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Mikyong (Meekie) Shin, MPH, DrPH

Kanta Sircar, MPH, PhD

Tracking Carbon Monoxide Poisoning to Better Understand How People Are Poisoned

Editor's Note: **As part of our continuing effort to highlight innovative approaches and tools to improve the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Centers for Disease Control and Prevention's (CDC's) Environmental Public Health Tracking Network (Tracking Network). The Tracking Network is a system of integrated health, exposure, and hazard information and data from a variety of national, state, and city sources. The Tracking Network brings together data concerning health and environmental problems with the goal of providing information to help improve where we live, work, and play.**

Environmental causes of chronic diseases are hard to identify. Measuring amounts of hazardous substances in our environment in a standard way, tracing the spread of these over time and area, seeing how they show up in human tissues, and understanding how they may cause illness is critical. The Tracking Network is a tool that can help connect these efforts. Through these columns, readers will learn about the program and the resources, tools, and information available from CDC's Tracking Network.

The conclusions of this article are those of the author(s) and do not necessarily represent the views of CDC.

Meekie Shin is an epidemiologist in the Environmental Health Tracking Branch. She is a subject matter expert on tracking carbon monoxide poisonings, heart attacks, and reproductive birth outcomes. Kanta Sircar is an epidemiologist in the Air Pollution and Respiratory Health Branch. She is a subject matter expert on carbon monoxide poisoning and air pollution epidemiology.

On an evening in December 2014, a teenager passed out after finishing a hockey game in Lake Delton, Wisconsin. Other players and spectators reported headaches, nausea, vomiting, and dizziness. Local emergency response staff were contacted and they conducted an air quality test upon arrival at the ice arena. The test revealed dangerously high levels of carbon monoxide (CO). Response staff worked with four area hospitals to triage people for appropriate care. In total, 92 people were seen, with two individuals requiring hyperbaric oxygen treatment (Vogt, Christenson, Olson, & Creswell, 2015).

Tracking CO Poisoning Mortality and Morbidity

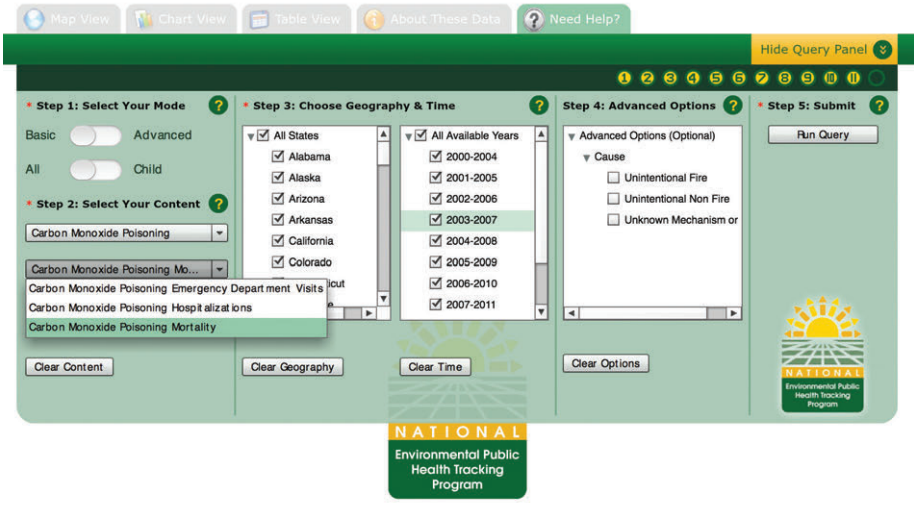
By tracking cases of CO poisoning and investigating their causes, public health findings have provided information to inform the development of laws and regulations. These developments include requiring CO detectors in new homes and other structures; engineering solutions to reduce the amount of CO emitted by appliances; and health education campaigns to promote CO detector use, regular maintenance of appliances, and proper use of generators following a power outage.

For decades, the Centers for Disease Control and Prevention (CDC) and state and local health departments have seen a critical need for public health solutions to CO poisoning. In 2013, the Council of State and Territorial Epidemiologists updated its CO poisoning position statement. They recommended CDC collect data on CO poisoning cases reported to state and local health departments, summarize it, and publish a national summary of CO poisoning (Council of State and Territorial Epidemiologists, 2013).

Planning and implementing this collection of data required the joint expertise of two programs at CDC's National Center for Environmental Health, Division of Environmental Hazards and Health Effects. CO poisoning mortality and morbidity surveillance is a collaboration between the Air Pollution and Respiratory Health Branch (APRHB) and the Environmental Health Tracking Branch. APRHB provides subject matter expertise in quantifying, investigating, and preventing CO poisoning through behavioral education (CDC, 2016a). The Tracking Branch guides

FIGURE **1**

Tracking Portal Displaying Carbon Monoxide Poisoning Indicators



surveillance activities and provides a platform for displaying the CO poisoning data. This platform, the National Environmental Public Health Tracking Network (Tracking Network), is a multitiered, web-based system of integrated health, exposure, and hazard information and data with components at national, state, and local levels. CO poisoning is one of the content areas included on the Tracking Network.

CO Poisoning Data

Working with APRHB and state and local partners, the Tracking Branch developed uniform case definitions using death certificate data and hospital and emergency department databases to measure the national burden of CO poisoning. There are three CO poisoning indicators on the Tracking Network: CO poisoning mortality, CO poisoning emergency department visits, and CO poisoning hospitalizations (Figure 1). Each indicator has three standardized measures: number of cases (count), crude rate (per 100,000 population), and adjusted rate (per 100,000 population). Also, each measure has an advanced option based on the CO poisoning cause: fire related, nonfire related, and unknown. All data are shown only at the state level in order to protect confidentiality of data and produce stable rates. For the mortality indicator, CDC combined 5 years of data to calculate the count and prevalence measures. The CO poisoning indicators related to the hospital and emergency department visits are calculated for single years.

Data for unintentional CO poisoning deaths, hospitalizations, and emergency department visits can be viewed in charts, maps, and tables on the Tracking Network. More information about the data and its limitations is available on the Tracking Network at www.cdc.gov/ephtracking. Additional data are available through the state and local tracking program Web sites (CDC, 2016b).

Tracking CO Poisoning at State and Local Health Departments

Recognizing CO poisoning as a preventable public health problem, many state health departments have established programs to help reduce the incidence of CO poisoning. CO poisoning monitoring by Tracking Program grantees has supported several public health actions, including identification of novel sources of CO exposure (e.g., the off-road motorsport known as mudbogging, indoor pool heaters, and bridge construction work), support for emergency response, and delivery of targeted messages to at-risk populations. A great example comes from Wisconsin.

Spurred by the CO poisoning incident at the ice rink in Lake Delton, the Wisconsin Tracking Program realized the state health department needed an active system to notify staff when a mass CO poisoning occurs. Wisconsin Poison Center leadership worked with Tracking Program epidemiologists to create an alert system. The new alert system sends an e-mail to tracking staff when an unusually high number of poisoning calls occur within a defined time frame. Tracking staff are now equipped to alert local public health authorities to potential CO poisoning issues and to provide guidance and technical assistance as needed. As Wisconsin's Tracking Program established the alert system, health department staff have access to near real-time information about mass CO poisoning in the state—information that can be used to prevent future events like the one in Lake Delton (Vogt et al., 2015).

Carbon Monoxide (CO) Poisoning

CO is a colorless, odorless, nonirritating gas that is produced through the incomplete combustion of hydrocarbons (U.S. Environmental Protection Agency, 2016). Sources of CO include combustion devices (e.g., boilers and furnaces), motor vehicle exhaust, generators and other gasoline or diesel powered engines, gas space heaters, woodstoves, gas stoves, fireplaces, tobacco smoke, and various occupational exposures (Council of State and Territorial Epidemiologist, 2013).

Breathing high levels of CO can cause severe illness and even death in just minutes. Every year, approximately 450 people in the U.S. die as a result of unintentional, nonfire related exposure to this toxic gas, and thousands more across the U.S. require emergency medical care for illness caused by CO poisoning (Centers for Disease Control and Prevention, 2008; Sircar et al., 2015). More cases of CO poisoning occur in the winter than in the summer, and after a natural disaster when utilities are down and people turn to alternative heating and energy sources.

For more information, check out the CO poisoning and the environment infographic at http://ephtracking.cdc.gov/showCOEnv.action.

Sharing Success Stories of Preventing Carbon Monoxide (CO) Poisoning

The Maine Department of Public Health has a long-standing focus on CO poisoning. In 2012, the Maine Tracking program identified two CO poisoning deaths from off-roading. These deaths were the first time that Maine's program encountered CO poisoning due to off-roading. They rapidly alerted public health staff to the new risk, created advisories, and brought awareness to the problem. They also shared their findings with other state health departments to spread awareness of the issue.

The Kansas Department of Public Health received a report that more than two dozen children were stricken with sudden, severe headaches and nausea at an indoor pool party held at a hotel in 2014. Tracking program and state health department public information staff developed an awareness campaign with educational materials that warned residents about CO risks and provided ways to prevent exposures. Messages were shared through statewide news releases and social media.

More success stories about CO poisoning and other environmental health topics can be found at www.cdc.gov/nceh/tracking/successstories.htm.

Future Directions

CO poisoning is preventable. APRHB and the Tracking Branch are working together to improve nationwide surveillance efforts to better capture the burden of CO poisoning and to identify the most vulnerable populations. One approach will be to add CO poisoning data from the National Poison Data System, which is compiled from poison control centers. The programs will collaborate to evaluate different public health interventions to determine if CO poisonings can be reduced. One area of focus is to inventory current state laws and regulations about CO alarm usage and to provide data to better inform regulators. As CO poisoning continues to be an important issue in post-disaster settings, the programs will also continue to collaborate with partners to develop public health tools, such as CDC's CO Poisoning Prevention Toolkit to help alert people about CO poisoning and decrease CO poisoning-related morbidity (National Public Health Information Coalition, 2014).

Corresponding Author: Kanta Sircar, Epidemiologist, Air Pollution and Respiratory Health Branch, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, CDC, 4770 Buford Highway NE, MS F-60, Atlanta, GA 30341. E-mail: ksircar@cdc.gov.

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