Carbon Monoxide

Carbon Monoxide Poisoning

DATA & MEASURES 2000-2007

MN EPHT

Environment, Exposure & Health

Minnesota
Environmental
Public Health
Tracking

MINNESOTA MDH DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

December 2009

Dear Colleague:

The Minnesota Department of Health (MDH) is pleased to present the first series of reports of the Minnesota Environmental Public Health Tracking (MN EPHT) program. The purpose of the report is to share environmental and health tracking data with the public, in accordance with Minnesota Statutes, section 144.996, Subdivision 1.2.

Environmental public health tracking is a public health tool that uses a variety of existing data sources to provide information about environmental hazards, chemical exposures and population health in our state, as well as what preventative actions can be taken to protect the public. The value of environmental public health tracking increases with each year of data collection.

In 2009 MN EPHT became part of the National Environmental Public Health Tracking Network (Tracking Network) under a cooperative agreement grant, joining New York City and 21 other states in the Tracking Network. This grant from the Centers for Disease Control and Prevention (CDC) will help support ongoing data collection and the development of a web-based information system for the public to access MN EPHT data in the years ahead. Improved public access to current, accurate information will help inform individual decisions as well as public policy to prevent disease and promote health.

An electronic version of this report is available on the MN EPHT website: http://www.health.state.mn.us/tracking/. For more information about this report, please contact MN EPHT at 651-201-4987 (toll free: 1-800-205-4987) or health.tracking@state.mn.us.

Sincerely,

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Report on Carbon Monoxide Data & Measures: 2000-2007

MN EPHT Report | December 2009

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Introduction to MN EPHT

The environment can mean many things to many people. For Environmental Public Health Tracking (EPHT), the environment is defined as our air, our water, our food, and our surroundings. The environment plays an important role in health and human development. The Minnesota Environmental Public Health Tracking (MN EPHT) system brings together existing data in the state about environmental hazards, population exposure, and health outcomes.

EPHT data may be used to:

- Recognize patterns and evaluate trends in environmental conditions, population exposure and rates of disease
- Measure impacts of public health interventions
- Identify populations most affected or most vulnerable
- Identify opportunities for research and/or public health interventions to reduce exposures to potential environmental health hazards and prevent disease

Minnesota Statutes, section 144.996, directs the Minnesota Department of Health (MDH) to establish an environmental health tracking program. The goal of MN EPHT is to provide information that can be used to plan and evaluate actions to prevent diseases and promote healthy environments in Minnesota. By making data on environmental hazards, exposures and health available in one place and by systematically monitoring those data, an environmental public health tracking program can create new opportunities for learning about the risks of environmental exposures and for understanding the relationships between the environment and health.

National Tracking Network Data and Measures

MN EPHT works in partnership with other states as part of the Centers for Disease Control and Prevention's (CDC) National Environmental Public Health Tracking Network (Tracking Network). Since MN EPHT began in 2007, the program has been collecting and analyzing data in 8 content areas that the Tracking Network has identified as priorities shown in the table below.

Tracking Network Content Areas 2007		
Environmental Hazards Air quality Drinking water quality	Exposures Childhood blood lead exposure	Health Outcomes Hospitalizations Cancer Carbon monoxide poisoning Reproductive outcomes Birth defects

Within each content area, tracking measures are used as indicators of population health with respect to environmental factors. These measures are summary characteristics or a statistic, such as a sum, percentage, or rate. Tracking measures are used to assess health, or a factor associated with health, in a population through direct or indirect measures. For example, because the amount of lead in paint in older homes is difficult to measure, MN EPHT uses blood lead measurements in children to indicate both the lead paint hazard and the risk for childhood lead poisoning. Similarly, MN EPHT measures levels of a pollutant in the environment as an indicator of possible exposure.

Nationally consistent data and measures (NCDMs) were developed by CDC in collaboration with national, state, and local environmental health partners. NCDMs allow for data from any state's EPHT system to be integrated into the Tracking Network, a national database of environmental hazards, environmental exposures, and health effects. Except where noted, MN EPHT has prepared Minnesota data and measures according to the NCDM standards.

Healthy People 2010

Healthy People 2010 is a set of disease prevention and health promotion objectives for the United States to achieve by the year 2010. Healthy People 2010 has two goals: increase quality and years of healthy life, and eliminate health disparities. These two goals are supported by 467 objectives in 28 focus areas. Healthy People 2010 is an instrument to improve health and a valuable tool for those who work to improve health.[1]

Several of the Tracking Network's measures align with Healthy People 2010 objectives. Where applicable, Healthy People 2010 objectives are provided in order to provide context for how Minnesota compares in reaching national health targets.

MN EPHT Data and Measures Reports

This report is one in a series of first reports produced in 2009 for MN EPHT and compiles available carbon monoxide poisoning data from 2000-2007. MN EPHT is a growing program, and MN EPHT and the Tracking Network will be adding new content areas over time. Updates to the carbon monoxide poisoning content area as well as new content area data will be reported and made available on our website. For more information about MN EPHT or the CDC Tracking Network, please visit:

MN EPHT: http://www.health.state.mn.us/tracking
National Tracking Network: http://ephtracking.cdc.gov

Carbon Monoxide (CO) Poisoning Data Highlights

- Unintentional, non-fire related CO poisonings resulting in a visit to the emergency department increased in 2007 compared with previous years (2000 to 2006).
- An increase in the rate of unintentional CO exposure calls to the Minnesota Poison Control System was also seen in 2007, compared with previous years (2002 to 2006).
- Unintentional, non-fire related CO hospitalizations occur at a higher rate in older populations (65 years of age and older). In contrast, emergency department visits resulting from unintentional, non-fire related CO poisonings occur at a higher rate in younger populations (under age 65).
- Males had higher rates of unintentional, non-fire related CO hospitalizations and deaths compared with females. The emergency department visit rates were similar for males and females.
- In Minnesota, unintentional, non-fire related CO poisoning rates follow seasonal patterns, with greater hospitalizations, emergency department visits, and calls to the poison center occurring in the fall and winter months.
- Unintentional, non-fire related CO hospitalizations, emergency department visits, and deaths occurred at higher rates outside of the seven-county Metro region compared with the Metro region.

Data Source Acknowledgement: The MN EPHT Program gratefully acknowledges Minnesota Department of Health's Injury and Violence Prevention Unit for providing data on hospitalizations, emergency department visits, and deaths due to carbon monoxide in Minnesota as presented in this Tracking Report. The Program also acknowledges both the Minnesota Poison Control System and the Minnesota Department of Health Division of Infectious Disease Epidemiology, Prevention and Control, for providing data on carbon monoxide exposure calls to the Minnesota Poison Control System.

Carbon Monoxide Poisonings and the Environment

Carbon monoxide (CO) is a colorless and odorless gas that is produced by the incomplete burning of fossil fuels. When inhaled, CO interferes with normal oxygen uptake and deprives the body of oxygen. This is called CO poisoning. Symptoms of CO poisoning include headache, dizziness, weakness, nausea, confusion, disorientation, chest pain, shortness of breath, and impaired vision and coordination.[2] Exposure to high levels of CO can cause sudden illness, loss of consciousness, and death. Populations particularly at risk are individuals with anemia, cardiopulmonary disease, young children, the elderly, and pregnant women.[3]

Figure 1. *Anatomy of CO poisoning as CO enters the body through the lungs and binds with hemoglobin in the blood*

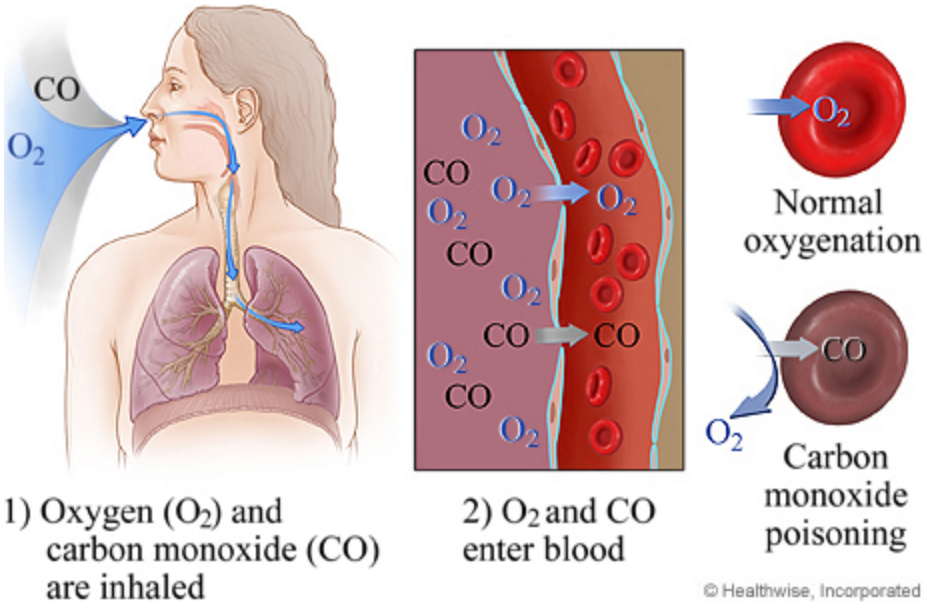


Figure 1 shows how CO poisoning affects the human body. Oxygen and CO enter the body through the lungs and bind with red blood cells. However, red blood cells pick up CO quicker than they pick up oxygen, which blocks oxygen from getting into the body. This damages tissues in the body and can cause death. Source: Healthwise.[4]

CO is produced by[5]:

- Gasoline or diesel power generators
- Motor vehicle, lawn mower, or boat exhaust
- Small-engine powered appliances and tools
- Portable propane heaters, non-electric space heaters
- Natural gas appliances, furnaces, heaters, water heaters, stoves
- Wood-burning stoves and fireplaces
- Charcoal grills and barbecues
- Ice resurfacers and ice maintenance equipment
- Fires (forest fires, residential fires)

CO can build up to dangerous concentrations indoors if fuel-burning devices are not properly vented, operated, or maintained. Emergency situations such as natural disasters and power outages have also been associated with CO poisoning due to inadequate ventilation or the improper use of equipment such as generators, grills, and camp stoves.[6, 7] Unintentional CO poisoning can even occur outdoors, such as while boating or camping, from sources such as boat exhaust, gasoline powered generators, and non-electric heaters.[8, 9] Residential fires often result in unintentional CO poisoning.[10, 11]

The Tracking Network's CO poisoning activity is the first consistent approach to CO poisoning surveillance nationally. Tracking unintentional CO poisonings will close gaps in public health knowledge of the epidemiology of unintentional CO exposures during routine activities as well as those related to disasters; the long-term negative after-effects of CO poisoning; and prevention and risk behaviors.

Preventing Environmental Causes of CO Poisoning

Where to find more information:

Many unintentional CO poisonings can be prevented by making sure that all fuel-burning appliances and heating devices are properly installed, vented, and maintained.[12] In order to detect potentially deadly conditions, CO detectors should be installed and regularly maintained in all households. In Minnesota, this has become mandated by state law under the Minnesota Department of Public Safety (Minnesota Statutes, sections 299F.50 – 299F.51).[13] This law states that CO alarms are required in all single and multi-family Minnesota residences within 10 feet of each room used for sleeping.

MDH addresses CO exposure and poisoning through regulation, education, and surveillance. The MDH Indoor Air Unit is responsible for overseeing CO-related regulations, as well as for public education regarding CO poisoning prevention. MN EPHT conducts surveillance related to CO exposure and poisoning. An important application for MN EPHT data is to monitor the impacts of state and local public health programs and polices that are designed to reduce exposure and prevent disease.

Regulation

The Minnesota Enclosed Sports Arena Rule[14] was enacted in 1973 (amended, 1977) to protect the public from exposure to exhaust emissions that can occur in indoor sports arenas. The MDH Indoor Air Unit enforces this rule by regulating air quality in Minnesota's enclosed sports arenas and by conducting systematic inspections. MDH requires monitoring of carbon monoxide and nitrogen dioxide in all enclosed arenas in which sporting events and demonstrations occur and where internal combustion engines are used. Ice arenas that use internal combustion engine-powered vehicles for ice maintenance; indoor go-cart tracks; and arenas used for racing, competition or demonstrations of midget cars, motorcycles, and snowmobiles must comply with the Minnesota Enclosed Sports Arena Rule. The MDH Indoor Air Unit is in the process of updating and revising this rule as of October 2009.

Education

The MDH Indoor Air Unit provides information to the general public regarding the dangers of CO through factsheets, presentations, trainings, podcasts, radio station interviews, and by answering phone inquiries. Because Minnesota has a large immigrant and refugee population, CO factsheets are available in several languages including English, Spanish, Cambodian, Laotian, Hmong, and Somali. Several times each year, the Indoor Air Unit provides trainings about the hazards of carbon monoxide to immigrants in classes for learning English.

Surveillance

MN EPHT tracks unintentional CO poisoning events due to fire-related and non-fire related conditions. Intentional CO poisoning events (primarily suicides and nonfatal self-inflicted harm) are not included, as the prevention and intervention messages associated with intentional events differ from unintentional CO poisoning. CO poisoning surveillance will help MDH to better understand trends in the burden of unintentional CO poisoning and target prevention messages in Minnesota. Surveillance data will also help to identify the impact of the recent implementation of the statewide law requiring CO alarms in all single and multi-family residences. Beginning in 2009, the Minnesota Behavioral Risk Factor Surveillance System (BRFSS) included a question asking about the presence of CO detectors in homes. The inclusion of this question in the MN BRFSS will enhance the scope of CO poisoning/exposure surveillance in the state.

Carbon Monoxide Poisoning Data and Measures

The Healthy People 2010 objective relating to carbon monoxide (CO) poisoning is provided in order to provide context for how Minnesota compares in reaching national health targets.

- Healthy People 2010 Objective 8-27h. Increase the number of Territories, Tribes, and States, and the District of Columbia, that monitor carbon monoxide poisoning.[1]

In line with this Healthy People 2010 objective, Minnesota now conducts routine surveillance for CO poisoning under the MN EPHT program.

The Tracking Network CO poisoning measures are the counts, crude rates, and age-adjusted rates for CO-related hospitalizations, emergency department (ED) visits, and deaths; and counts and crude rates for CO exposure calls to the poison control center (PCC). All hospitalization, ED visit, and mortality measures are for unintentional CO poisoning for years 2000-2007; PCC call measures are for unintentional CO exposures for years 2002-2007.

CO Poisoning Nationally Consistent Data and Measures (NCDMs)	
A. Hospitalizations B. Emergency Department (ED) visits C. Deaths	1. Annual number (hospitalizations, ED visits, deaths) due to unintentional CO poisoning by fire-relatedness. 2. Annual crude and age-adjusted rates (hospitalizations, ED visits, deaths) due to unintentional CO poisoning by fire-relatedness. 3. Average annual rate (hospitalizations, ED visits, deaths) due to unintentional CO poisoning by fire-relatedness.
D. Poison Control Center (PCC) calls	1. Annual number and crude rate of cases of unintentional CO exposure reported to the state PCC. 2. Annual number and crude rate of unintentional CO exposure calls by presence of a reported health effect. 3. Annual percentage of unintentional CO exposure calls in which the case experienced a health effect and was treated in a healthcare facility.
CO Poisoning Minnesota-specific Data and Measures	
E. Unintentional, non-fire related CO poisoning events	1. By age (age-specific rates for hospitalizations, ED visits, deaths) 2. By sex (crude rates for hospitalizations, ED visits, deaths) 3. By seasonality (crude rates for hospitalizations, ED visits, deaths, and PCC calls) 4. By region of state (age-adjusted rates for hospitalizations, ED visits, deaths)

MN EPHT adheres, for the most part, with the NCDMs for CO poisoning established by the Tracking Network. MN EPHT has expanded upon the CO poisoning NCDMs by including 95% confidence intervals for rates, and by including analyses by age, sex, region of residence and seasonality. Other departures from the Tracking Network are outlined below:

- The Tracking Network recommends using "date of event" for analysis of mortality data. For analysis of MN mortality data, "date of injury" was used; if "date of injury" was missing, then "date of death" was used.
- Intentionality and fire-relatedness for CO mortality analyses were based on ICD10 codes in the underlying and contributing causes of death, rather than only the underlying cause of death.

Each CO poisoning measure has a different data source. CO poisoning hospitalizations and ED visits are from the inpatient and ED files of the Minnesota Hospital Discharge Data. The Minnesota Hospital Discharge Data collects hospital discharge information from acute care hospitals submitting data to the Minnesota Hospital Association (MHA). CO poisoning death data are from Minnesota Mortality Data, which contains information on demographic and cause of death data collected from death certificates. MN EPHT receives Minnesota Hospital Discharge Data and Minnesota Mortality Data from the MDH Injury and Violence Prevention Unit. CO poisoning PCC calls are from the Minnesota Poison Control System (MPCS) at Hennepin Regional Poison Center and the MDH Infectious Disease Epidemiology, Prevention and Control Division.

Hospitalization and ED visit measures were calculated for Minnesota residents admitted to a Minnesota hospital with a discharge diagnosis of unintentional carbon monoxide poisoning (International Classification of Disease 9th Revision Clinical Modification (ICD-9-CM) codes N986, E868.2, E868.3, E868.8, E868.9, E950.0, E952.1, E982.0, and E982.1). ICD-9-CM codes E890.0-E899.9 were classified as unintentional, fire-related; ICD-9-CM codes E800.0-E848.9, E850-E869.9, E880-E888.9, and E900-E928.9 were classified as unintentional, non-fire related; and the remainder of the records were classified as CO hospitalizations of undetermined intent.

Death measures were calculated for Minnesota residents with toxic effect of CO listed as a contributing case of death (ICD-10 code T58). ICD-10 codes X00-X09 were classified as unintentional fire-related; ICD-10 codes V01-W99, X10-X59, and Y85-Y86 were classified as unintentional non-fire related; ICD-10 codes X60-Y09 were classified as intentional; and ICD-10 codes Y10-Y34 were classified as CO deaths of undetermined intent.

Poison Control Center measures were calculated for unintentional CO exposure calls originating in Minnesota that were reported to the MPCS. Calls were included if the patient species was human; the substance was carbon monoxide; the call type was exposure; the medical outcome was not listed as death-indirect report or confirmed non-exposure; and the exposure reason was unintentional. The MPCS receives both exposure calls (where the caller reports exposure to a potentially harmful substance) and inquiry calls (where the caller simply requests information about a potentially harmful substance and no exposure is reported). Only the exposure calls have been included for the PCC call measures.

Rates take into account the size of the population and allow for comparison of events in two different populations. Rates were calculated using mid-year Minnesota population estimates from the U.S. Census Bureau's annual population estimates by state and by age group. Crude rates are the number of events in a given area per 100,000 people in that area. Age-adjustment is a statistical method that is useful when comparing populations that have different age distributions. MN EPHT age-adjusted rate measures are calculated using the direct method of standardization using the U.S. 2000 population as the standard. A directly age-adjusted rate represents what the crude rate would have been in the community if that community's population had the same age distribution as the standard population. A large difference between crude and age-adjusted rates is likely due to small numbers. Aggregated rates may be a more useful measure for these instances, where they apply.

Calculations of 95% confidence intervals were based on the inverse gamma distribution when the number of events was fewer than 100 and the normal approximation when the number of events was 100 or greater. The 95% confidence interval is a measure of reliability. It is the interval within which the true value of the rate would be expected to fall 95 times out of 100.

Non-Minnesota residents are excluded in these measures, as are Minnesota residents seen out-of-state. Potential transfers and admission duplicates are also excluded. Multiple admissions by the same patient in a year are not excluded. Calls to the MPCS from out-of-state callers are excluded.

To maintain confidentiality, the Injury and Violence Prevention Unit and the MPCS provide de-identified data. De-identification means that the data have been stripped of personal identifying information such as name and address. When the number of cases within a group is small or the population from which the cases are determined is small, the risk of allowing a specific individual to be identified may be deemed too large to be acceptable. MN EPHT suppresses hospitalization counts ≤ 5 and rates based on counts ≤ 5 for single years to protect an individual's privacy. Rates based on small counts (≤ 20) are flagged as unstable and should be interpreted with caution. These rates are unstable because they can change dramatically with the addition or subtraction of one case.

A. Hospitalizations

CO poisoning hospitalizations can be used to assess the burden of severe CO poisoning, as persons hospitalized with CO poisoning are among the most severely poisoned cases. CO poisoning hospitalizations may also represent patients who require monitoring over several days because of pre-existing health conditions or other complications.

A.1. Annual number of unintentional CO poisoning

Table 1 shows the number of hospitalizations due to unintentional CO poisonings in Minnesota from 2000 to 2007. The number of hospitalizations is categorized into those that are fire-related, non-fire related, and those of unknown intent. The number of unintentional, non-fire related CO poisoning hospitalizations ranged from 25 to 42 hospitalizations per year. There were fewer hospitalizations per year due to unintentional, fire-related CO poisoning and CO poisoning of unknown intent. However, direct comparisons across fire-relatedness should not be made, as classification of fire-related CO poisoning events is not as straightforward as for non-fire related CO poisoning events.

Table 1: *Annual number of unintentional CO poisoning hospitalizations, Minnesota, 2000-2007.*

Year	Unintentional, Non-fire related	Unintentional, Fire-related	Unknown intent
2000	31	6	*
2001	29	6	6
2002	29	8	11
2003	41	*	14
2004	42	12	15
2005	25	*	6
2006	39	10	6
2007	28	9	12

* MN EPHT suppresses counts ≤ 5 to protect an individual's privacy.

A.2. Annual crude and age-adjusted rates of unintentional CO poisoning

Figure 2 shows age-adjusted rates of non-fire related, unintentional CO poisoning hospitalizations by year. Age-adjusted rates of non-fire related, unintentional CO poisoning hospitalizations have remained steady from 2000 to 2007 in Minnesota, with fluctuating increases in 2003, 2004, and 2006.

Figure 2: *Annual age-adjusted unintentional, non-fire related CO poisoning hospitalization rates per 100,000 people, Minnesota, 2000-2007.*

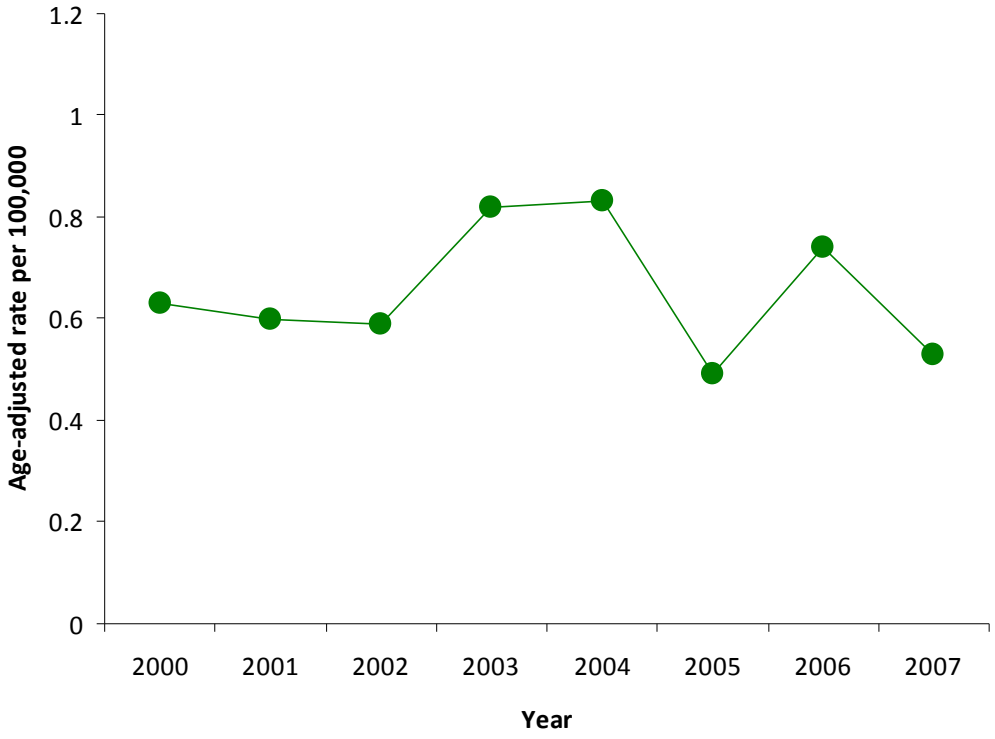


Table 2 shows crude and age-adjusted rates of unintentional CO poisoning hospitalizations, by fire-relatedness, from 2000 to 2007. Rates take into account the size of the population and allow for comparison of a health event in two different populations. Crude rates are the number of deaths in a given area per 100,000 people in that area. Age-adjustment allows communities with different age structures to be compared.

Rates based on counts ≤ 5 have been suppressed to maintain confidentiality. When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution. These rates are unstable because they can change dramatically with the addition or subtraction of one case.

Table 2: *Annual crude and age-adjusted rates of unintentional CO poisoning hospitalizations per 100,000 by fire-relatedness, Minnesota, 2000-2007.*

Year	Unintentional, Non-fire related		Unintentional, Fire-related	
	Crude Rate	Age-Adjusted Rate	Crude Rate	Age-Adjusted Rate
2000	0.63	0.63	0.12*	0.12*
2001	0.58	0.60	0.12*	0.12*
2002	0.58	0.59	0.16*	0.16*
2003	0.81	0.82	**	**
2004	0.83	0.83	0.24*	0.23*
2005	0.49	0.49	**	**
2006	0.76	0.74	0.19*	0.20*
2007	0.54	0.53	0.17*	0.17*

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.
** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

Table 3 shows the average annual hospitalization rates by fire-relatedness, aggregated from 2003 to 2007. Aggregating data over several years increases the number of counts which increases the stability of the rate, but hides trends over time. Rates are shown by age group, sex, region (seven-county Metro region vs. non-Metro region), and month. Rates based on counts ≤ 5 have been suppressed to maintain confidentiality. When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution.

The rates of unintentional, non-fire related CO poisoning hospitalizations were higher for older age groups compared with younger age groups, for males, and for residents in the non-Metro region. Unintentional, non-fire related CO poisoning hospitalizations followed a seasonal trend, with the highest rates occurring in the fall and winter months.

Table 3: *Average annual rates of unintentional CO poisoning hospitalizations per 100,000 by fire-relatedness, Minnesota, aggregated from 2003 to 2007.*

	Unintentional, Non-fire related Rate (95% Confidence Interval)	Unintentional, Fire-related Rate (95% Confidence Interval)
Total†	**0.68 (0.58, 0.78)**	**0.16 (0.11, 0.21)**
Age group		
0-17	0.17* (0.09, 0.31)	0.09* (0.03, 0.21)
18-34	0.61 (0.43, 0.85)	**
35-64	0.65 (0.51, 0.83)	0.21 (0.13, 0.32)
65+	1.96 (1.50, 2.52)	0.26* (0.11, 0.51)
Sex		
Male	0.96 (0.79, 1.13)	0.19 (0.12, 0.28)
Female	0.41 (0.31, 0.54)	0.13* (0.08, 0.21)
Region†		
Non-Metro	0.76 (0.61, 0.93)	0.05* (0.02, 0.10)
Metro	0.60 (0.47, 0.75)	0.25 (0.17, 0.35)
Month		
January	0.09 (0.06, 0.14)	0.03* (0.01, 0.06)
February	0.07* (0.04, 0.11)	**
March	0.06* (0.04, 0.10)	**
April	0.02* (0.01, 0.05)	**
May	0.03* (0.01, 0.06)	**
June	0.02* (0.01, 0.05)	0.03* (0.01, 0.06)
July	**	**
August	**	**
September	0.04* (0.02, 0.07)	**
October	0.07* (0.04, 0.11)	**
November	0.08 (0.13, 0.05)	**
December	0.16 (0.12, 0.22)	**

† Age-adjusted rates

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.

** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

Data Notes: The Metro region includes residents of the seven-county Metro area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington counties). The non-Metro region includes all residents outside of the seven-county Metro area.

B. Emergency Department (ED) visits

Emergency department visits for CO poisoning can represent a range of CO exposures, from suspected exposure to severe poisonings. These ED visits may result in treatment and release, or in hospitalization or death. ED visits that result in hospitalizations are counted as inpatient hospitalization cases and do not appear in the ED visit dataset.

B.1. Annual number of unintentional CO poisoning

Table 4 shows the number of ED visits due to unintentional CO poisonings in Minnesota from 2000 to 2007. Counts ≤ 5 have been suppressed to maintain confidentiality and are marked with asterisks. The number of ED visits is categorized into those that are fire-related, non-fire related, and those of unknown intent. The number of unintentional, non-fire related CO poisoning ED visits ranged from 211 to 334 visits per year. There were substantially fewer ED visits per year due to unintentional, fire-related CO poisoning and CO poisoning of unknown intent. However, direct comparisons across fire-relatedness should not be made, as classification of fire-related CO poisoning events is not as straightforward as for non-fire related CO poisoning events.

Table 4: *Annual number of unintentional CO poisoning ED visits, Minnesota, 2000-2007.*

Year	Unintentional, Non-fire related	Unintentional, Fire-related	Unknown intent
2000	247	7	57
2001	249	6	53
2002	222	9	60
2003	211	9	48
2004	259	11	47
2005	242	*	50
2006	215	10	55
2007	334	9	83

* MN EPHT suppresses counts ≤ 5 to protect an individual's privacy.

B.2. Annual crude and age-adjusted rates of unintentional CO poisoning

Figure 3 shows age-adjusted rates of non-fire related, unintentional CO poisoning ED visits by year from 2000 to 2007. Age-adjusted rates were stable from years 2000 to 2006. The year 2007 shows an increase in the rate of ED visits compared with previous years. Increased reporting or better case ascertainment might account for this apparent increase; however, conclusions cannot be drawn regarding the cause of the increased ED visit rates.

Figure 3: *Annual age-adjusted rates of unintentional, non-fire related CO poisoning ED visits per 100,000 people, Minnesota, 2000-2007.*

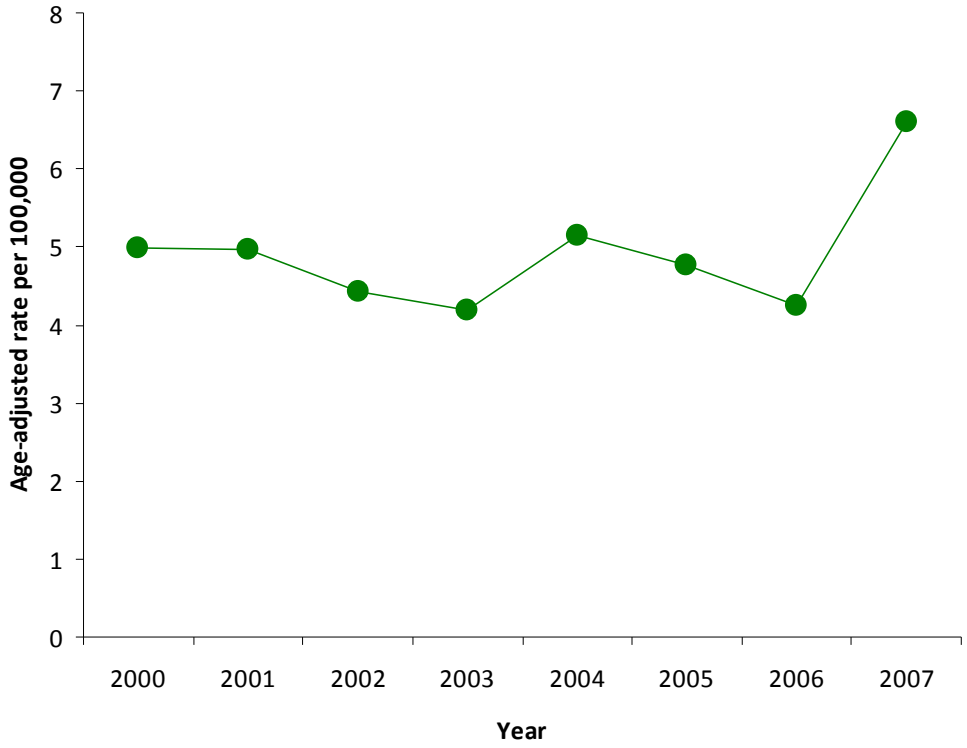


Table 5 shows crude and age-adjusted rates of unintentional CO poisoning ED visits, by fire-relatedness, from 2000 to 2007. Rates take into account the size of the population and allow for comparison of a health event in two different populations. Crude rates are the number of deaths in a given area per 100,000 people in that area. Age-adjustment allows communities with different age structures to be compared.

Rates based on counts ≤ 5 have been suppressed to maintain confidentiality. When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution. These rates are unstable because they can change dramatically with the addition or subtraction of one case.

Table 5: *Annual crude and age-adjusted rates of unintentional CO poisoning ED visits per 100,000 by fire-relatedness, Minnesota, 2000-2007.*

Year	Unintentional, Non-fire related		Unintentional, Fire-related	
	Crude Rate	Age-Adjusted Rate	Crude Rate	Age-Adjusted Rate
2000	5.01	4.99	0.14*	0.14*
2001	5.00	4.97	0.12*	0.12*
2002	4.43	4.43	0.18*	0.18*
2003	4.18	4.19	0.18*	0.18*
2004	5.10	5.15	0.22*	0.22*
2005	4.74	4.77	**	**
2006	4.18	4.24	0.19*	0.19*
2007	6.44	6.61	0.17*	0.18*

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.
** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

Table 6 shows the average annual ED visit rates by fire-relatedness, aggregated from 2003 to 2007. Aggregating data over several years increases the number of counts which increases the stability of the rate, but hides trends over time. Rates are shown by age group, sex, region (seven-county Metro region vs. non-Metro region), and month. Rates based on counts ≤ 5 have been suppressed to maintain confidentiality. When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution.

The rate of unintentional, non-fire related CO poisoning ED visits was highest for individuals 18-34 years of age, for males, and for residents in the non-Metro region. Unintentional, non-fire related CO poisoning ED visits followed a seasonal trend, with the highest rates occurring in the fall and winter months.

Table 6: *Average annual rates of unintentional CO poisoning ED visits per 100,000 by fire-relatedness, Minnesota, aggregated from 2003 to 2007.*

	Unintentional, Non-fire related Rate (95% Confidence Interval)	Unintentional, Fire-related Rate (95% Confidence Interval)
***Total*†**	**4.99 (4.72, 5.27)**	**0.17 (0.12, 0.23)**
Age group		
0-17	5.26 (4.69, 5.82)	0.13* (0.05, 0.25)
18-34	7.08 (6.40, 7.76)	0.26* (0.14, 0.42)
35-64	4.37 (3.96, 4.77)	0.14* (0.07, 0.23)
65+	2.09 (1.62, 2.67)	0.19* (0.07, 0.42)
Sex		
Male	5.16 (4.77, 5.56)	0.24 (0.16, 0.34)
Female	4.71 (4.33, 5.08)	0.10* (0.05, 0.17)
Region†		
Non-Metro	5.50 (5.07, 5.93)	0.16* (0.10, 0.25)
Metro	4.60 (4.24, 4.96)	0.18 (0.12, 0.27)
Month		
January	0.73 (0.63, 0.84)	**
February	0.76 (0.66, 0.87)	0.02* (0.01, 0.05)
March	0.46 (0.37, 0.54)	0.03* (0.01, 0.06)
April	0.21 (0.16, 0.27)	**
May	0.16 (0.12, 0.22)	**
June	0.23 (0.18, 0.30)	**
July	0.19 (0.14, 0.25)	0.00
August	0.19 (0.14, 0.25)	0.00
September	0.23 (0.17, 0.29)	**
October	0.34 (0.27, 0.42)	**
November	0.51 (0.42, 0.60)	**
December	0.92 (0.81, 1.04)	0.04* (0.02, 0.07)

† Age-adjusted rates

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.

** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

Data Notes: The Metro region includes residents of the seven-county Metro area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington counties). The non-Metro region includes all residents outside of the seven-county Metro area.

C. Deaths

A CO-related fatality is the most severe outcome of carbon monoxide poisoning; those that are unintentional are almost entirely preventable.

C.1. Annual number of unintentional CO poisoning

Table 7 shows the number of deaths due to unintentional CO poisonings in Minnesota from 2000 to 2007. The number of deaths is categorized into those that are fire-related, non-fire related, and those of unknown intent. The number of unintentional, non-fire related CO poisoning deaths ranged from 9 to 20 per year. In general, there were fewer deaths per year due to unintentional, fire-related CO poisoning. However, direct comparisons across fire-relatedness should not be made, as classification of fire-related CO poisoning events is not as straightforward as for non-fire related CO poisoning events.

Table 7: *Annual number of unintentional CO poisoning deaths, Minnesota, 2000-2007.*

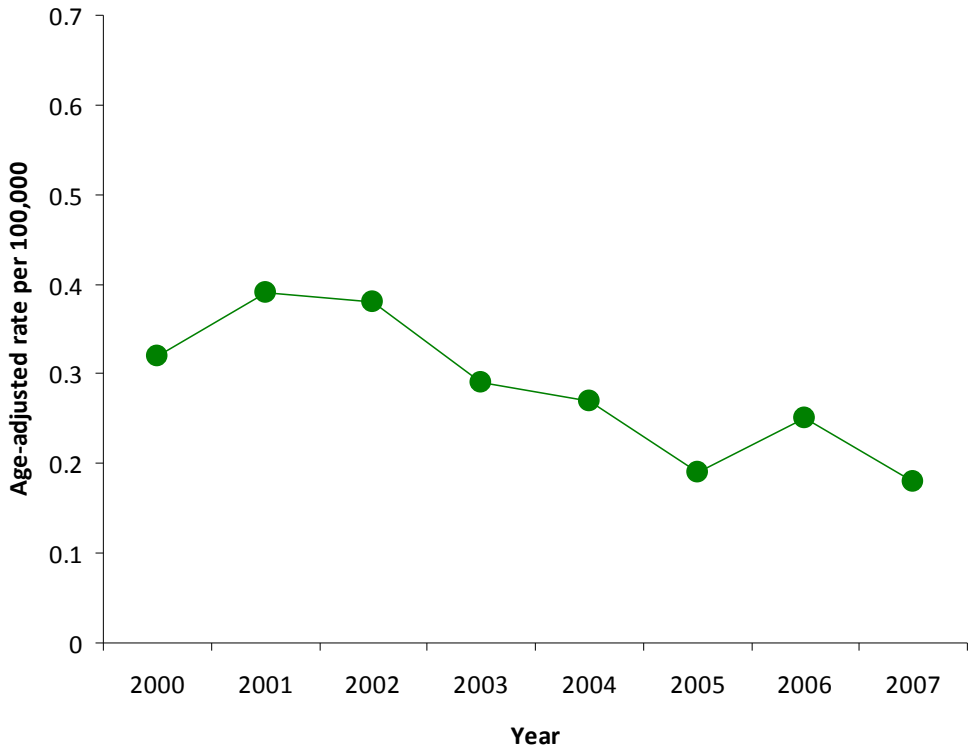
Year	Unintentional, Non-fire related	Unintentional, Fire-related	Unknown intent
2000	16	9	*
2001	20	14	*
2002	19	14	*
2003	15	18	*
2004	14	7	*
2005	10	7	*
2006	13	10	*
2007	9	10	*

* MN EPHT suppresses counts ≤ 5 to protect an individual's privacy.

C.2. Annual crude and age-adjusted rates of unintentional CO poisoning

Figure 4 shows age-adjusted rates of non-fire related, unintentional CO poisoning deaths by year. The age-adjusted rates have been steadily decreasing from 2000 to 2007. Because these rates are based on counts ≤ 20, they may be unstable and should be interpreted with caution. These rates are unstable because they can change dramatically with the addition or subtraction of one case.

Figure 4: *Annual age-adjusted rates of unintentional, non-fire related CO poisoning deaths per 100,000 people, Minnesota, 2000-2007.*



* Rates shown are based on counts ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.

Table 8 shows crude and age-adjusted rates of unintentional CO poisoning deaths from 2000 to 2007. Rates take into account the size of the population and allow for comparison of a health event in two different populations. Crude rates are the number of deaths in a given area per 100,000 people in that area. Age-adjustment allows communities with different age structures to be compared.

When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution. These rates are unstable because they can change dramatically with the addition or subtraction of one case.

Table 8: *Annual crude and age-adjusted rates of unintentional CO poisoning deaths per 100,000 by fire-relatedness, Minnesota, 2000-2007.*

Year	Unintentional, Non-fire related		Unintentional, Fire-related	
	Crude Rate	Age-Adjusted Rate	Crude Rate	Age-Adjusted Rate
2000	0.32*	0.32*	0.18*	0.18*
2001	0.40*	0.39*	0.34*	0.34*
2002	0.38*	0.38*	0.34*	0.34*
2003	0.30*	0.29*	0.36*	0.36*
2004	0.28*	0.27*	0.14*	0.14*
2005	0.20*	0.19*	0.14*	0.13*
2006	0.25*	0.25*	0.19*	0.19*
2007	0.17*	0.18*	0.19*	0.19*

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.

Table 9 shows the average annual death rates by fire-relatedness, aggregated from 2003 to 2007. Aggregating data over several years increases the number of counts which increases the stability of the rate, but hides trends over time. Rates are shown by age group, sex, region (seven-county Metro region vs. non-Metro region), and month. Rates based on counts ≤ 5 have been suppressed to maintain confidentiality. When a rate is based on a count ≤ 20 (marked with an asterisk), it may be unstable and should be interpreted with caution.

Deaths occurring among adults 35-64 years of age accounted for the highest non-fire related unintentional CO death rate. The rates of unintentional, non-fire related CO poisoning deaths were higher for males and for residents of the non-Metro region.

Table 9: *Average annual rates of unintentional CO poisoning deaths per 100,000 by fire-relatedness, Minnesota, aggregated from 2003 to 2007.*

	Unintentional, Non-fire related Rate (95% Confidence Interval)	Unintentional, Fire-related Rate (95% Confidence Interval)
Total†	**0.23 (0.18, 0.30)**	**0.20 (0.15, 0.26)**
Age group		
0-17	0.17* (0.09, 0.31)	0.14* (0.07, 0.27)
18-34	0.24* (0.13, 0.40)	0.17* (0.09, 0.34)
35-64	0.28 (0.19, 0.41)	0.19* (0.11, 0.29)
65+	0.23* (0.09, 0.46)	0.42* (0.22, 0.72)
Sex		
Male	0.39 (0.29, 0.51)	0.27 (0.19, 0.37)
Female	0.09* (0.05, 0.16)	0.14* (0.08, 0.22)
Region†		
Non-Metro	0.32 (0.23, 0.44)	0.32 (0.23, 0.44)
Metro	0.16 (0.10, 0.24)	0.09* (0.05, 0.16)
Month		
January	0.03* (0.01, 0.06)	0.04* (0.02, 0.07)
February	0.03* (0.01, 0.06)	0.05* (0.02, 0.08)
March	0.04* (0.02, 0.08)	**
April	0.02* (0.01, 0.05)	**
May	0.00	**
June	**	**
July	**	**
August	0.00	**
September	**	0.00
October	**	**
November	0.02* (0.01, 0.05)	**
December	0.05* (0.02, 0.08)	0.03* (0.01, 0.06)

† Age-adjusted rates

* Rate is based on a count ≤ 20 and should be interpreted with caution; the rate may be unstable because it can change dramatically with the addition or subtraction of one case.

** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

Data Notes: The Metro region includes residents of the seven-county Metro area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington counties). The non-Metro region includes all residents outside of the seven-county Metro area.

D. Poison Control Center calls

PCC calls may represent CO exposure events that may not otherwise be captured in hospital discharge data or ED data. They may include events where CO exposure was detected but did not result in symptoms, where symptoms were mild and did not require follow-up in a healthcare facility, and where the event resulted in symptoms but the patient refused to seek medical treatment. However, PCC call data are highly reliant on the knowledge, attitudes, and practices by local residents around the use of poison control centers.

D.1. Annual number of unintentional CO poisoning

Table 10 shows the number of unintentional CO exposures reported to the MN Poison Control System from 2002 to 2007. The presence of any health effects is also shown. Year 2007 experienced a steep increase in the number of unintentional CO exposure calls compared with previous years.

Table 10: *Annual number of unintentional CO exposure calls to the Minnesota Poisoning Control System, Minnesota, 2002-2007.*

Year	Total Unintentional	Presence of a Health Effect		
		Yes	*No*	*Unknown*
2002	275	71	41	163
2003	262	98	48	116
2004	303	86	47	170
2005	286	73	49	164
2006	215	59	40	116
2007	537	106	111	320

D.2. Annual crude and age-adjusted rates of unintentional CO poisoning

Table 11 shows the crude rates of unintentional CO exposures reported to the MN Poison Control System from 2002 to 2007. The presence of any health effects is also shown. Rates take into account the size of the population and allow for comparison of a health event in two different populations. Crude rates are the number of exposure calls in a given area per 100,000 people in that area.

Table 11: *Annual rates of unintentional CO exposure calls to the Minnesota Poison Control System per 100,000 people, Minnesota, 2002-2007.*

Year	Total Unintentional Rate per 100,000	Presence of a Health Effect Rate per 100,000		
		Yes	*No*	*Unknown*
2002	5.48	1.42	0.82	3.25
2003	5.19	1.94	0.95	2.30
2004	5.97	1.69	0.93	3.35
2005	5.60	1.43	0.96	3.21
2006	4.18	1.15	0.78	2.26
2007	10.36	2.05	2.14	6.17

Figure 5 shows the annual crude rates of unintentional CO exposure calls from 2002 to 2007. Rates of unintentional CO exposure calls by year were stable from 2003 to 2005. The rate significantly decreased in 2006; however, year 2007 shows a sharp increase in the rate of unintentional CO exposure calls. Increased reporting and increased public awareness of poison center services might account for this apparent increase; however, conclusions cannot be drawn regarding the cause of the increased call rates in 2007.

Figure 5: *Annual rates of unintentional CO exposure calls to the Minnesota Poison Control System per 100,000 people, Minnesota, 2002-2007.*

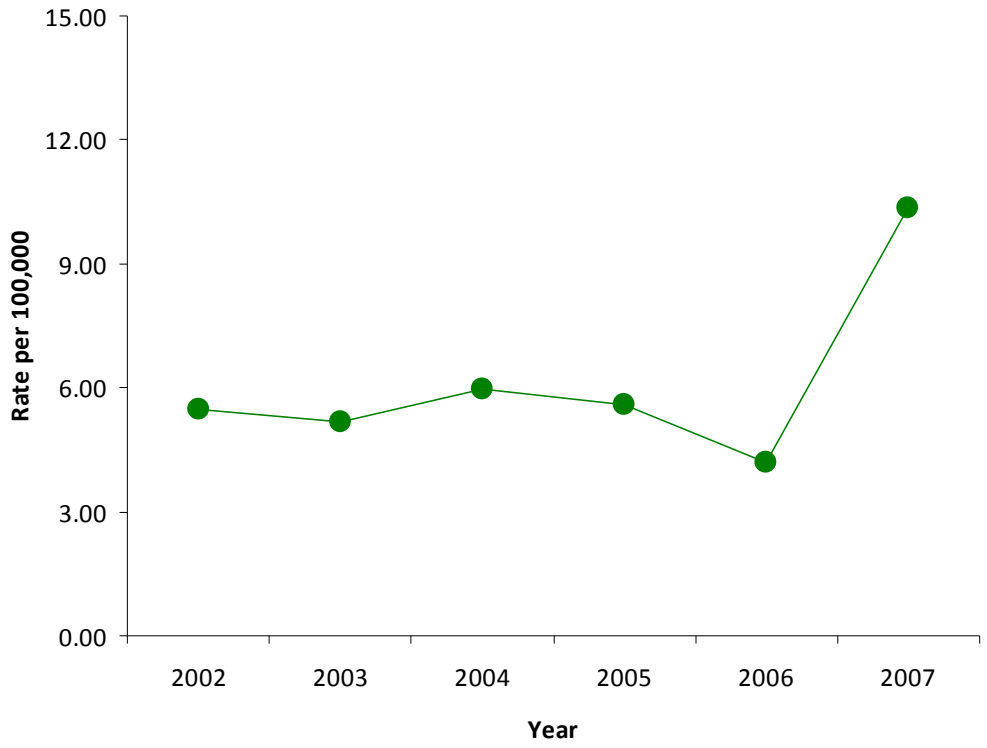


Figure 6 shows annual crude rates of unintentional CO exposures, by presence of a reported health effect, from 2002 to 2007. The rates of unintentional CO exposure calls with a known health effect have remained relatively stable, with a slight increase in 2007. The rates of unintentional CO exposure calls with no known health effect showed similar trends. The rates of unintentional CO exposure calls with an unknown health effect significantly increased in year 2007. Ninety-five percent confidence intervals are shown around the rates.

Figure 6: *Annual crude rates of unintentional CO exposure calls to the Minnesota Poison Control System showing health effects, Minnesota, 2002-2007.*

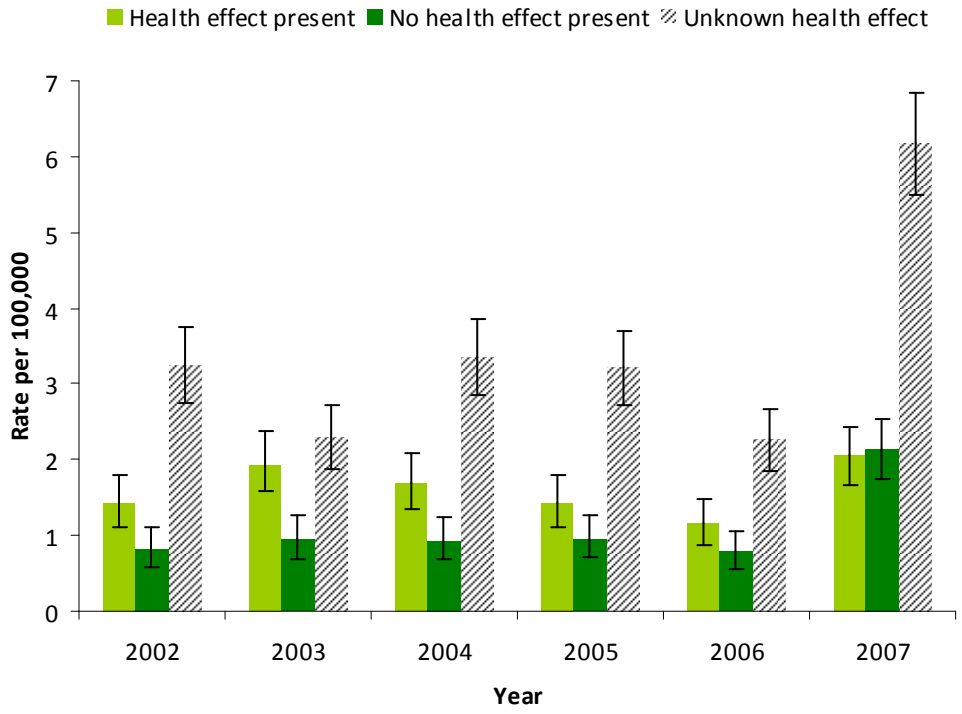
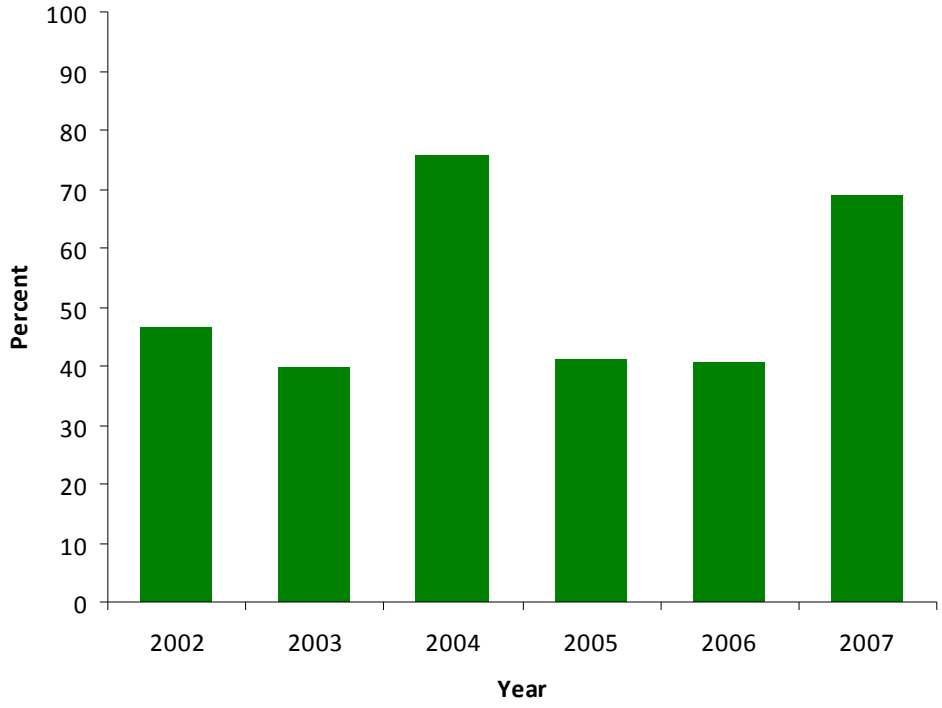


Figure 7 shows the annual percentage of unintentional CO exposure calls in which the case experienced a health effect and was treated in a healthcare facility from 2002 to 2007. Of the unintentional CO exposure calls to the Minnesota Poison Control System with a known health effect, the percentage of cases treated in a healthcare facility was mostly consistent across those years. The exceptions were in 2004 and 2007, when higher percentages of unintentional CO exposure calls with a known health effect were treated in a healthcare facility compared with other years.

Figure 7: *Annual percentage of unintentional CO exposure calls to the Minnesota Poison Control System with a known health effect that were treated in a healthcare facility, Minnesota, 2002-2007.*

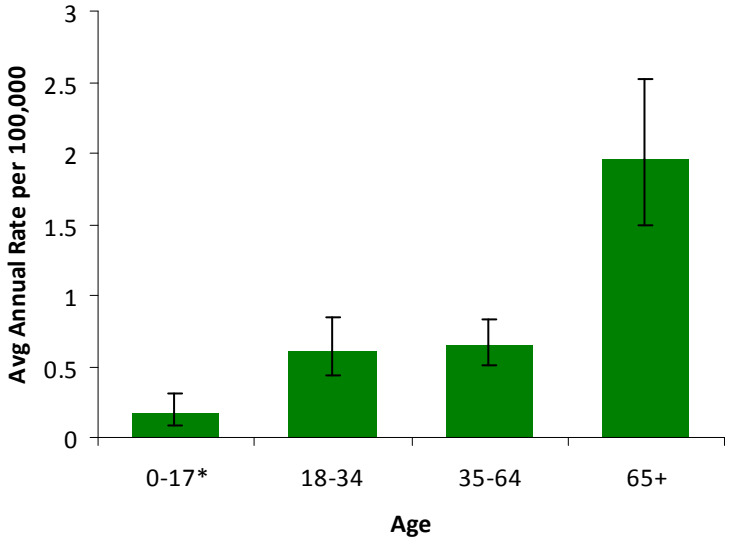


E. Unintentional, non-fire related CO poisoning events

E.1. By Age

Figure 8a shows that unintentional, non-fire related CO hospitalization rates increased with age for years 2003-2007. They were lowest among the 0-17 year old age group (statistically significant), and highest among adults 65 years of age and older (statistically significant).

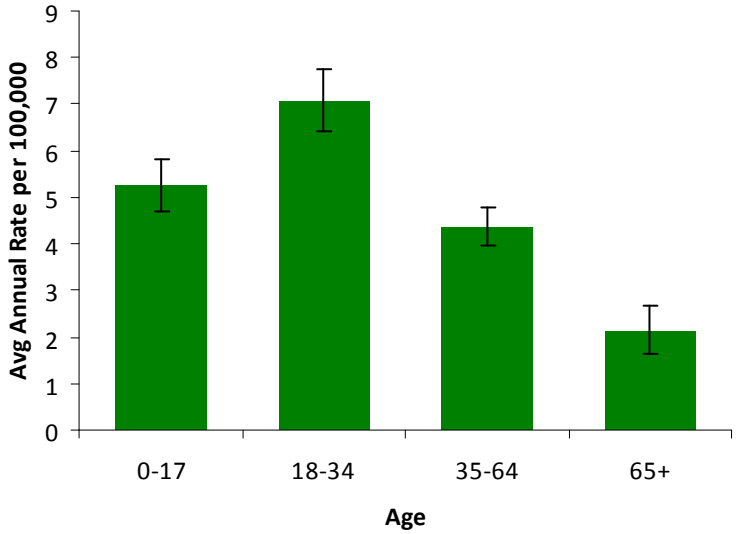
Figure 8a: *Average annual rates of unintentional, non-fire related CO poisoning hospitalizations by age, Minnesota, aggregated from 2003 to 2007.*



* Hospitalization rate of youngest age group (0-17 years) is based on counts ≤ 20 and should be interpreted with caution.

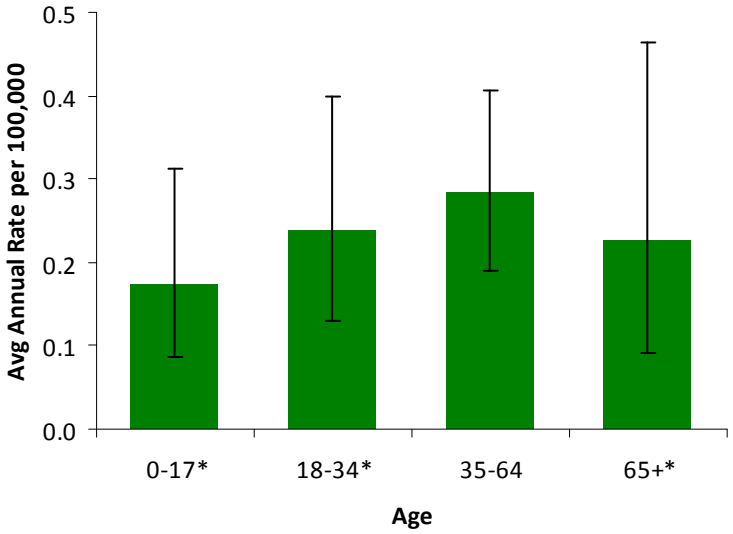
Figure 8b, however, shows that there was a flip-flop in the age distribution of ED visits compared with hospitalizations. ED visit rates for years 2003-2007 were lowest among adults 65 years of age and older; this result was statistically significant. The highest ED visit rates occurred in adults ages 18-34. It seems that younger age groups were more likely to be seen in the ED for unintentional, non-fire related CO poisoning, and that older age groups were more likely to be hospitalized.

Figure 8b: *Average annual rates of unintentional, non-fire related CO poisoning ED visits by age, Minnesota, aggregated from 2003 to 2007.*



Finally, there were no statistically significant age-specific trends for unintentional, non-fire related CO poisoning deaths in 2003-2007, as shown in Figure 8c. Deaths occurring among adults 35-64 years of age accounted for the highest non-fire related unintentional CO death rate, but this was not a statistically significant finding.

Figure 8c: *Average annual rates of unintentional, non-fire related CO poisoning deaths by age, Minnesota, aggregated from 2003 to 2007.*



*Mortality rate of several age groups (0-17 years, 18-34 years, and 65+ years) are based on counts ≤ 20 and should be interpreted with caution.

E.2. By sex

Sex-specific CO poisoning trends were observed in years 2003 to 2007. Unintentional CO poisoning rates were significantly higher in males compared to females for non-fire related hospitalizations and non-fire related deaths, as shown in Figures 9a and 9c, respectively. Males may be more predisposed to CO exposure because of certain high-risk occupational and recreational activities, such as the operation of fuel-burning tools and small-engine powered appliances.

These trends were not observed, however, for non-fire related ED visits shown in Figure 9b. Non-fire related unintentional CO ED visit rates were slightly higher among males compared with females from 2003 to 2007, but this result was not statistically significant.

Figure 9a: *Average annual crude rates of unintentional, non-fire related CO poisoning hospitalizations by sex, Minnesota, aggregated from 2003 to 2007.*

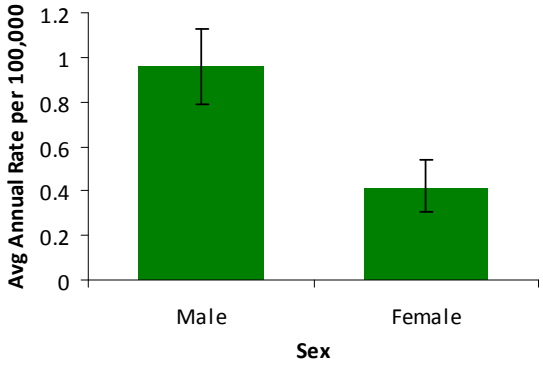


Figure 9b: *Average annual crude rates of unintentional, non-fire related CO poisoning ED visits by sex, Minnesota, aggregated from 2003 to 2007.*

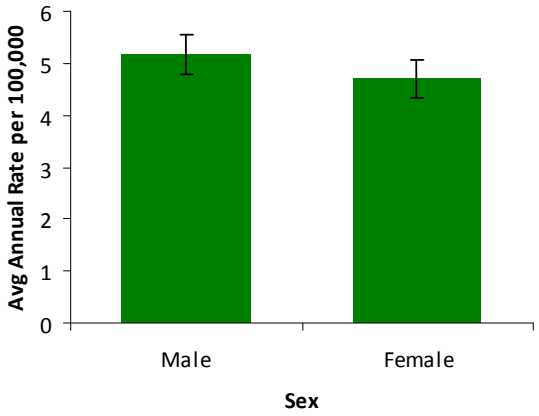
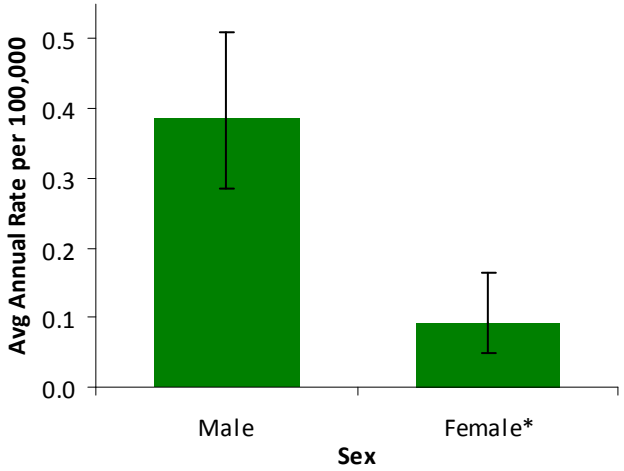


Figure 9c: *Average annual crude rates of unintentional, non-fire related CO poisoning deaths by sex, Minnesota, aggregated from 2003 to 2007.*



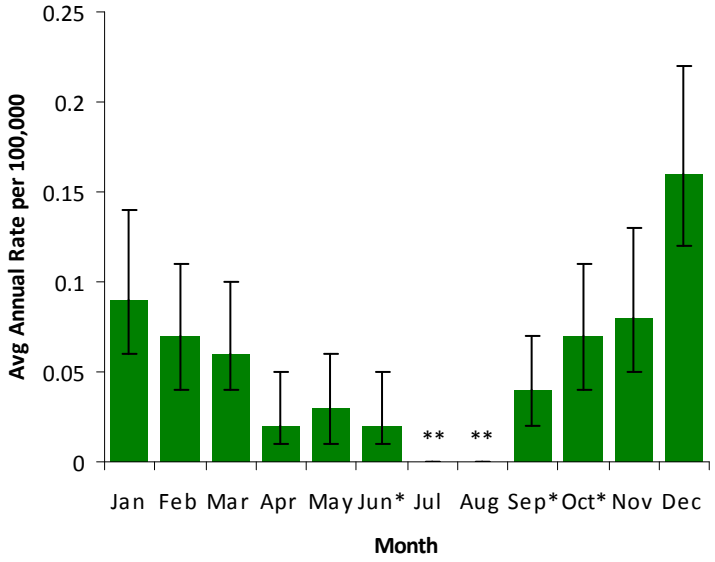
* Mortality rate of females is based on counts ≤ 20 and should be interpreted with caution.

E.3. By Seasonality

Non-fire related unintentional CO exposure and poisoning events followed a seasonal pattern in years 2003-2007, with higher rates occurring in the fall and winter months and lower rates occurring in the spring and summer months for hospitalizations, ED visits, and exposure calls to the Minnesota Poison Control System. This trend reflects the higher usage of fuel-burning devices during periods of colder weather. The monthly distributions of unintentional CO poisoning hospitalizations, ED visits, and exposure calls to the Minnesota Poison Control System are shown below in Figures 10a-c.

Figure 10a shows the monthly distribution of unintentional, non-fire related CO poisoning hospitalizations for a 5-year period from 2003 to 2007. Hospitalization trends follow a seasonal pattern.

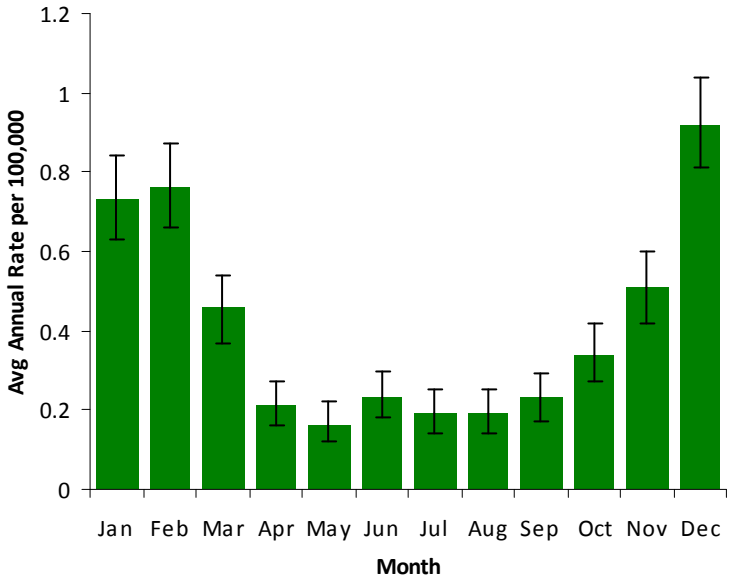
Figure 10a: *Average annual crude rates of unintentional, non-fire related CO poisoning hospitalizations by month, Minnesota, aggregated from 2003 to 2007.*



* Hospitalization rates of several months (June, September, and October) are based on counts ≤ 20 and should be interpreted with caution.
** MN EPHT suppresses rates based on counts ≤ 5 to protect an individual's privacy.

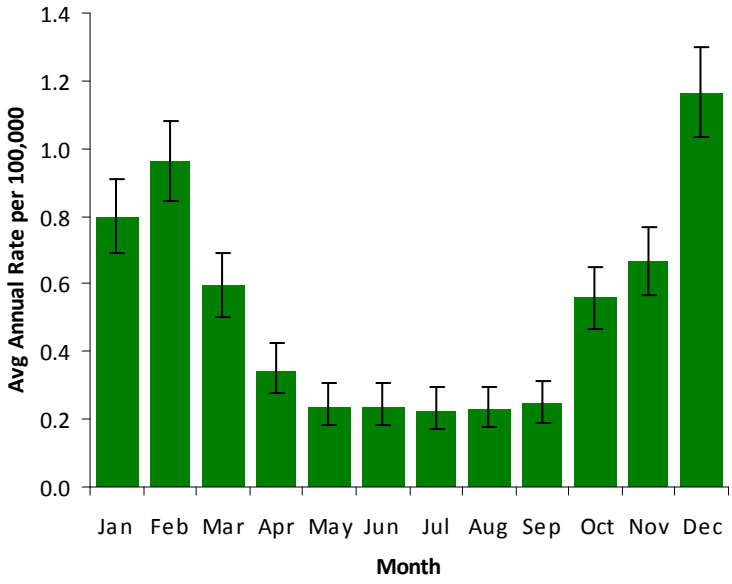
The same seasonal trend can be seen in the monthly distribution of unintentional, non-fire related CO poisoning ED visits during 2003-2007, as shown in Figure 10b.

Figure 10b: *Average annual crude rates of unintentional, non-fire related CO poisoning ED visits by month, Minnesota, aggregated from 2003 to 2007.*



CO exposure calls also follow a seasonal pattern. Figure 10c shows the average annual crude rates of unintentional, non-fire related CO exposure calls by month during 2003-2007.

Figure 10c: *Average annual crude rates of unintentional, non-fire related CO exposure calls by month, Minnesota, aggregated from 2003 to 2007.*

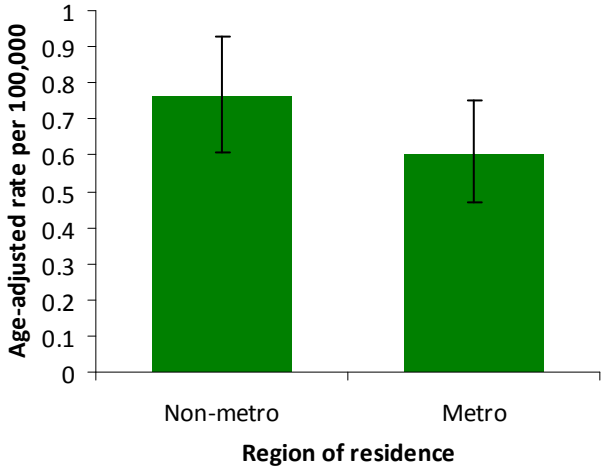


E.4. By Region

The Twin Cities Metro region includes residents of the seven-county Metro area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington counties). The non-Metro region includes all residents outside of the seven-county Metro area.

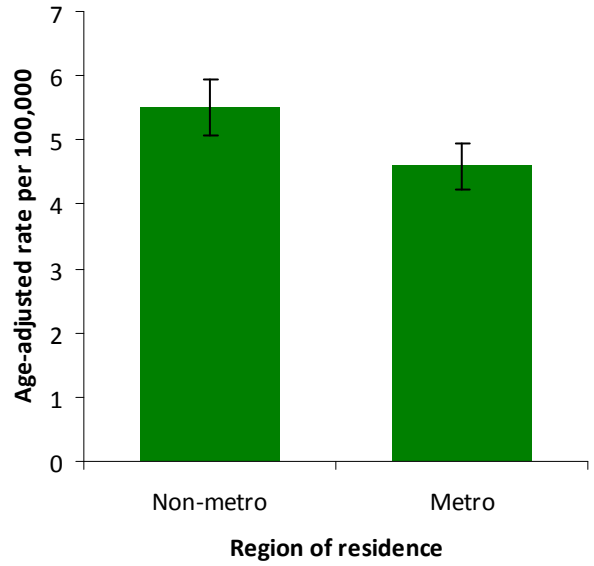
Figure 11a shows average annual age-adjusted rates of unintentional, non-fire related CO poisoning hospitalizations by region for years 2003-2007. Non-fire related unintentional CO hospitalizations occurred at a higher rate outside of the Metro region compared with the Metro region in years 2003-2007, but this result was not statistically significant.

Figure 11a: *Average annual age-adjusted rate of unintentional, non-fire related CO poisoning hospitalizations by region of residence, Minnesota, aggregated from 2003 to 2007.*



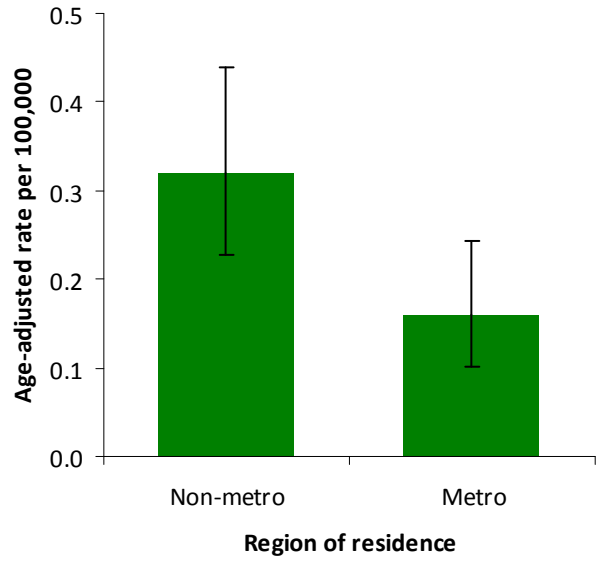
Likewise, Figure 11b shows that non-fire related unintentional CO ED visits rates were higher outside of the Metro region in years 2003-2007. This result was statistically significant.

Figure 11b: *Average annual age-adjusted rate of unintentional, non-fire related CO poisoning ED visits by region of residence, Minnesota, aggregated from 2003 to 2007.*



Finally, Figure 11c shows that non-fire related unintentional CO poisoning death rates were higher outside of the Metro region in years 2003-2007, but this was not a statistically significant finding.

Figure 11c: *Average annual age-adjusted rate of unintentional, non-fire related CO poisoning deaths by region of residence, Minnesota, aggregated from 2003 to 2007.*



Strengths and Limitations of Data Source and Measures

Hospital Discharge and Emergency Department Data:

- Symptoms of CO poisoning are non-specific and can be easily misdiagnosed, resulting in missed cases.
- Admissions to Veteran's Administration and other federal facilities are not included.
- Hospitalizations of MN residents that occurred out of state are not included.
- Variations in coding practice limit state-to-state comparisons.
- Records are selected for a particular year using admission date. Thus, discharge records occurring late in a year may be included in the following year's discharge data set. This is adjusted for if the following year's discharge data set was available.
- Repeat follow-up visits for a single event can not be distinguished from independent events.
- Lack of personal identifiers makes it difficult to determine the degree of overlap between this data source and others.
- Classification of fire-related CO poisoning events is not as straightforward as for non-fire related CO poisoning due to limitations in case definitions; comparisons should not be made across fire-relatedness.

Death Certificate Data:

- CO poisoning deaths may be misclassified and attributed to other causes, resulting in missed deaths.
- Some medical examiners, coroners, or physicians may be less inclined to classify a death as intentional, resulting in a higher rate of unintentional deaths in a particular jurisdiction.
- The length and comprehensiveness of death investigations may vary by jurisdiction.
- Classification of fire-related CO poisoning events is not as straightforward as for non-fire related CO poisoning due to limitations in case definitions; comparisons should not be made across fire-relatedness.

Poison Control Center (PCC) Data:

- State and ZIP code of the caller is often used as a surrogate measure for the patient's residence, which may not accurately represent the patient's actual residence.
- Exposure status reported by the caller should not be considered a confirmed CO exposure, as call data represent *possible* CO exposures, and may not necessarily represent actual CO poisoning events. Reported CO exposure calls to the Minnesota Poison Control System can include events where: (1) CO exposure was detected but did not result in symptoms, (2) symptoms were mild and did not result in follow-up in a healthcare facility, and (3) there were symptoms, but the patient refused medical treatment.
- Not all CO exposures or poisonings are captured by PCC calls, since patients, witnesses to the event, and/or health care providers may not always notify the PCC. Call data are highly reliant on the knowledge, attitudes, and practices of residents around the use of poison control centers.
- In the event of an overload of calls to the MN Poison Control System, calls are re-routed to another state and are not included in the MN database. This is corrected for in the national dataset maintained by the American Association of Poison Control Centers (AAPCC), leading to slight discrepancies in the number of cases between the national and MN datasets.

- Multiple calls made to the poison center for a single event can not be distinguished from independent events.
- Lack of personal identifiers makes it difficult to determine the degree of overlap between this data source and others.

Limitations/Challenges of the Measures:

- Some of the calculated rates are based on numerators $\leq$ 20. These are considered to be unstable and should be interpreted with caution. Rates based on numerators $\leq$ 5 were not calculated.
- The measures represent only a portion of the true burden of carbon monoxide exposures and poisonings in Minnesota. The actual number of Minnesotans experiencing carbon monoxide poisoning is unknown. Carbon monoxide poisoning currently is not a reportable condition in Minnesota.
- These measures may not account for chronic, low-level exposures to carbon monoxide, or to mild exposures that do not result in a visit to the ED or a call to the poison control center. Accordingly, the possible effects of such exposures on other health outcomes, such as fetal growth or neurological injury, are not quantified.

Acronyms

AAPCC	American Association of Poison Control Centers
BRFSS	Behavior Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CO	Carbon monoxide
ED	Emergency department
EPHT	Environmental Public Health Tracking
ICD-9-CM	International Classification of Disease, 9th Revision, Clinical Modification
ICD-10	International Classification of Disease, 10th Revision
MDH	Minnesota Department of Health
MHA	Minnesota Hospital Association
MN EPHT	Minnesota Environmental Public Health Tracking
MPCS	Minnesota Poison Control System
MPCA	Minnesota Pollution Control Agency
NCDM	Nationally Consistent Data and Measures
PCC	Poison Control Center

Glossary

Age-adjusted rate: a measure of some event, disease, or condition with some specification of time with age adjustment, used to compare risks of two or more age categories of the population; age-adjusted rates are typically presented per 100,000 people and calculated by a direct method using a standard age distribution (typically the 2000 U.S. population in MN EPHT materials); an age-adjusted rate is a weighted average of the age-specific rates for an age group

Age-specific rate: a measure of some event, disease, or condition with some specification of time within an age category; similar to a crude rate but is calculated within an age category

CDC: the Centers for Disease Control and Prevention, a part of the U.S. Department of Health and Human Services, is the nation's public health agency that works to ensure health protection through promotion, prevention, and preparedness

Crude rate: a measure of some event, disease, or condition in relation to a unit of population, along with some specification of time without respect to age category, often presented per 1,000, per 10,000 or per 100,000 people

Environmental Public Health Tracking (EPHT): the ongoing collection, integration, analysis, interpretation, and dissemination of data from environmental hazard monitoring, and from human exposure and health effects surveillance

Healthy People 2010: launched by the Department of Health and Human Services in January 2000 as a comprehensive, nationwide health promotion and disease prevention agenda; contains 467 objectives within 28 focus areas designed to serve as a framework for improving the health of all people in the U.S. during the first decade of the 21st century

Hospitalization: a subject is admitted to a hospital for treatment of a disease or condition

Incidence: the number of new cases of a condition, symptom, death, or injury that arise during a specific period of time, often expressed as a percentage of a population; shows the likelihood that a person in that population will be affected by the condition

International Classification of Disease 9th Revision Clinical Modification (ICD-9-CM): a clinical modification of the World Health Organization's 9th revision of the international classification of diseases; the official system of assigning codes to diagnoses and procedures associated with hospital utilization in the United States

International Classification of Disease 10th Revision (ICD-10): the 10th revision of the international classification of diseases that replaces ICD-9 as of January 1, 1999; designed to promote international comparability in the collection, processing, classification, and presentation of mortality statistics

Measure: for tracking, a measure is a specific way to calculate a value from the data describing population health, hazard or exposure; measures should be clearly and uniquely defined such that, given the appropriate data, the value of the measure could be calculated in a consistent fashion (like a statistic)

Minnesota Department of Health (MDH): the state government agency in Minnesota that focuses on protecting, maintaining and improving the health of all Minnesotans; consists of seven major divisions, including Community and Family Health, Compliance Monitoring, Environmental Health, Health Policy, Health Promotion and Chronic Disease, Infectious Disease Epidemiology Prevention and Control, and Public Health Laboratory

Minnesota Environmental Public Health Tracking Program (MN EPHT): As defined in Minnesota Statutes, section 144.995, a state program for the ongoing collection, integration, interpretation, and dissemination of environmental hazard, exposure, and health effects data. MN EPHT produces a network or system of integrated data in the state about environmental hazards, population exposure, and health outcomes; MN EPHT works in partnership with other states as part of CDC's National Environmental Public Health Tracking Network (Tracking Network)

Minnesota Hospitalization Association (MHA): an organization representing 147 hospitals in Minnesota that works to develop, promote, and implement progressive health policy in the state and nation that benefits hospitals' employees, patients and communities; provides data resources for members, policy-makers, researchers and others

Minnesota Poison Control System: The Minnesota Poison Control System at Hennepin Regional Poison Center collects call data from the general public and healthcare providers, mostly for calls involving an acute exposure to a toxic substance. The primary function of the poison center is to provide the caller with toxicologic and treatment information, and to refer the patient to a healthcare facility if necessary

National Environmental Public Health Tracking Network (Tracking Network): a web-based, secure network of standardized health and environmental data; the Tracking Network is a product of CDC's National Environmental Public Tracking Program, drawing data and information from state and local tracking networks as well as national-level and other data systems; it provides the means to identify, access, and organize hazard, exposure, and health data from these various sources and to examine and analyze those data on the basis of their spatial and temporal characteristics

Nationally Consistent Data and Measures (NCDM): adaptation of a single set of national standards for data collection, analysis and reporting to enable CDC to compile a core set of nationally consistent data and measures across multiple states

Prevalence: the number of new and pre-existing cases of a condition, symptom, death, or injury among persons alive on a certain date; a function of both the incidence of the condition and survival

Poison Control Center (PCC): poison control centers respond to calls from the public and healthcare providers concerning exposure to toxic substances

Sources:
Health, U.S. 2008 Appendix II: Definitions and Methods
Last, John M. 2001. *A Dictionary of Epidemiology 4th ed.* Oxford: Oxford University Press.
NIH: http://www.nhlbi.nih.gov/ and http://www.nlm.nih.gov/
MPCS: http://www.mnpoison.org/

Carbon Monoxide Poisoning Resources

Minnesota Environmental Public Health Tracking
http://www.health.state.mn.us/tracking

Minnesota Department of Health, Indoor Air Unit
http://www.health.state.mn.us/divs/eh/air
http://www.health.state.mn.us/divs/eh/indoorair/co/index.html

The Minnesota Department of Health does not endorse any opinion, report, product or service described in the following links.

National Environmental Public Health Tracking Network
http://ephtracking.cdc.gov

Minnesota Poison Control System, Carbon Monoxide
http://www.mnpoison.org/index.asp?pageID=112

Minnesota Department of Public Safety, Carbon Monoxide Information
http://www.dps.state.mn.us/fmarshal/CO/CO.htm

CDC Carbon Monoxide Poisoning
http://www.cdc.gov/co/default.htm

EPA Indoor Air Quality
http://www.epa.gov/iaq/co.html

EPA Carbon Monoxide Poisoning
http://www.epa.gov/aging/resources/factsheets/pcmp/index.htm

US Consumer Products Safety Commission, Carbon Monoxide Questions and Answers
http://www.cpsc.gov/CPSCPUB/PUBS/466.html

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13. Minnesota Office of Revisor of Statutes. 2008 Minnesota Statutes: 299F.50. 2008; https://www.revisor.leg.state.mn.us/statutes/?id=299F.50.

14. Minnesota Department of Health. Indoor Arenas Statute and Rules. April 15, 2008; http://www.health.state.mn.us/divs/eh/indoorair/arenas/rules.html.

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