance.

A case is categorized as a prevalent case when there are multiple reports for the same person for the same episode, such as when there are multiple COHb lab test results or when a patient receives multiple hyperbaric treatments following a single poisoning event.

A case should be categorized as a new (incident) case when there is either:

- New exposure to CO from different exposure source
- Repeated exposure as defined by having the same exposure source as previous occurrence where the criteria used to designate a case has been resolved prior to repeat exposure

CSTE Report: Technical Supplement

Table VI. Table of criteria to determine whether a case should be reported to public health authorities

Criterion	Report of CO Poisoning
<i>Clinical Evidence (Tier 1)</i>	
A person with signs or symptoms consistent with carbon monoxide poisoning, which may include an elevated pulse CO-oximetry measurement and non-specific symptoms such as nausea, vomiting, confusion, shortness of breath, chest pain, and loss of consciousness	S
<i>Laboratory Evidence (Tier 1)</i>	
Carboxyhemoglobin (COHb) \geq 2.5% as measured in a blood sample	S
<i>Administrative Records Evidence (Tier 2)</i>	
A person whose healthcare record contains a diagnosis of carbon monoxide poisoning (see Appendix 2)	S
A person whose emergency department record includes mention of carbon monoxide in the chief complaint (See Appendix 6)	S
A person whose poison control center record indicates an exposure to carbon monoxide (see Appendix 3)	S
A person whose workers compensation record contains a finding, problem, diagnosis, or other indication of exposure to carbon monoxide or carbon monoxide poisoning (see Appendix 4)	S
A person whose death certificate lists carbon monoxide poisoning, toxic effect of carbon monoxide, or carbon monoxide exposure as a cause of death or a significant condition contributing to death (see Appendix 5)	S

Notes:

S = This criterion alone is SUFFICIENT to report a case.

CSTE Report: Technical Supplement

Table VII.A. Classification Table: Criteria for defining a case of carbon monoxide poisoning using clinical, laboratory, and exposure evidence (Tier 1)

Criterion	Suspected			Probable			Confirmed				
<i>Demographic</i>											
Age < 14 years old	O	N	O			O			O	N	O
Age ≥ 14 years old	O		O	N		O	N		N	O	O
Person does not smoke	N										N
Person smokes			N			N				N	
Person with unknown smoking status			N	N			N		N		N
<i>Clinical Evidence</i>											
Loss of consciousness					O	O			O		
Death					O	O			O		
Elevated pulse CO-oximetry measurement	O				O				O		
Nausea	O				O				O		
Vomiting	O				O				O		
Confusion	O				O				O		
Shortness of breath	O				O				O		
Chest pain	O				O				O		
<i>Laboratory Criteria</i>											
COHb ≥ 2.5% and < 5.0% as measured in a blood sample		N	N								
COHb ≥ 5.0% as measured in a blood sample										N	N
COHb ≥ 7.0% and < 9.0% as measured in a blood sample				N	N						
COHb ≥ 9.0% and ≤ 12.0% as measured in a blood sample							N	N			
COHb > 12.0% as measured in a blood sample									N	N	
<i>Environmental Exposure Criteria</i>											
Exposure to an elevated level of CO based on a dedicated or multi-gas meter/instrument (e.g., fire department notation) for a known duration that is consistent with CO poisoning									N		
Person was in a location where there was documentation that a CO detector's alarm sounded	O						O				
Person physically and temporally associated with a CO-emitting source (e.g., gasoline-powered generator, power washer, malfunctioning furnace, and fire) at the time of onset	O						O				
<i>Epidemiologic evidence</i>											
Person who was present and exposed in the same CO exposure event as that of a confirmed CO poisoning case						N					

CO = Carbon monoxide

Notes:

N = All "N" criteria in the same column are NECESSARY to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below). If the absence of a criterion (i.e., criterion NOT present) is required for the case to meet the classification criteria, list the absence of criterion as a necessary component.

O = At least one of these "O" (ONE OR MORE) criteria in **each category** (categories=clinical evidence, laboratory evidence, and epidemiologic evidence) **in the same column**—in conjunction with all "N" criteria in the same column—is required to classify a case. A number following an "O" indicates that this criterion is only required for a specific disease/condition subtype.

CSTE Report: Technical Supplement

Table VII.B. Classification Table: Criteria for defining a case of carbon monoxide poisoning using evidence from administrative records (Tier 2)

Criterion	Suspected			Probable			Confirmed
<i>Administrative Records Evidence</i>							
A person whose healthcare record contains an explicit diagnosis of CO poisoning (see Appendix 2)							S
A person whose healthcare record contains a diagnosis of CO poisoning by motor vehicle exhaust (see Appendix 2)						S	
A person whose healthcare record contains a diagnosis inclusive of CO poisoning by sources other than motor vehicle exhaust (see Appendix 2)			S				
A person whose poison control center record indicates an exposure to CO (see Appendix 3)		N				N	
A person whose poison control center record indicates a moderate or major medical outcome, or death (see Appendix 3)						N	
A person whose poison control center record indicates a minor medical outcome (see Appendix 3)		N					
A person whose workers compensation record contains a <u>paid</u> claim with a finding, problem, diagnosis, or other indication of exposure to CO or CO poisoning (see Appendix 4)					S		
A person whose workers compensation record contains a <u>submitted</u> claim with a finding, problem, diagnosis, or other indication of exposure to CO or CO poisoning (see Appendix 4)	S						
A person whose death certificate lists explicitly CO poisoning, toxic effect of CO, or CO exposure as a cause of death or a significant condition contributing to death (see Appendix 5)							S
A person whose death certificate lists a cause of death that is inclusive of CO poisoning, toxic effect of CO, or CO exposure as a cause of death or a significant condition contributing to death (see Appendix 5)				S			
A person whose emergency department record mentions exposure to CO in the chief complaint			S				

CO = Carbon monoxide

Notes:

S = This criterion alone is SUFFICIENT to classify a case.

N = All "N" criteria in the same column are NECESSARY to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below). If the absence of a criterion (i.e., criterion NOT present) is required for the case to meet the classification criteria, list the absence of criterion as a necessary component.

PART 3

CDC Draft Message Mapping Guide (MMG)

CDC Message Mapping Guide (MMG) for Carbon Monoxide Poisoning

Reminder of Key Characteristics of CO Surveillance:

No active national surveillance system for CO poisoning.

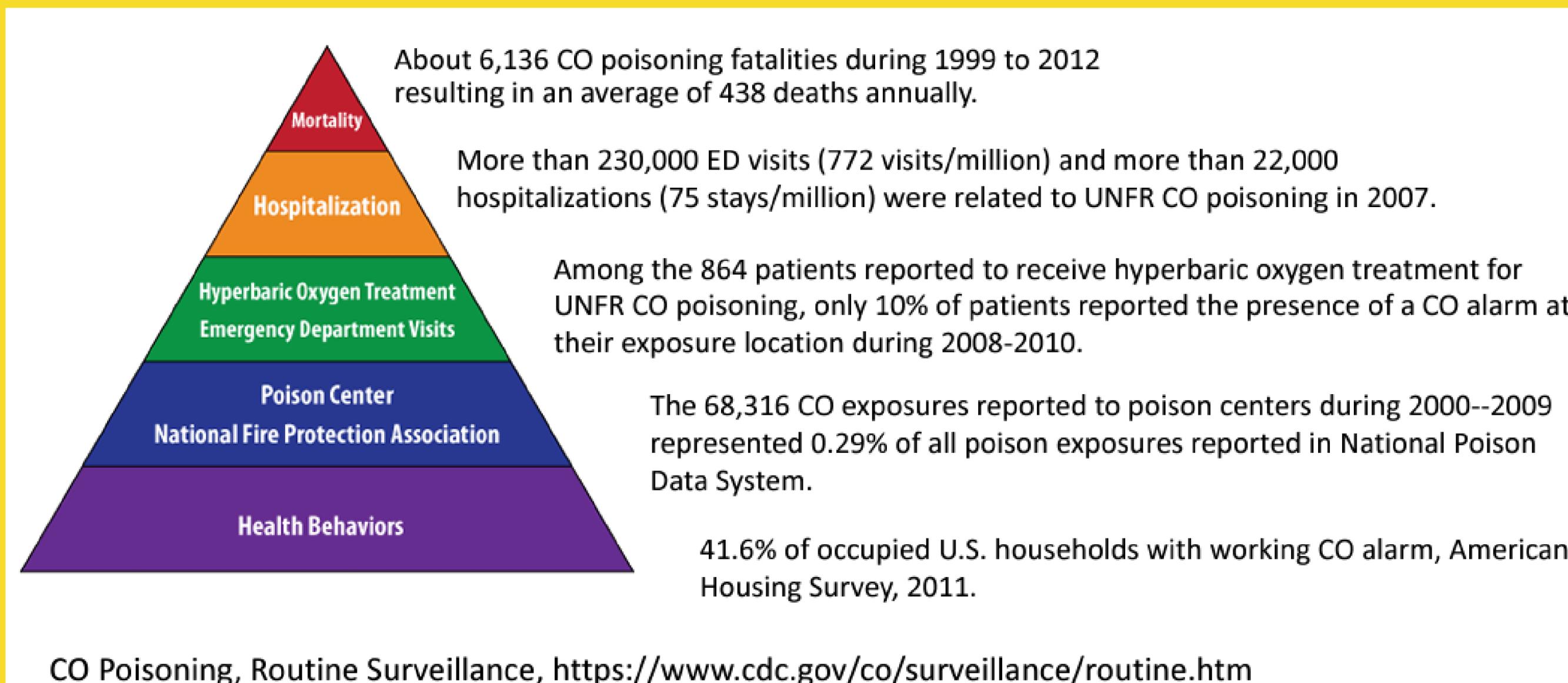
Estimates and surveillance activities rely on data sources that were not primarily designed for CO poisoning surveillance.

The CDC National Environmental Tracking Network collects and disseminates unintentional CO poisoning data (hospitalizations, emergency department visits, and deaths) in a standard way to monitor trends and better understand the health consequences of CO poisoning across the United States.

CO poisoning: a nationally notifiable condition since 2014.



CDC Message Mapping Guide (MMG) for Carbon Monoxide Poisoning

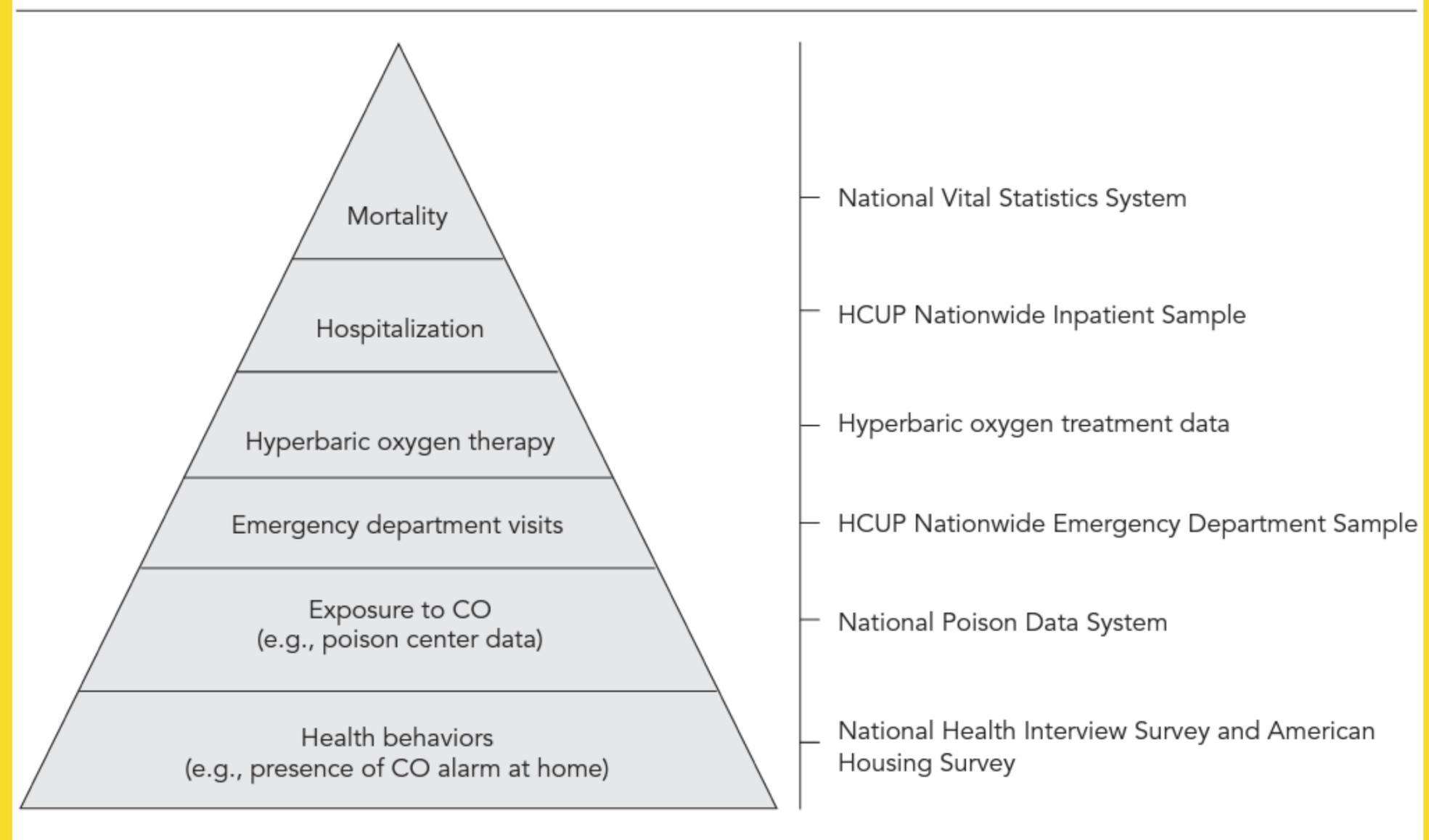


2012 Research Article: CO Surveillance Framework

Note: the CDC also mentions 3 sources not listed here:

1. National Fire Protection Association (NFPA)
2. BRFSS (Health Behaviors): the Behavioral Risk Factor Surveillance Survey
3. HealthyStyles Survey (Health Behaviors)

Figure 2. National surveillance framework for unintentional, non-fire-related CO poisoning in the United States



CO = carbon monoxide

HCUP = Healthcare Cost and Utilization Project

Iqbal S, Clower JH, King M, Bell J, Yip FY. National carbon monoxide poisoning surveillance framework and recent estimates. *Public Health Rep.* 2012 Sep-Oct;127(5):486-96. doi: 10.1177/003335491212700504. PMID: 22942466; PMCID: PMC3407848.

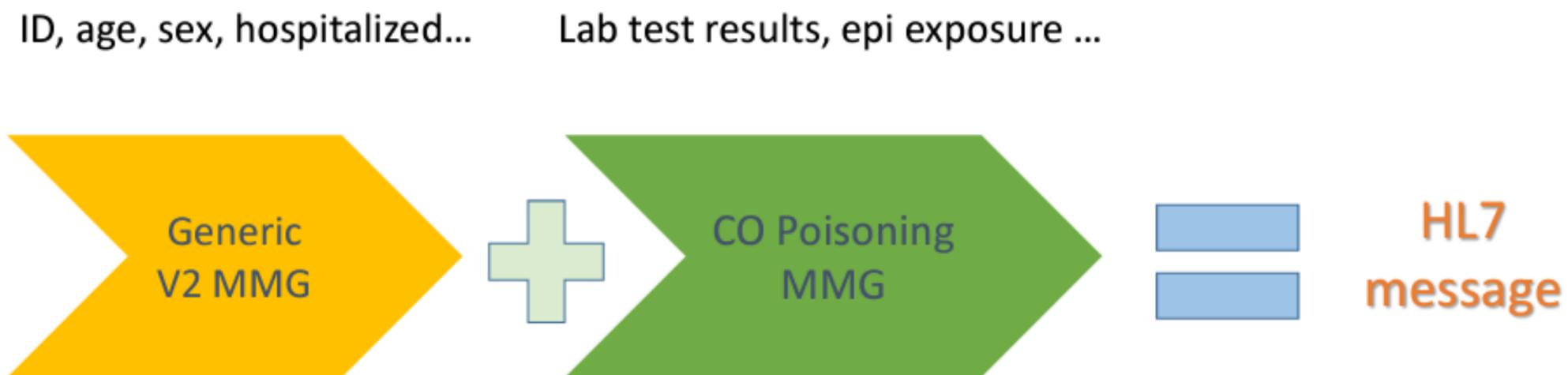
CDC MMG: Improvement of CO Poisoning Surveillance

- **Collect clinical, laboratory, epidemiologic, and exposure data.**
- **Provide standardized criteria for case identification and classification for CO poisoning.**
- **Plan for prevention program, identification of high-risk areas and population sub-groups.**
- **Investigation of novel exposure pathways and previously unknown determinants/poisoning scenarios.**

CDC MMG: CO Poisoning MMG Layout

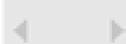
MMG Overview

Includes data elements to be used in HL7 case notifications sent to CDC



CDC MMG: CO Poisoning MMG Layout

A	B	C	D	E	F	G	H
Data Element (DE) Name	DE Identifier Sent in HL7	DE Code System	Data Element Description	Data Type	CDC Priority	May Repeat	Value Set Name (VADS Hyperlink)
Data Reporting Source	INV1303	N/A	What is the facility reporting the data or the data source for case ascertainment?	Coded	P	Y	Data Reporting Source (CO)
Intent of Exposure	92945-5	LN	Was the intent of the carbon monoxide exposure self-harm/assault (intentional) or accidental (unintentional)?	Coded	P	N	Intent of Exposure (CO)
Fire Related Exposure	TBD		Was the carbon monoxide exposure related to a fire?	Coded	P	N	Yes No Unknown (YNU)
Power Outage Event	397789006	SCT	Was the carbon monoxide exposure related to an event causing a power outage?	Coded	P	N	Yes No Unknown (YNU)
Extreme Weather	92943-0	LN	Was the carbon monoxide exposure related to an extreme weather event?	Coded	P	N	Extreme Weather Type (CO)
Extreme Weather Type	TBD	N/A	Identify the extreme weather event occurring when the patient was exposed to	Coded	P	Y	Extreme Weather Type (CO)



Introduction

MMG Column Descriptions

CO Poisoning Data Elements

CO Poisoning TS



CDC MMG: CO Poisoning MMG Layout with HL7 Columns

A	B	E	F	G	J	K	L	M	N	O	P
Data Element (DE) Name	DE Identifier Sent in HL7 Message	Data Type	CDC Priority	May Repeat	HL7 Message Context	HL7 Data Type	HL7 Usage	HL7 Cardinality	HL7 Implementation Notes	Repeating Group Element	Sample Segment
Data Reporting Source	INV1303	Coded	P	Y	OBX segment with OBX-	CWE	RE	[0..*]		NO	OBX nn CWE INV1303^Data Reporting Source^N/A C0814525^Medical
Intent of Exposure	92945-5	Coded	P	N	OBX segment with OBX-3.1=92945-5	CWE	RE	[0..1]		NO	OBX nn CWE 92945-5^Intent of Exposure^LN 361390002^Unintentional^SCT F
Fire Related Exposure	TBD	Coded	P	N							
Power Outage Event	397789006	Coded	P	N	OBX segment with OBX-3.1=397789006	CWE	RE	[0..1]		NO	OBX nn CWE 397789006^Power Outage Event^SCT Y^Yes^HL70136 F
Extreme Weather	92943-0	Coded	P	N	OBX segment with OBX-	CWE	RE	[0..1]		NO	OBX nn CWE 92943-0^Extreme Weather^LN N^No^HL70136 F
Extreme Weather	TBD	Coded	P	Y	OBX segment	CWE	RE	[0..*]		NO	OBX nn CWE TBD^Extreme

CDC MMG: CO Poisoning MMG Layout with GenV2 Data Elements

A	B	C	D	E	F	G	H	I
Data Element (DE) Name	DE Identifier Sent in HL7 Message	DE Code System	Data Element Description	Data Type	CDC Priority	May Repeat	Value Set Name (VADS Hyperlink)	Value Set Code
Case Disease Imported Code	77982-7	LN	Indication of where the disease/condition was likely acquired.	Coded	P	N	Disease Acquired Jurisdiction	PHVS_DiseaseAcquiredJurisdiction_NND
Imported Country	INV153	PHINQUES	If the disease or condition was imported, indicates the country in which the disease was likely acquired.	Coded	P	N	Country	PHVS_Country_ISO_3166-1
Imported State	INV154	PHINQUES	If the disease or condition was imported, indicates the state in which the disease was likely acquired.	Coded	P	N	State	PHVS_State_FIPS_5-2
Imported City	INV155	PHINQUES	If the disease or condition was imported, indicates the city in which the disease was likely acquired.	Coded	P	N	City	PHVS_City_USGS_GNIS
Imported County	INV156	PHINQUES	If the disease or condition was imported, contains the county of origin of the	Coded	O	N	County	PHVS_County_FIPS_6-4

CDC MMG: Data Reporting Sources

- Hospital (Hospital discharge),
- Emergency room (Emergency department)
- Poison control center
- Laboratory (Laboratory report)
- Vital statistics (Death certificate)
- Provider report (clinician report)
- Medical examiner report
- Urgent care
- Hyperbaric facility
- Electronic medical record
- Workers compensation record
- Unknown
- Other ()

PART 4

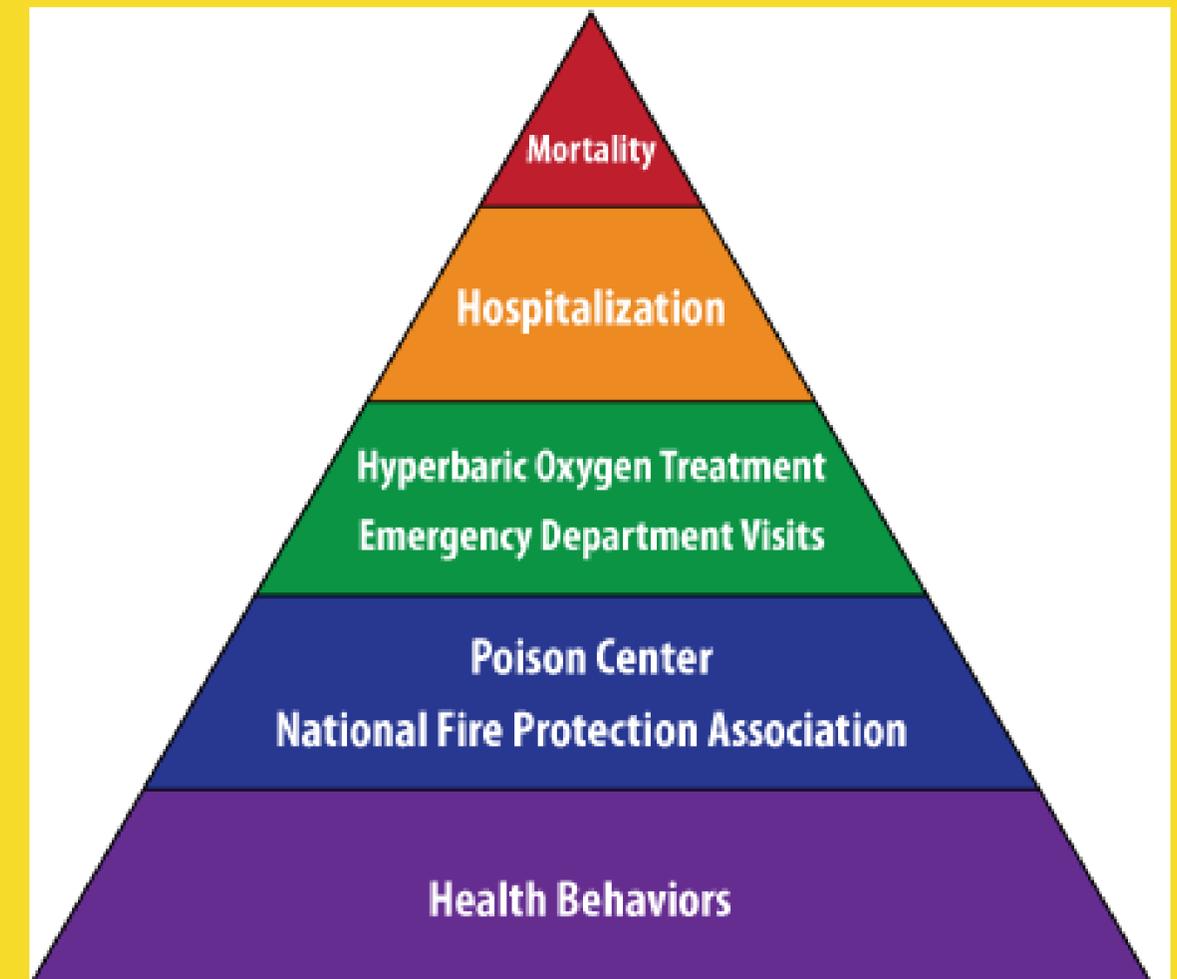
Other CO Surveillance Information and Resources

CDC CO Poisoning Website: Surveillance

In the absence of an active national surveillance system for carbon monoxide poisoning, estimates and surveillance activities rely on data sources that were not primarily designed for carbon monoxide poisoning surveillance.

The figure to the right illustrates the surveillance components of CDC's carbon monoxide poisoning surveillance framework.

The surveillance framework outlined here focuses only on unintentional, non-fire related carbon monoxide poisoning because approaches to preventing intentional and fire-related carbon monoxide exposures greatly differ from those for prevention of unintentional exposures.



National Environment Public Health Tracking: CO Poisoning



The Tracking Network uses data from the U.S. Census Bureau, hospital and emergency department databases, and death certificate data to get state and local data about CO poisonings.

State-to-state comparisons about CO poisonings must be made carefully because data collection and reporting methods vary by state.

Tracking CO poisoning in a standard way over time can help us:

- better understand the health consequences of CO poisoning across the US,
- learn about the effects of long-term exposures to low levels of CO,
- monitor trends,
- identify high risk groups, and
- determine the impact of public health policy aimed at preventing CO poisoning.

National Environment Public Health Tracking: CO Poisoning - Types of Data

The Tracking Network provides data about health effects due to CO poisoning. These data can be used to assess the burden of severe CO poisoning, monitor trends over time, identify high-risk groups, and enhance prevention, education, and evaluation efforts

Some data types are only available for certain states

- **Unintentional CO Poisoning Emergency Department Visits:**
 - The number of patients seen in an emergency department for CO poisoning.
 - Advanced options include distinctions between fire, non-fire, unknown intent or mechanism poisonings.
- **Unintentional CO Poisoning Hospitalizations:**
 - This indicator estimates the number of people who were admitted to the hospital due to CO exposure.
 - Advanced options include distinctions between fire, non-fire, unknown intent or mechanism poisonings.
- **Unintentional CO Poisoning Mortality:**
 - This indicator tracks the number of people who died because they were exposed to CO unintentionally.
 - Advanced options include distinctions between unintentional fire, non-fire, unknown intent or mechanism poisonings.
 - These data come from hospital records but recording a cause of injury in hospital admission or discharge records is not required in all states. This limits the ability to compare data across states. In addition, death investigation laws and reporting vary by place. This limits the ability to compare mortality data across locations.

PART 5

The Role of the CO Safety Coalition by NCOAA Data Surveillance Work Group

CO Safety Coalition by NCOAA

Mission of the Coalition:

The Coalition is a collaborative working group partners focused on improving carbon monoxide safety.

What we aim to accomplish:

The Coalition will bring together professionals, survivors, advocates and more from every sector that is touched by CO poisoning. We will work together to impact legislation, regulation, products, public awareness, and more.

Membership:

Membership in the Coalition is free and is open to professionals, survivors, advocates and others who wish to work towards an end to CO poisoning.

[NCOAA.us/Coalition](https://www.ncoaa.us/Coalition)



Data Surveillance Work Group

Temporary Co-Chairs:

- Birgitte Messerschmidt: Director, Research at NFPA
- Patrick Smith: R.E.M. Risk Consultants

Initial Goals:

1. **Identify Data Sources:** Identify what data is available.
2. **Analyze:** Where are gaps in data collection?
3. **Needs Assessment:** Define contributing factors to under-reporting of incidence.
4. **Prevalence Study:** Partner with or support another organization (e.g., CPSC or CO Research Trust) to conduct a prevalence study in the U.S. Place special emphasis on health equity and determining health disparities



Data Surveillance Work Group: Questions for Co-Chairs to Consider

- 1. Who do we want to recruit to join this work group, and what steps will we take to recruit these individuals and organizations?**
- 2. How will we work with Work Group members to affirm or revise goals and action plans?**
- 3. When will we conduct an election to either affirm our own positions or to elect new co-chair(s)? How long will co-chair terms be - 1 year or 2? If affirmed, how will identify and prepare future leaders to carry on the work when our term is finished?**
- 4. While the majority of the work accomplished will be carried out by Work Group members at no cost, what items will require funding (Ex: Prevalence Study)? How will we work with NCOAA and others to seek funding?**
- 5. Which projects can or should be started simultaneously? Do certain tasks need to be completed before others can be started? Do we have enough members to carry out more than one project at a time?**
- 6. How will we handle conflicts or differences in priorities/opinions?**



Data Surveillance Work Group: Responsibilities of Co-Chairs

- 1. Goals:** Set Work Group goals, objectives and work plans – get buy-in from Work Group members
- 2. Membership:** Identify and recruit potential Work Group members
- 3. Meetings:** Prepare for, schedule and lead quarterly Work Group meetings
- 4. Minutes:** Draft and distribute meeting minutes following each quarterly meeting
- 5. Reporting:** Report annually to CO Safety Coalition Advisory Board on activities, challenges, successes and progress towards goals
- 6. Events:** Help plan content related to Work Group for virtual webinars and in-person conferences
- 7. Leadership:** Identify future Work Group co-chairs and coordinate future elections



Data Surveillance Work Group: Potential Members

Potential Members - Individuals

- State and federal epidemiologists
- Individuals at emergency response entities, hospitals, workers compensation companies, etc. who are responsible for compiling and reporting data
- Public health professionals (academia, public sector, etc.)
- Researchers
- Carbon monoxide survivors/victims
- Individuals who have conducted similar work in other topic areas who are familiar with data surveillance improvement

Potential Members - Organizations

- CSTE
- Safe States
- State Kids Worldwide
- NFPA
- Public health departments at colleges/universities
- Government agencies: CPSC, CDC, etc.
- Other CO-related nonprofits



Data Surveillance Work Group:

Goal 1 - Identify Data Sources

Questions to Guide Our Work:

1. Are there any data sources missing from the those listed in this presentation?
2. Once all data sources identified, which states utilize which sources?
3. Does case ascertainment criteria vary by state or data source?
 - a. List case ascertainment criteria for various case types (suspected, probable, etc.) and identify variations in criteria by data source and/or state.

Action to Be Taken:

- Review and revise list of above questions
- Create grid(s) detailing state-level reporting for each data source
- Create grid(s) detailing variations in definitions and processes by data source and/or state
- **FINAL DELIVERABLE:** Report/white paper on findings and recommendations



Data Surveillance Work Group:

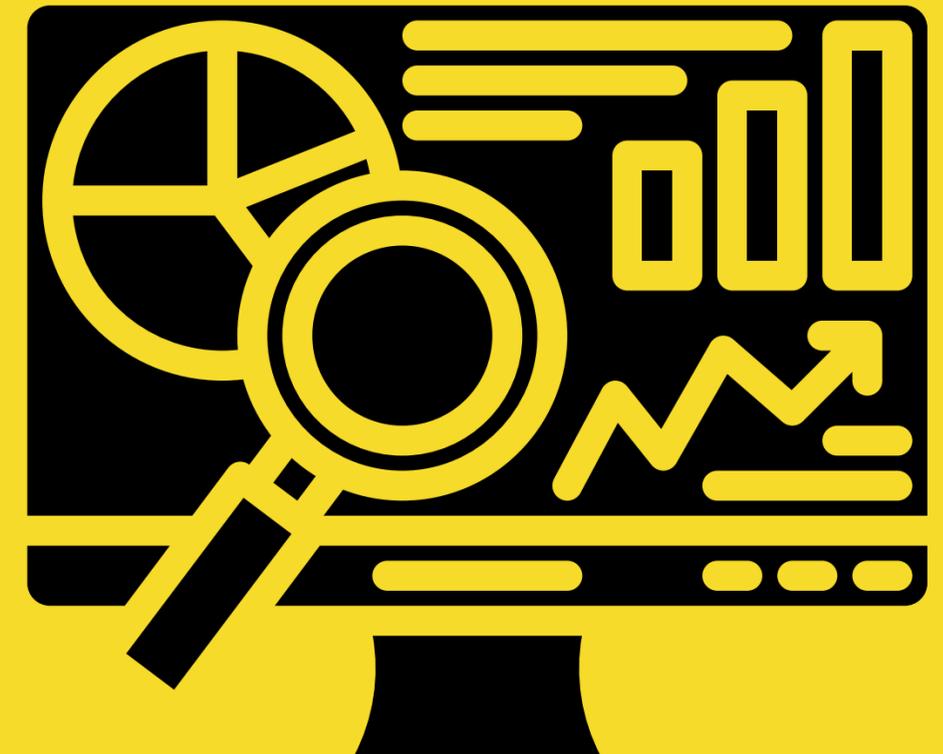
Goal 2 - Gap Analysis

Questions to Guide Our Work:

1. What data should be collected to identify major health disparities?
 - a. For each data source, what additional data points are collected that can help identify health disparities (e.g., race/ethnicity, home address, age, gender, socioeconomic information, insurance status, etc.)? What's missing?
2. Which states collect data that is not subsequently reported at the federal level?
3. For all sources identified, which are optional vs. mandatory?
 - a. For instance, are only some hospitals, and not all, reporting laboratory or clinical data?
 - b. What proportion of workers compensation claims data is collected and reported?
 - c. Example: not all fire departments report to NFIRS.

Actions to Be Taken:

- Review and revise list of above questions
- Determine health equity data needs/preferences and create grid(s) to detail health disparity data collected at state-level and/or by data source
- Utilize grid(s) created in Goal 1 to detail which states collect data that they do not report federally
- Create grid(s) to detail gaps in optional data sources (e.g. estimate of how many fire stations do not report to NFIRS, how many hospitals do not report their data, etc.)
- FINAL DELIVERABLE: Position Statement or Issue Brief Detailing Findings and Recommendations



Data Surveillance Work Group: Goal 3 - Needs Assessment for Underreporting

Questions to Guide Our Work:

1. Is there underreporting due to lack of knowledge?

- a. Do emergency responders and physicians/hospitals recognize CO poisoning symptoms and know when to order tests or conduct examinations to diagnose CO poisoning?
- b. Do those who are reporting the data know what and when to report?
- c. Do those collecting and analyzing the data know which keywords and data sources to use?
CSTE provides recommended query search criteria, but is this list comprehensive and is it actually utilized?

2. Does criteria account for latest diagnostic technology? (e.g., breath tests)

Actions to Be Taken:

- Review and revise above list of questions
- Determine plan of action for identifying issues related to lack of knowledge and underreporting (e.g., conducting surveys, working with state epidemiologists to audit reported data and determine whether CO poisoning was properly reported and recorded)
- List all potential criteria for case ascertainment (that which is currently used and that which should be used but is not currently used). Create grid(s) whether criteria accounts for latest diagnostic technology by state and/or data source.
- FINAL DELIVERABLE: Plan of action for addressing underreporting over the next year.



Data Surveillance Work Group:

Goal 4 - Prevalence Study

Questions to Guide Our Work:

1. What are our research questions?
2. How many participants are needed to yield statistically significant results, particularly with sub-analysis of health disparities, geographic variation, source of exposure, etc.
3. What data will we collect, and what is our plan for analysis?
4. What data collection instruments should be used? For example:
 - a. In-home meter with data tracking capabilities (over course of 2? weeks)
 - b. Breath tests
 - c. Blood tests
5. Where should data collection take place? Nationally vs. state-based vs. regional.
6. Who should participate in the study?
 - a. Oversampling of lower income neighborhoods, racial/ethnic minorities, etc?
 - b. Renters vs. homeowners
 - c. Commercial vs. residential buildings
7. When should data collection take place? Higher COP rates linked to certain seasons depending on geographic location (e.g., colder weather/winter storms, hurricanes, etc.)

Actions to Be Taken:

- Review and revise above questions
- Create research questions and develop research plan/protocols (independently or in coordination with CPSC and/or CO Research Trust)
- Conduct research, analyze results, and discuss findings/implications
- **FINAL DELIVERABLE:** Submit research publication for scientific peer review

