2012
Annual Report on
Carbon Monoxide Poisoning
In Michigan

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2012 ANNUAL REPORT ON CARBON MONOXIDE POISONING IN MICHIGAN

A Joint Report Of

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SUMMARY

This is the fourth annual report on carbon monoxide (CO) poisoning surveillance in Michigan. This report provides information about the 765 individuals who were unintentionally poisoned by CO in Michigan in 2012, including 22 individuals who died from CO exposure. It is based on data collected as a result of regulations promulgated September 18, 2007, by the Michigan Department of Community Health (MDCH). The State's Public Health Code requires health care facilities and health care professionals to report unintentional CO poisoning. MDCH regulations also require laboratories to report carboxyhemoglobin test results

BACKGROUND

One of the leading causes of unintentional poisoning deaths in the United States is CO poisoning.[1] CO is an odorless and colorless gas found in combustion fumes, such as those produced by cars and trucks, small engines, burning charcoal and wood, natural gas or wood fired furnaces/stoves, and fires. The Environmental Protection Agency (EPA) allowable environmental exposure to CO in outdoor ambient air is 9 parts per million (ppm) for an 8-hour average.[2] Workplace standards set by the Michigan Occupational Safety and Health Administration (MIOSHA) for general industry require the CO level be kept below a time weighted average (TWA) of 35 ppm for an 8-hour day and a 200 ppm ceiling that should never be exceeded; for the construction industry, the TWA is 50 ppm averaged over an 8-hour work day without a standard for a ceiling level.[3,4] The National Institute for Occupational Safety and Health (NIOSH) Immediately Dangerous to Life and Health (IDLH) is 1200 ppm.[5]

When inhaled, CO binds to hemoglobin in the blood as well as other proteins in the body such as myoglobin, reducing the delivery of oxygen to the brain, heart, and all other body tissues. Hemoglobin combines with CO to form a bright red compound called carboxyhemoglobin (COHb), which can be measured in the blood. Non-smoking individuals generally have less than 1.0% COHb in their blood as a consequence of the normal breakdown of red blood cells. Cigarette smokers have an average 4.0% COHb, with heavier smokers having higher values. Breathing CO at the MIOSHA TWA for general industry of 35 ppm will cause a 5.4% COHb blood level. Breathing CO at the TWA for construction of 50 ppm will cause a 7.4% COHb blood level.[6] CO home detectors manufactured to meet the requirements of ANSI/UL 2034 are designed to alarm at levels that would result in a COHb level of 10% in adults.[7] Exposure to CO from multiple sources is additive (e.g., the average cigarette smoker working at the MIOSHA general industry TWA would be expected to have 9.4% COHb level).[6] COHb has a half-life in the blood of four to six hours. Oxygen administration reduces the half-life to approximately an hour or less; hyperbaric oxygen treatment will reduce the half-life to less than half an hour.[6] In individuals with atherosclerosis, COHb levels as low as 3-4% can increase the frequency and severity of angina or claudication, 6% can induce cardiac arrhythmias, and 10% may precipitate a

myocardial infarction.[6] In individuals without atherosclerosis, COHb levels below 30% can cause headaches, nausea and muscle weakness. COHb levels above 30% can cause increased weakness and decreased metal awareness. Breathing higher levels of COHb can result in coma and death.[6]

METHODS

The major data sources for this report were the Michigan Poison Control Center (PCC), Michigan hospitals, and death certificates for the period 1/1/2012 to 12/31/2012. The PCC reported all calls where the substance was CO, the individual had one or more "clinical effects" (symptoms), and the reason for exposure was "unintentional". Hospitals were required to report patients who had ICD-9 discharge codes of 986, E868.3, E868.8, E868.9, or E982.1* as a discharge diagnosis. Death certificates were obtained where a contributing cause of death was ICD-10 code T58 ("Toxic effects of carbon monoxide…accidental (unintentional)").

Hospital medical records and PCC case reports were reviewed to determine if they met the following surveillance case definition. A confirmed case of CO poisoning was defined as an individual who was treated by a health care provider for symptoms related to unintentional CO exposure. If a person called PCC about CO and/or CO-related symptoms but did not seek medical care they were excluded. Also excluded were cases where the physician ruled out CO poisoning in the medical record notes, even though CO poisoning may have been suspected initially and thus assigned a CO ICD code in the discharge diagnosis string. It should be noted that individuals were included as cases regardless of laboratory confirmation based on the COHb result. In many cases the COHb result was not available or the blood specimen from the patient was collected too long after exposure or after treatment with oxygen to still be elevated. All death certificate cases with cause of death code T58 were considered confirmed cases.

Confirmed cases were abstracted into a uniform data system that included, for each individual case report, demographic information (age, gender and race), admission date, discharge date, exposure date, COHb test result, cigarette smoking status, report source(s), source of CO exposure (e.g. furnace, forklift), treatment (including hyperbaric chamber).

For individuals who had multiple reports for the same exposure, records were combined and considered as one case. This was done for individuals who had multiple reports from different reporting sources as well as multiple entries of the same report source (e.g. transfers between

* ICD-9 code definitions: 986 = ""Toxic effects of CO"; E868,3 = "CO from incomplete combustion of other domestic fuels"; E868.8 = "CO from other sources"; E868.9 = "Unspecified CO"; E982.1 = "Poisoning by other CO"

hospitals for treatment with hyperbaric oxygen, and multiple hospital visits due to the same exposure).

Frequencies and rates of CO poisoning were generated from these data. Denominators used to calculate rates were from the U.S. Census Bureau.[10]

RESULTS

A total of 860 reports of unintentional CO poisoning were received on 765 individuals, after deduplication of multiple reports on single individuals. One hundred and twelve of these individuals were poisoned at work, and the rest were exposed in non-occupational settings.

Death

There were 22 (2.9%) deaths from unintentional CO poisoning, none of which were work-related. The vital status could not be determined in four (0.5%) of the 765 cases. Five deaths were fire related. Source of CO was unknown for 10 deaths; four were from a vehicle, one was from a furnace or water heater, one was from a space heater and one was from an unclassified source.

Gender and Age

Gender was known for 756 individuals, of which 372 (49.2%) were male and 384 (50.8%) were female. (Of the 742 individuals where age and gender were known, 142 (19.1%) were 17 years old or younger, 343 (46.2%) were 18 – 44, 177 (23.9%) were 45 – 64, and 80 (10.8%) were 65 or older. Females age 18 – 44 (10.56/100,000) and males age 18 – 44 (9.63/100,000) had the highest incidence rates. (Figure 1 and Table 1.)

Figure 1

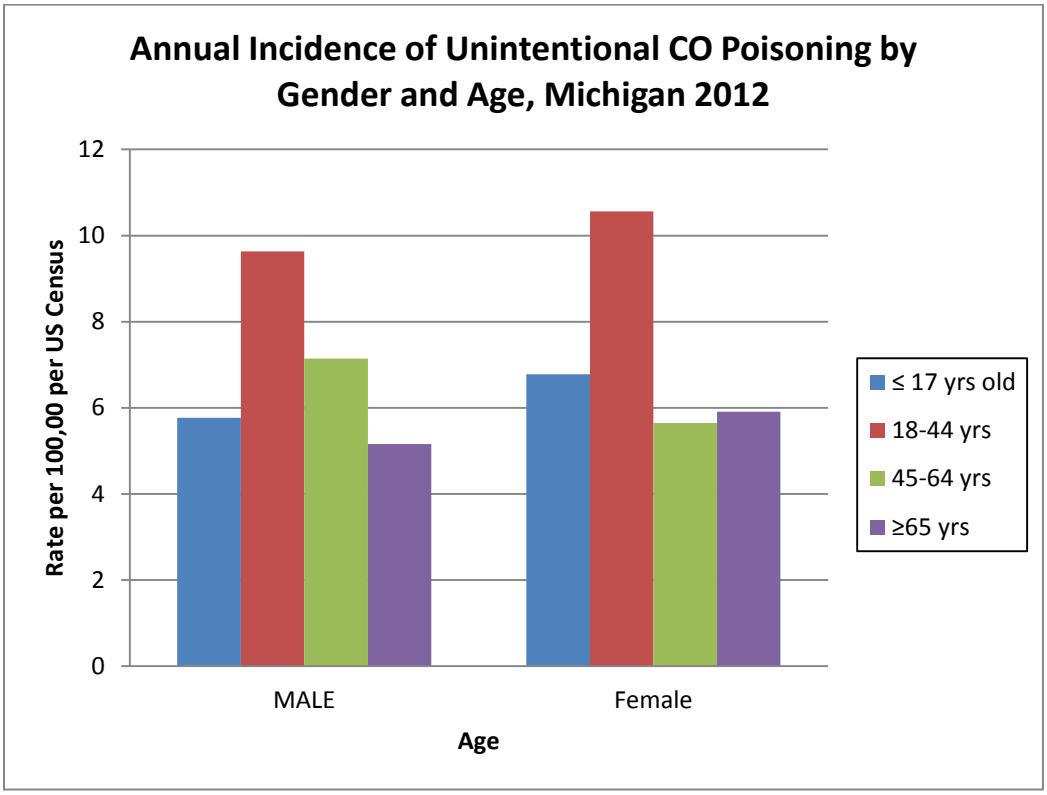


Table 1

Annual Incidence of Unintentional CO Poisoning by Gender and Age, Michigan 2012							
	Gender						
Age	Male	MI Male Population	Male Rate/100000	Female	MI Female Population	Female Rate/100,000	Total
≤ 17 yrs old	67	1,159,942	5.77	75	1,106,298	6.78	142
18 - 44 yrs	164	1,702,261	9.63	179	1,695,995	10.56	343
45 - 64 yrs	97	1,358,568	7.14	80	1,416,952	5.65	177
≥65 yrs	32	629,740	5.16	48	812,974	5.91	80

Race

Race was known for 393 (51.4%) individuals. Of the individuals where race was known, 244 (62.1%) were Caucasian, 119 (30.2%) were African American, 28 (7.1%) were Hispanic, one (0.3%) was Native American and one (0.3%) was of multiple races. African Americans had the highest incidence rate of CO poisoning (8.57/100,000). (Table 2)

Table 2

Unintentional CO Poisoning by Race, Michigan 2012			
Race	Michigan Population	# Cases	Rate/100,000
Caucasian	7,840,426	244	3.11
African American	1,388,360	119	8.57
Hispanic	454,918	28	6.15
Native American	56,356	1	1.77
Multiple Races	254,344	1	0.39

Month of Poisoning

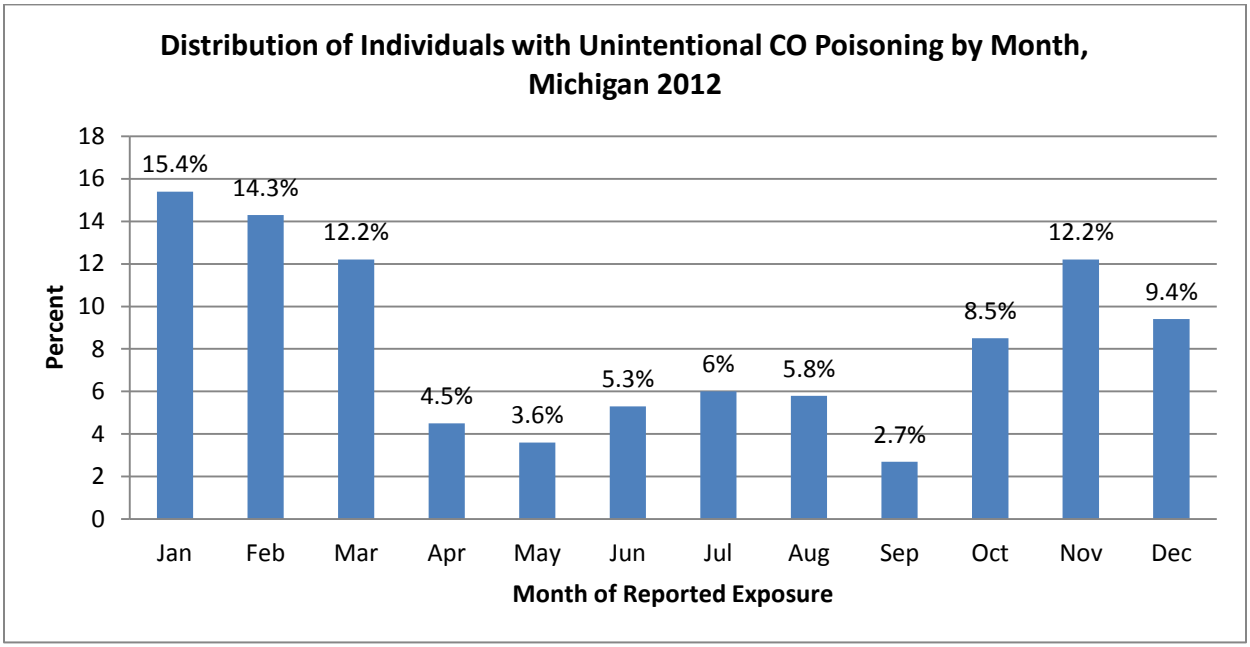
Month of exposure was known for 551 (72%) individuals (Table 3 and Figure 2). January was the most common month for exposure - 85 (15.4% of 551 cases. The lowest numbers were in the late spring and summer and early fall months, September being the lowest with 15 individuals (2.7%).

Table 3

Unintentional CO Poisoning by Month, Michigan 2012		
Month	# Individuals	%
January	85	15.4
February	79	14.3
March	67	12.2
April	25	4.5
May	20	3.6
June	29	5.3
July	33	6
August	32	5.8
September	15	2.7
October	47	8.5
November	67	12.2
December	52	9.4
Total	551*	99.9

* Where month of exposure was known

Figure 2



Carboxyhemoglobin Testing

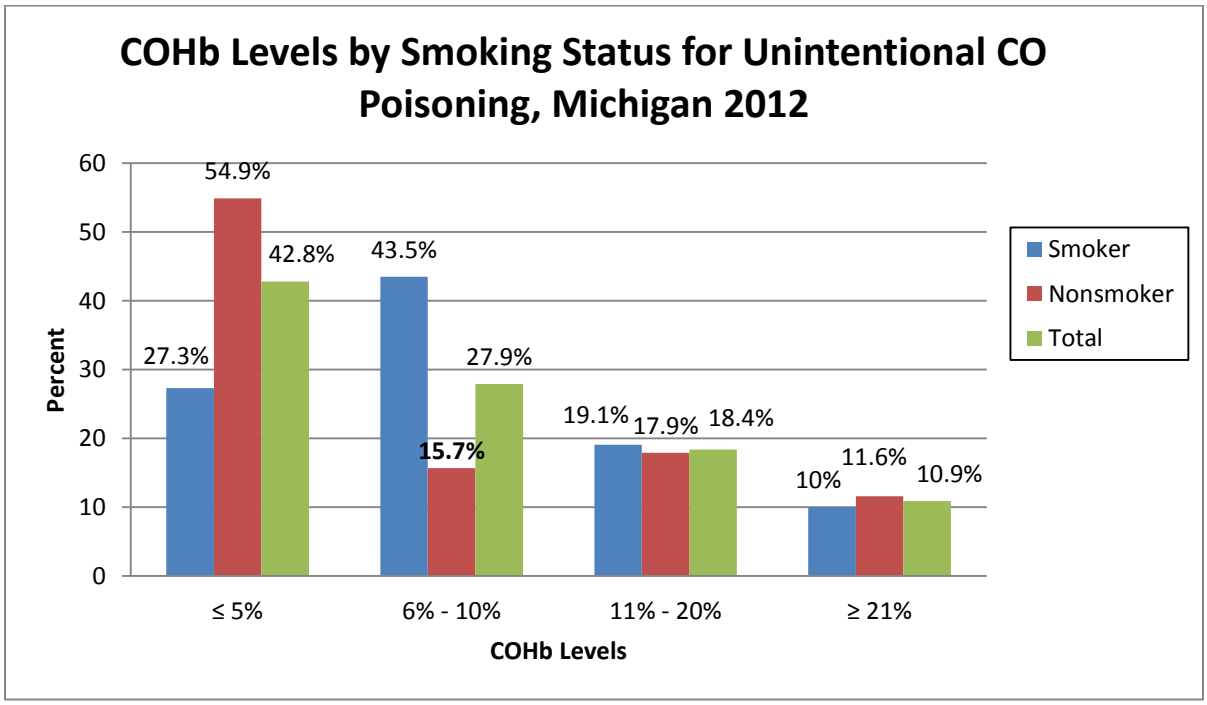
COHb was known for 640 (84.7%) of the 765 individuals. The average COHb level for all individuals tested was 10.1%. The range of COHb was 0.0% to 53.2%. Two hundred and thirty-one (36.1%) individuals had a COHb level greater than 10% and 96 (15.0%) individuals had a COHb level equal to or greater than 21.0%. Smoking status was known for 477 (74.5%) of the 640 individuals tested for COHb, and 533 (69.7%) of all 765 individuals. The distribution of COHb levels by smoking status is shown in Table 4 and Figure 3.

Table 4

COHb Levels by Smoking Status for Unintentional CO Poisoning, Michigan 2012

	Smoking Status					
COHb Level	Smoker	%	Nonsmoker	%	Total	%
≤ 5%	57	27.3	147	54.9	204	42.8
6% - 10%	91	43.5	42	15.7	133	27.9
11% - 20%	40	19.1	48	17.9	88	18.4
≥ 21%	21	10	31	11.6	52	10.9
Total	209	100	268	100	477	100
Average COHb	10.08		8.5		9.2	
Median COHb	7.7		4.3		6.7	

Figure 3



Hyperbaric Treatment

Thirty-five (4.6%) individuals were known to have been treated with hyperbaric chamber oxygen. All patients treated with oxygen in a hyperbaric chamber had their COHb measured. The average COHb level recorded for these individuals was 28.5%.

Twenty-eight (80.0%) of the hyperbaric treatments were non-occupational exposures, including 10 from generator exposures, five from a fire, four from a vehicle exposure, two from a furnace or water heater exposure, and five from assorted other sources including a portable grill and a space heater. For two individuals the source of non-occupational exposure was unknown. There were seven occupational exposures that were treated with hyperbaric oxygen; three from generators, two from vehicles, one from a space heater and one had an unknown source. Thirty-two of the 35 (91.4%) treated individuals were over age 35.

CDC recommends to "Consider hyperbaric oxygen therapy (HBO) therapy when the patient has a COHb level of more than 25- 30%, there is evidence of cardiac involvement, severe acidosis, transient or prolonged unconsciousness, neurological impairment, abnormal neuropsychiatric testing, or the patient is ≥36 years in age. HBO is also administered at lower COHb(<25%) levels

if suggested by clinical condition and/history of exposure." [11] Table 5 shows the hyperbaric treatment status of the 267 individuals age 36 and older stratified by their COHb levels.

Table 5

Hyperbaric Treatment for Individuals 36 Years and Older					
Received Hyperbaric Treatment	Average COHb	Number of individuals			
		Total	COHB <25	COHb 25-30%	COHb >30
yes	29.9	32	11	6	15
no	9.3	235	220	14	1

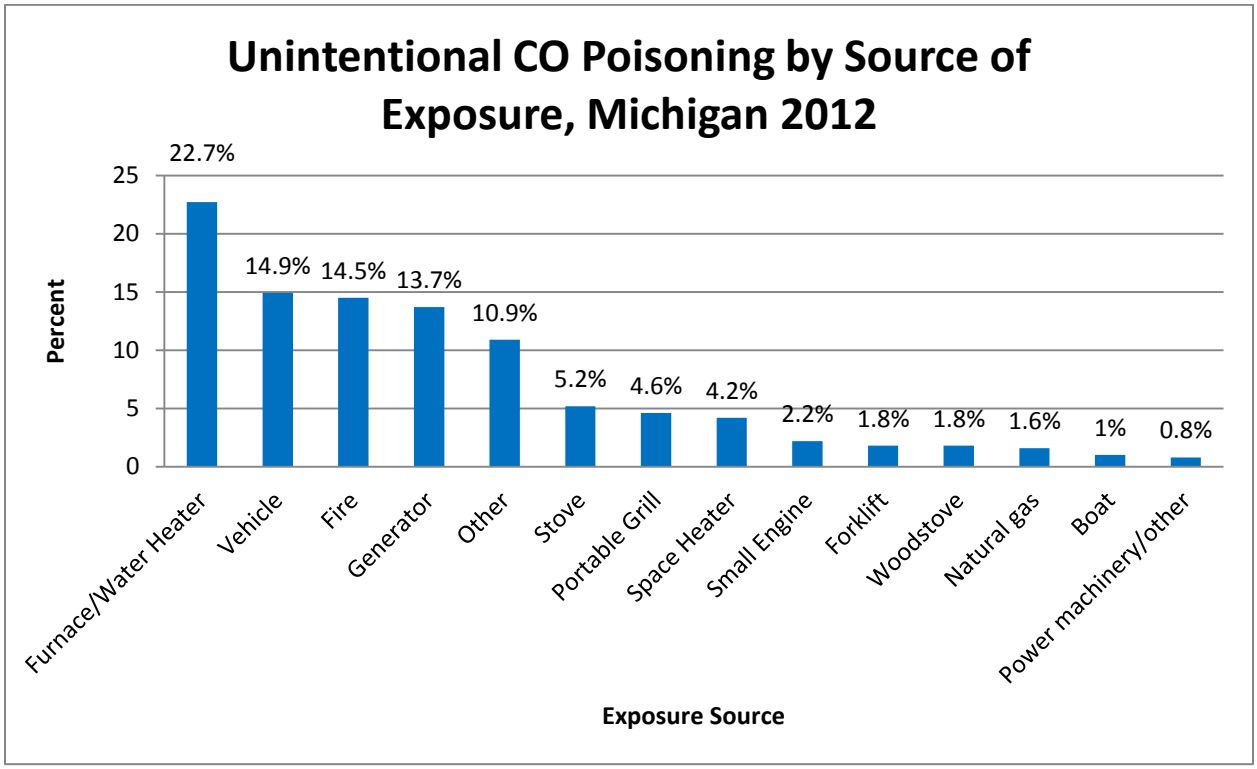
Source of Exposure

Exposure source was known for 497 (65.0%) of the 765 individuals (Table 6, Figure 4). The most common exposure source of exposure among these 497 individuals was furnace/water heater (22.7%), followed by exposure from a vehicle (14.9%) and then fire (14.5%). There were 268 (35.0%) individuals with CO exposure where the source of exposure was unknown.

Table 6

Unintentional Co Poisoning by Source of Exposure, Michigan 2012		
Source	**#**	**%**
Furnace/Water Heater	113	22.7
Vehicle	74	14.9
Fire	72	14.5
Generator	68	13.7
Other	54	10.9
Stove	26	5.2
Portable Grill	23	4.6
Space Heater	21	4.2
Small Engine	11	2.2
Forklift	9	1.8
Woodstove	9	1.8
Natural gas	8	1.6
Boat	5	1
Power machinery/other	4	0.8
Total	**497**	**99.9**

Figure 4



Fire

Fire was the source of CO exposure for 72 (14.5%) of the 497 individuals where a source was known. There were five (7%) work-related fire exposures, 64 (88.9%) were non-work-related and three (4.2%) were unknown. Five (7%) of the fire related exposures resulted in death; none of these deaths were work-related. For one (1.4%) of the fire related exposures the vital status was unknown.

Hospitalizations

Of the 765 individuals with reported CO exposure, 92 (12.0%) were hospitalized overnight. The most common source of CO requiring overnight hospitalization included 30 (32.6%) from a fire exposure, 10 (10.9%) from generators, six (6.5%) from a furnace or water heater, and six (6.5%) from other sources. For the 75 individuals where length of stay was known, the average stay was 6.5 days and median stay was 3 days. The longest hospitalization was for 60 days following an unknown exposure. Thirty-five (46.7%) stayed two days or less, 26 (34.6%) stayed 3 to 7 days, 8 (10.7%) stayed 8 to 14 days, and 6 (8.0%) stayed more than two weeks.

Eight (8.7%) of the 92 hospitalizations were due to occupational CO exposure. Of the eight occupational exposure-related hospitalizations, one (12.5%) was from a space heater, two

(25.0%) were from vehicle exhaust, two (25.0%) were from a generator, 1 (12.5%) was from a forklift, one (12.5%) was from a furnace or water heater, and there was one (12.5%) with unknown source.

ANALYSIS OF OCCUPATIONAL EXPOSURES

Exposure location was known for 654 individuals in 2012 and 112 (17.1%) were identified as having occurred at work. Gender was known for all of the work-related cases; 77 (68.9%) male, 35 (31.3%) female. Seventy-five (70.0%) were between the age of 18 and 44, and 31 (27.7%) were between age 45 to 65. (Table 8)

Table 8

Percent by Gender and Age of Unintentional Occupational CO Poisoning, Michigan 2012						
Age	**Gender**					
	Male	**% of Males**	**Female**	**% of Females**	**Total**	**% of Total**
Unknown Age	6	7.8	0	0	6	5.4
≤ 17 years old	0	0	0	0	0	0
18 - 44 yrs	51	66.2	24	68.6	75	70.0
45- 65 yrs	20	26.0	11	31.4	31	27.7
Total	**77**	**68.9 % Male**	**35**	**31.3% Female**	**112**	**100**

Thirty-four (70.8%) of the 48 with known race were Caucasian, 10 (20.8%) were African American, and four (8.3%) were Hispanic.

COHb tests were reported for 95 individuals with occupational exposure. The average COHb level for occupationally exposed individuals tested was 18.0%. Smoking status was known for 76 (80.0%) of the 95 occupationally exposed individuals with COHb levels. The distribution of COHb levels by smoking status is shown in Table 9.

Table 9

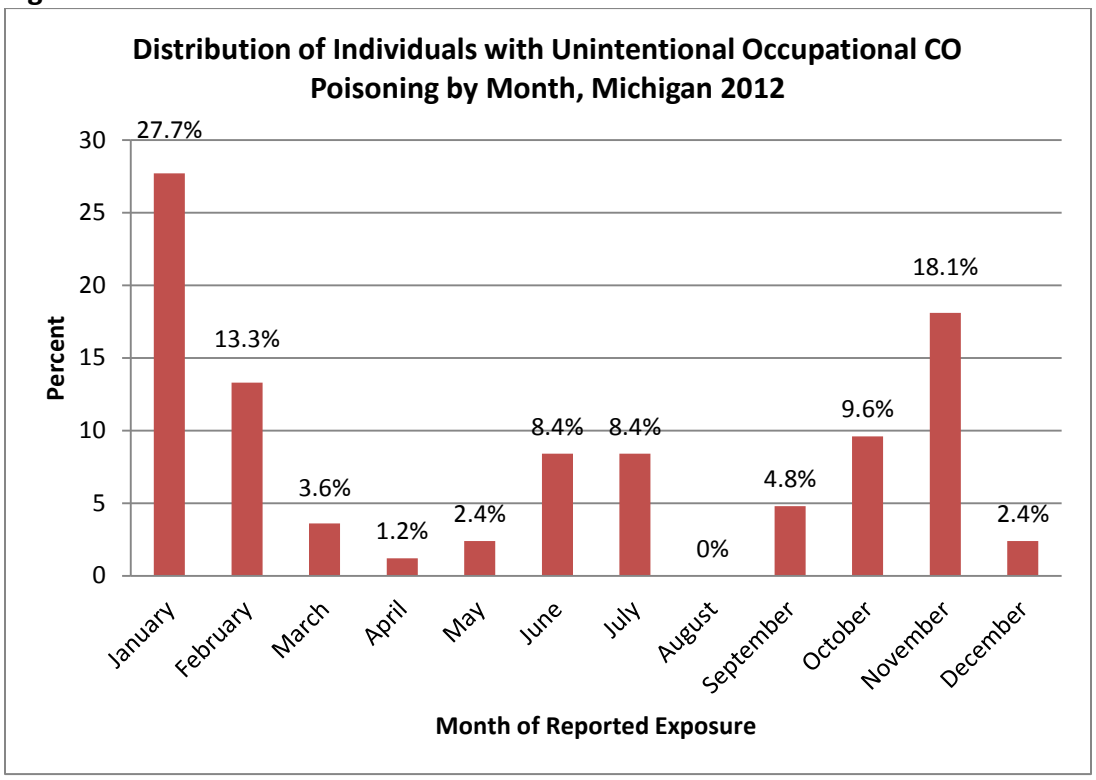
Unintentional Occupational CO Poisoning by Reported COHb Levels and Smoking Status, Michigan 2012								
COHB %	**Smoker**	**% of Smokers**	**Nonsmoker**	**% of Nonsmokers**	**Unknown**	**% of Unknown**	**Total**	**%**
≤ 5%	9	25.0	25	64.1	7	35.0	41	43.2
6 - 10%	13	36.1	9	23.1	4	20.0	26	27.3
11-20%	13	36.1	5	12.8	3	15.0	21	22.1
≥ 21%	1	2.8	0	0	6	30.0	7	7.4
Total	**36**	**37.8% Smokers**	**39**	**41.1% Nonsmokers**	**20**	**21.1% Unknown**	**95**	**100**
Average COHb	10.3		5.2		14.1		9.0	
Median COHb	9.1		3.4		9.2		7.1	

Of the 112 individuals occupationally exposed, the month of exposure was known for 84 (75.0%). (Table 10 and Figure 5) The largest percentage of reported exposure occurred in January with 23 (27.4%) exposures. No exposures occurred in August.

Table 10

Unintentional Occupational CO Poisoning by Month, Michigan 2012		
Month	**# Individuals**	**%**
January	23	27.7
February	11	13.3
March	3	3.6
April	1	1.2
May	2	2.4
June	7	8.4
July	7	8.4
August	0	0.0
September	4	4.8
October	8	9.6
November	15	18.1
December	2	2.4
Total	**83**	**100.0**

Figure 5

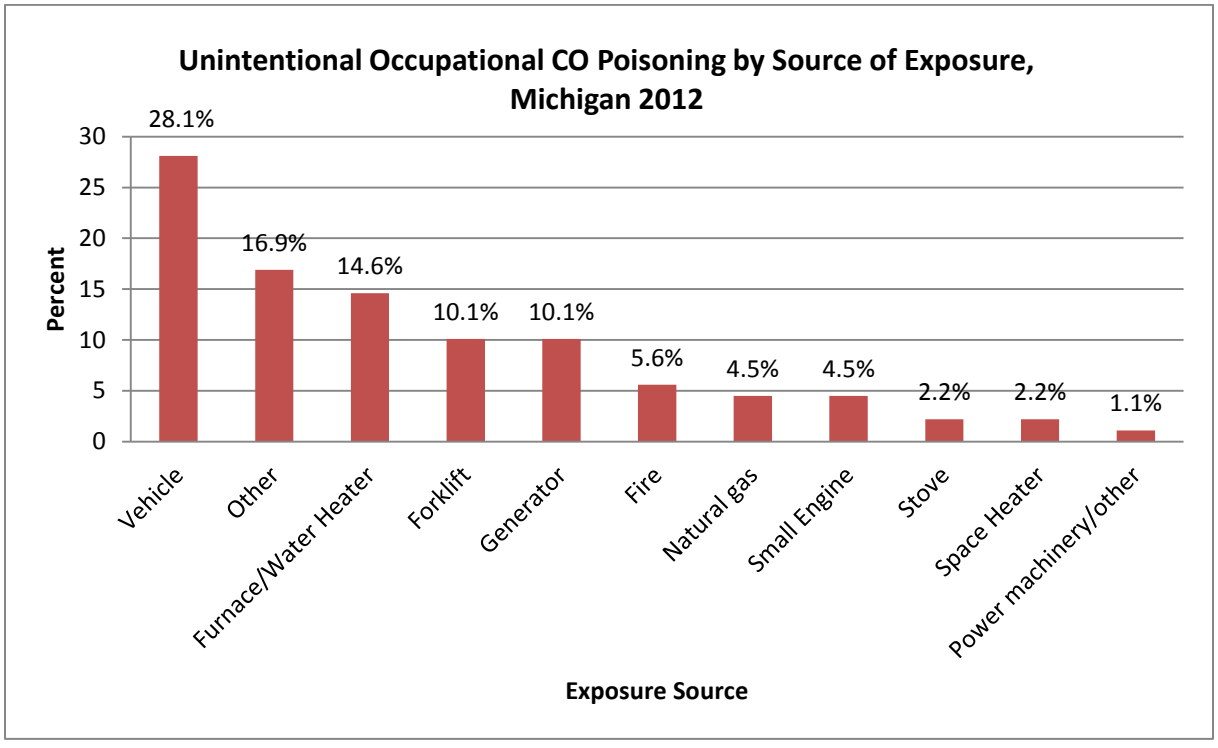


Of the 112 individuals occupationally exposed, source of exposure was known for 89 (79.5%). The most common source of work-related exposure was from vehicles (25 of 89 individuals, or 28.1%). (Table 11, Figure 6).

Table 11

Unintentional Occupational CO Poisoning by Source of Exposure, Michigan 2012		
Source	**#**	**%**
Vehicle	25	28.1
Other	15	16.9
Furnace/Water Heater	13	14.6
Forklift	9	10.1
Generator	9	10.1
Fire	5	5.6
Natural gas	4	4.5
Small Engine	4	4.5
Stove	2	2.2
Space Heater	2	2.2
Power machinery/other	1	1.1
Total	**89**	**100**

Figure 6

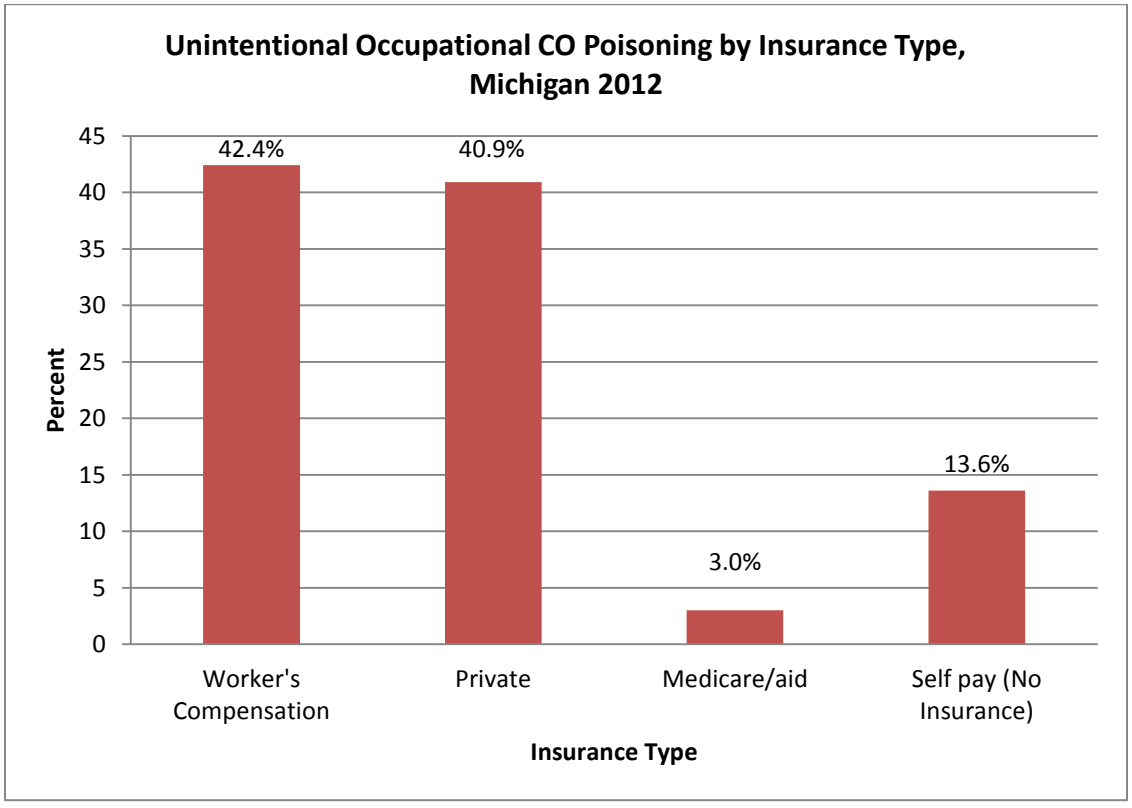


Of the 112 individuals occupationally exposed, insurance type was known for 66 employees (58.9%). For 28 (42.4%) of these 66, Worker's Compensation was the expected payer, 27 (40.9%) had private insurance, 2 (3.0%) had Medicare or Medicaid, and nine (13.6%) did not have insurance (Table 12, Figure 7).

Table 12

Unintentional Occupational CO Poisoning by Insurance Type, Michigan 2012		
Insurance Type	**#**	**%**
Worker's Compensation	28	42.4
Private	27	40.9
Medicare/aid	2	3.0
Self Pay (No Insurance)	9	13.6
Total	**66**	**100**

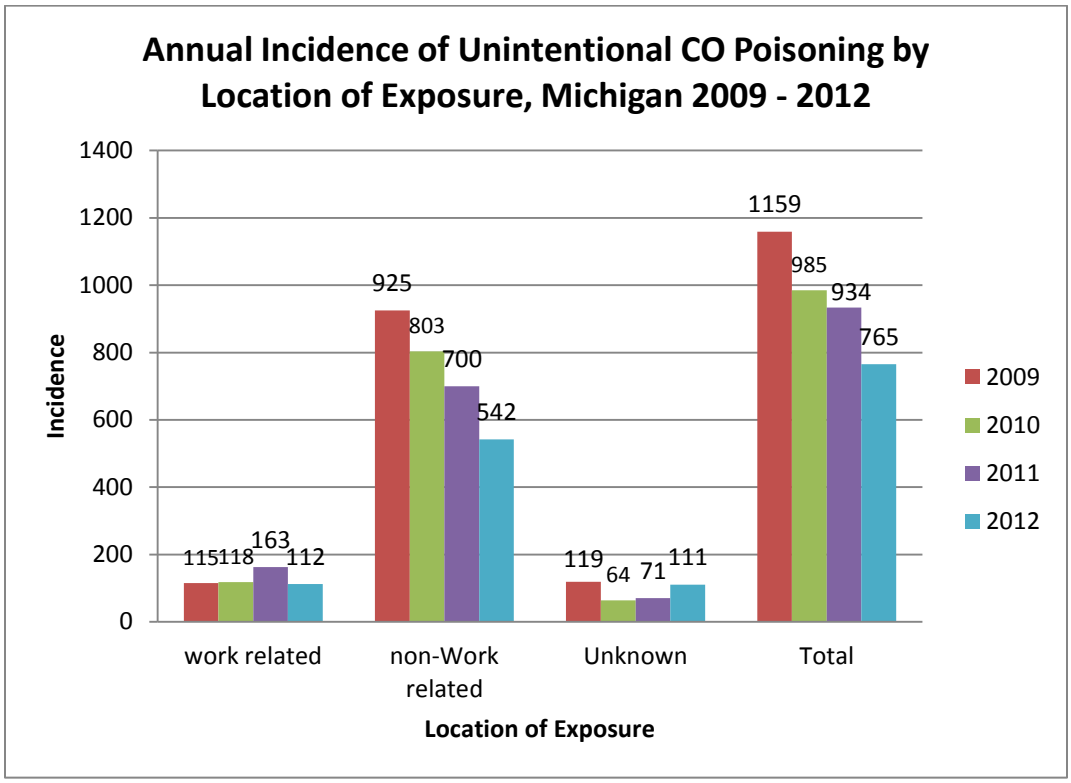
Figure 7



DISCUSSION

CO is one of the leading causes of unintentional poisoning deaths in the United States and 68,316 CO exposures were reported to poison centers in the U.S. during 2000—2009.[8] In Michigan, for the year 2012, reports were received on 765 individuals with confirmed unintentional CO poisoning. Twenty-two (2.9%) deaths were reported, five (31.8%) of which were fire related. The numbers of cases have decreased for each year of surveillance going back to 2009 (Figure 8). There were 51 fewer occupational poisonings, a 31% decrease from 2011, but no change from 2009 and 2010 (Figure 8)

Figure 8



The most common exposure source was a furnace or water heater in 113 (22.7%) individuals with 13 individuals being exposed at work (Table 5 and Figure 4 – source of exposure of all CO poisonings, Table 10 and Figure 6 – occupational sources of exposure). The known source in occupational settings was most commonly vehicles (25, 28.1%)

Most unintentional CO poisoning exposures occurred in January (85, 15.4%).

COHb testing was reported for 640 (84.7%) individuals. COHb reports are indicators of exposure; however levels reported cannot be considered an accurate measure of the true

extent of the exposure for several reasons. Results from hospital records will be lower than the level an individual would have at the time of exposure due to time elapsed between exposure and medical evaluation, and the administration of oxygen in the ambulance or emergency department (ED) prior to the COHb test. In the general non-smoking population, normal levels of COHb are less than 1%. Approximately half (42.8%) of the COHb measured levels were less than or equal to 5% (Table 4).

Hyperbaric oxygen treatment

Hyperbaric oxygen treatment is used to decrease the half-life of COHb. The Centers for Disease Control and Prevention (CDC) recommends considering hyperbaric treatment when the patient has:

- A COHb level of more than 25-30%
- Evidence of cardiac involvement
- Severe acidosis
- Transient or prolonged unconsciousness neurological impairment
- Abnormal neuropsychiatric testing
- Is greater than 36 years of age[11].

We did not have sufficient information to determine if the treating health care provider followed these CDC recommendations to consider hyperbaric oxygen and elected to not administer hyperbaric oxygen or did not follow the CDC guidelines (e.g. only 12% of individuals greater than 36 years of age were treated with hyperbaric oxygen).

Carbon monoxide detectors

Most of Michigan's unintentional CO exposures occurred in non-occupational settings. There are no non-occupational indoor air standards for CO in Michigan. Installation of CO detectors is recommended in homes that burn natural gas, oil or wood. Effective March 23, 2009, a modification to Michigan's Uniform Construction Code (Act 230 of 1972) mandated that all single-family and multi-family dwellings have CO detectors installed at the time of initial construction, addition of a bedroom, or other renovation in which a permit is required. The location of these detectors and other specifics are outlined in section 125.1504f of Michigan Compiled Laws.

The CO detectors cited in the Construction Code are required to meet ANSI/UL Standard 2034. Standard 2034 was designed to protect adults by alarming at a CO level which would produce a level of 10% COHb in an adult. For 2012, 640 individuals had a COHb level recorded. Of the 640, 409 (63.9%) had a COHb level of less than 10%.

Before Standard 2034 was revised, CO detectors alarmed at lower levels. This created a large number of false alarms in some communities during particular weather patterns or in areas of high vehicle traffic. In order to reduce the number of false alarms, CO detectors meeting Standard 2034 will not alarm at levels less than 30 ppm for 30 days. Individuals with atherosclerosis or history of heart disease or stroke may want to consider purchasing a CO detector with a digital readout and a button that can be pressed to give the highest reading recorded. Depending on the CO detector, the level on the readout may be lower than 30 ppm. This type of detector can be used to give an earlier warning of elevated CO in the home.

Limitations

Several limitations have been identified with Michigan's CO surveillance system: 1) Information may be missing in the different reporting sources (e.g., source or COHb level). 2) Hospitals and other sources may not be reporting all cases and some cases are just simply missed. 3) The surveillance system does not capture Michigan residents who were treated for CO poisoning in out-of-state hospitals. 4) CO poisoning, particularly at lower levels of exposure, is a difficult condition to diagnose. In addition, some individuals exposed to CO may not seek medical attention. Thus we presume there are additional cases of unrecognized CO poisoning.

Interventions

Identification of individuals diagnosed with CO poisoning is the first step to initiate preventive interventions. The four most common elevated CO exposures were from furnaces (22.7%), vehicles (14.9%), fire (14.5%), and generators (13.7%). After natural disasters or during prolonged periods of power interruptions, including construction projects, winter storms, and floods, the use of generators is quite common, increasing the potential of excessive CO exposure. In many cases of CO poisoning, the generator is operated close to a window, in an attached garage or even inside the home to prevent theft. These generators are often run under full load which increases the amount of CO produced. Studies have shown that a generator operating in the basement of a home can produce a lethal level of CO in 15 minutes.[9]

Educational materials and campaigns to address this issue have been developed by CDC (www.cdc.gov/co) and MDCH (www.michigan.gov/carbononoxide). Topics for public education include the potential sources of CO exposure, common symptoms associated with CO poisoning, and the hazards associated with CO, especially in the colder months when the frequency of adverse effects is greatest.

Prevention strategies in both the home and workplace include not allowing motor vehicles to idle in enclosed areas, regularly checking and maintaining motor vehicle emissions, ensuring all gas appliances are installed correctly and are located in properly ventilated areas and

substituting electric powered forklifts and other equipment for fuel powered equipment during indoor work.

For the workplace at the minimum, periodic air monitoring should be conducted to ensure that the Michigan Occupational Safety and Health Administration (MIOSHA) standard for General Industry of 35 parts per million (ppm) as an 8-hour time-weighted-average (TWA) exposure limit, with a 200 ppm ceiling, and, for construction 50 ppm TWA, with no ceiling limit is being met.

Ongoing vigilance is needed by the public to protect itself from CO exposure wherever combustion takes place. Health care providers need to be vigilant in recognizing CO toxicity by considering where a patient's symptoms are occurring and confirming with measurement of COHb.

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11. http://emergency.cdc.gov/disasters/co_guidance.asp

APPENDIX A

Appendix A Michigan Uniform Construction Code (Act 230 of 1972) section 125.1504f of Michigan Compiled Laws

STILLE-DEROSSETT-HALE SINGLE STATE CONSTRUCTION CODE ACT (EXCERPT)
Act 230 of 1972

125.1504f Single-family or multifamily dwelling; installation of operational and approved carbon monoxide device; requirements; failure to comply; penalty; liability; definitions; name of section.

Sec. 4f. (1) The director may provide for, at the time of initial construction of a single-family dwelling or a multifamily dwelling, or at the time of renovation of any existing single-family dwelling in which a permit is required, or upon the addition or creation of a bedroom, the installation of at least 1 operational and approved carbon monoxide device within the single-family dwelling or within each unit of the multifamily dwelling. A carbon monoxide device shall be located in the vicinity of the bedrooms, which may include 1 device capable of detecting carbon monoxide near all adjacent bedrooms; in areas within the dwelling adjacent to an attached garage; and in areas adjacent to any fuel-burning appliances.

(2) The carbon monoxide device described in subsection (1) may be battery-powered, plug-in with or without battery backup, wired into the dwelling's AC power line with secondary battery backup, or connected to a system by means of a control panel. If the international residential code is adopted by the director as part of a code adopted after the effective date of the amendatory act that added this section, those requirements apply and shall be followed upon the effective date of the code.

(3) An enforcing agency shall not impose a penalty for the failure of a person to comply with subsection (1) until the effective date of the code that may be adopted after the effective date of the amendatory act that added this section that incorporates that requirement.

(4) A person licensed under article 24 of the occupational code, 1980 PA 299, MCL 339.2401 to 339.2412, who is in compliance with this section or rules promulgated under the code and installs, in accordance with manufacturer's published instructions at the time of installation, a carbon monoxide device shall have no liability, directly or indirectly, to any person with respect to the operation, maintenance, or effectiveness of the carbon monoxide device.

(5) As used in this section:

(a) "Approved" means a carbon monoxide device that is listed as complying with either ANSI/UL 2034 or ANSI/UL 2075 and that is installed in accordance with the manufacturer's instructions.

(b) "Carbon monoxide device" means a device that detects carbon monoxide and alerts occupants via a distinct and audible signal that is either self-contained in the unit or activated via a system connection.

(c) "Operational" means working and in service.

(6) This section shall be known and may be cited as the "Overbeck law".

History: Add. 2008, Act 377, Eff. Mar. 23, 2009.

Popular name: Act 230

Popular name: Uniform Construction Code