Using Poison Center Data for Postdisaster Surveillance

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Abbreviations:
CDC: Centers for Disease Control and Prevention
CO: carbon monoxide
DOH: local and state departments of health
KRPC: Kentucky Regional Poison Center
NPDS: National Poison Data System
PC: poison center

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Abstract:
The role of public health surveillance in disaster response continues to expand as timely, accurate information is needed to mitigate the impact of disasters. Health surveillance after a disaster involves the rapid assessment of the distribution and determinants of disaster-related deaths, illnesses, and injuries in the affected population. Public health disaster surveillance is one mechanism that can provide information to identify health problems faced by the affected population, establish priorities for decision makers, and target interventions to meet specific needs. Public health surveillance traditionally relies on a wide variety of data sources and methods. Poison center (PC) data can serve as data sources of chemical exposures and poisonings during a disaster. In the US, a system of 57 regional PCs serves the entire population. Poison centers respond to poison-related questions from the public, health care professionals, and public health agencies. The Centers for Disease Control and Prevention (CDC) uses PC data during disasters for surveillance of disaster-related toxic exposures and associated illnesses to enhance situational awareness during disaster response and recovery. Poison center data can also be leveraged during a disaster by local and state public health to supplement existing surveillance systems. Augmenting traditional surveillance data (ie, emergency room visits and death records) with other data sources, such as PCs, allows for better characterization of disaster-related morbidity and mortality. Poison center data can be used during a disaster to detect outbreaks, monitor trends, track particular exposures, and characterize the epidemiology of the event. This timely and accurate information can be used to inform public health decision making during a disaster and mitigate future disaster-related morbidity and mortality.

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Introduction

The role of public health surveillance in disaster response continues to expand as timely, accurate information is needed to mitigate the public health impact. Surveillance data provide actionable information for use by planners, emergency responders, and policy decision makers. During the past decade, the US experienced more than 650 federally-declared disasters causing billions of dollars in damage, thousands of deaths, and an unknown number of injuries and illnesses.[1] Health surveillance is defined as the ongoing, systematic collection, analysis, and interpretation of health data, essential to the planning, implementation, and evaluation of public health practice and closely integrated with timely dissemination.[2] Health surveillance after a disaster involves the rapid assessment of the distribution and determinants of disaster-related deaths, illnesses, and injuries in the affected population.[3] The ultimate goal of health surveillance after a disaster is to prevent the adverse health consequences of the disaster and assist decision-making processes associated with response and recovery.[3] Public health surveillance traditionally relies on a wide variety of data sources and methods. In recent years, new surveillance techniques (eg, syndromic surveillance) have been introduced to improve the timeliness of defining the nature and extent of health problems, identifying subpopulations at particular risk for adverse events, prioritizing response and recovery efforts, monitoring effectiveness of efforts, and providing recommendations for mitigating the health impact from future disasters.[3,4]

During a disaster, data must be collected rapidly under adverse conditions. Tapping into available data sources, using standardized procedures for collecting data, and having reliable sources can improve ability to collect information.[4,5] This report describes the value of poison center (PC) data as a source of information on chemical exposures and poisonings during a disaster and provides examples of how the data have been used in past disasters to inform disaster response. Calls to PCs can be indicative of the type of concerns in the affected community. For example, a disaster situation may lead to cases of carbon monoxide (CO) poisoning from the use of alternative sources of fuel for heating, gasoline exposure from siphoning, or food poisoning from inadequate refrigeration. If recognized as a public health threat, this data can potentially be used to drive public health and poisoning prevention messaging.

Report

In the United States, a system of 57 regional PCs serves the entire population of the 50 States, American Samoa, District of Columbia, Federated States of Micronesia, Guam, Puerto Rico, and the US Virgin Islands.[6] The PCs are available by phone free of charge, 24-hours a day, and 365 days a year. Poison centers respond to poison-related questions from the public, health care professionals, and public health agencies. Poison centers receive over 3.6 million calls annually involving an exposed human or animal or a request for information with no exposure.[6] Data are collected from each of these calls at the time of the call and uploaded into a national electronic database, the National Poison Data System (NPDS).[7] The NPDS is a data repository and web-based public health surveillance system. It is owned and operated by the American Association of Poison Control Centers. The NPDS collects call data from every PC and is used for national, near-real-time surveillance of potential toxic exposures and illness (ie, illness related to exposure to chemicals and poisons). Call data stored in NPDS includes basic demographics, clinical and management information, and the implicated exposure including the reason for exposure, amount of exposure, and substance. The data uploaded to NPDS are aggregated and analyzed by the Centers for Disease Control and Prevention (CDC) using automated algorithms to detect anomalies and trigger alerts. Alerts may be triggered by a data anomaly (ie, an increase in observed number of calls to a threshold based on historical data) or by a call meeting a specified case definition (eg, CO poisonings). Case definitions are a constellation of clinical signs or symptoms, demographic characteristics, specific products, or other exposure parameters. The CDC conducts its own analysis of NPDS data nationally, and also reports alerts of public health significance to states from which the calls originated.

In addition to the PC data available nationally to the CDC through NPDS, the NPDS system allows individual PCs and their state collaborators to create their own anomaly detection and alerting. Poison centers collect confidential information about the caller and detailed information about the exposure and medical consequences that are not available in the national NPDS database, but which may be accessed by local and state departments of health (DOHs) that have established data sharing agreements with their regional PCs.[7]

The CDC uses NPDS during disasters for surveillance of disaster-related toxic exposures and associated illnesses to enhance situational awareness during disaster response and recovery.[7] During a known event (eg, hurricane), PCs can label incoming calls with an event code, based on specified inclusion criteria, to allow for easy, systematic tracking of all calls related to the event. For example, after the 2011 earthquake and tsunami off the coast of Japan that led to the Fukushima Daiichi nuclear disaster, the CDC tracked the number of calls to PCs related to the Fukushima event.[8] From March 11, 2011 through April 18, 2011, 400 calls to PCs were associated with the event, with 340 calls requesting information about potassium iodide, radiation, and other iodine/iodide products and 60 calls reporting possible exposures to potassium iodide, radiation, and other iodine/iodide products. Based on the reported adverse health outcomes from misuse of iodine supplements, the PC data prompted the CDC and the DOHs to issue public health messaging and communication activities targeted at disseminating the correct information about the appropriate use of iodine supplements.[8]

Poison center data was also used following the 2010 Gulf of Mexico oil spill. On April 20, 2010 an explosion aboard the Deepwater Horizon drilling rig created the largest marine oil spill in history. In response, the CDC tracked all spill-related exposure and information calls.[9] From April 30, 2010 through July 31, 2010, the CDC identified 1,675 calls related to the oil spill. Of those calls, 1,028 were reporting a potential exposure. The top three reported health effects included headache (247), nausea (165), and coughing and choking (114). Summary analyses of oil spill data from PCs were shared with federal, state, and local public health officials to improve situational awareness and inform decision making for interventions.[9] During this event, PC information allowed public health to track the number of calls and type of concerns from the public and was used to create public health messaging regarding the disaster and related health effects.[10]

Poison center data can also be leveraged during a disaster by local and state public health to supplement existing surveillance systems. For example, PC data were used to track CO exposures during two disasters: Hurricane Sandy in the northeastern USA in 2012 and the ice storms in Kentucky (USA) in 2009.

Carbon monoxide exposure is a recurring public health concern during disasters.[11–15] Carbon monoxide is an odorless, colorless gas produced any time a fossil fuel is burned. Exposure to CO can cause adverse health effects ranging from fatigue and headache to cardiorespiratory failure, coma, and death.[12] During a disaster, such as a hurricane or winter storm, power outages occur and alternative sources of fuel for heating, cooling, or cooking are used. These alternative sources of fuel, combined with risky behavior, such as improper placement of generators, increase exposure to CO.[16] On October 29, 2012, Hurricane Sandy made landfall as a post-tropical cyclone along the cost of New Jersey (USA), leading to over 100 fatalities and causing major flooding and extensive power outages.[17] Within the first week following landfall, PCs in eight states reported over 260 CO exposures related to Hurricane Sandy, including four deaths from the use of a generator in a garage. The most frequently reported symptoms were headache (38%), nausea (24%), and dizziness (20%).[16] The DOHs and the CDC used information on these exposures to create public health messaging regarding the proper use of generators, alternative heating and cooking devices, the installation of battery-operated CO alarms in homes, and directions for what to do if exposed to CO.

The Kentucky Department of Public Health used PC data from the Kentucky Regional Poison Center (KRPC) to track CO exposures during a massive ice storm in January 2009 that left over 770,000 people without power across the state.[11] The storm caused extended power outages and disrupted transportation and communications. Damage was particularly severe in western

Kentucky; some households were without electricity for more than two weeks. During the two weeks following the storm, the KRPC received 115 CO exposure calls. Of these calls, 27% were in children younger than 18 years of age, and two deaths were reported. The most commonly reported exposure sources among the cases were heating devices (eg, kerosene heater and gas fireplace) and generators.[11] In response to the calls to KRPC, the Kentucky Department of Public Health issued news releases and public service announcements, distributed fact sheets, and activated a person-to-person network to contact members of vulnerable groups, such as the elderly, people with hearing impairments, and people living in remote areas, warning them of CO hazards. The Kentucky National Guard was mobilized for house-to-house welfare checks and other assistance. In coordination with the CDC and a mobile telephone provider, a mass text message regarding CO poisoning was sent to Kentucky residents.[11]

Discussion

To respond appropriately to the public health threats from disasters, timely and accurate information is required. The Hurricane Katrina Congressional Investigation committee reported that "many of the problems we have identified can be categorized as 'information gaps'… Better information would have been an optimal weapon against Katrina. Information sent to the right people at the right place at the right time."[18] Public health disaster surveillance is one mechanism that can provide information to identify health problems faced by the affected population, establish priorities for decision makers, and target interventions to meet specific needs. Surveillance has been used in recent years to provide data for case management, to detect outbreaks, target interventions, characterize the epidemiology of disease, injuries, and exposures, and evaluate effectiveness of public health programs.[4] Although health surveillance systems were originally designed to track infectious diseases, over the years, surveillance systems have become useful for noninfectious diseases and injures as well.[4] The wide-scale implementation of electronic information systems has increased the availability of a wide variety of data. With the availability of these data, prudent application of new analytic surveillance methods and interpretation of results from novel and nontraditional sources are being used to enhance public health capabilities and improve disaster response.[4,19]

While public health surveillance can be extremely helpful in a disaster setting, there are challenges to overcome, including the absence of baseline and logistical constraints impeding the collection of data. Using nontraditional data sources, such as PC data, can address some of these constraints and provide a more comprehensive picture of disaster-related morbidity and mortality. Poison center data can be used to determine who is most affected by disaster-related exposures. Appropriate public health messages can then be targeted to those populations. Using PC data to enhance situational awareness during the Fukushima Daiichi nuclear disaster, Gulf of Mexico oil spill, Hurricane Sandy, and the Kentucky ice storm responses allowed local, state, and federal public health departments to accomplish several goals. These included determining the extent of the problem, identifying trends in adverse exposures on a regional level, and identifying sources of adverse exposures. Information from these surveillance activities can be used to develop prevention strategies to reduce the future risk of morbidity and mortality from preventable exposures such as CO.

Poison centers have the ability to share real-time surveillance data with external organizations such as their DOHs.[6] According to a 2011 survey conducted by the Council for State and Territorial Epidemiologists, many states (58%) reported using PC data for disaster preparedness and response.[20] One way for DOHs to access PC data would be to establish relationships with PCs and work collaboratively to determine activities that mutually benefit both partners. Activities may include sharing surveillance technology, sharing real-time data streams, or enabling DOHs to create surveillance definitions for routing surveillance tasks or emerging public health threats with PC data.[20]

Conclusion

To appropriately respond to the public health threats of disasters, timely and accurate information is needed. Data must be collected rapidly under adverse conditions. To improve the traditional public health function of surveillance, public health departments may find it useful to update existing approaches and take advantage of evolving public health data sources such as PCs. Augmenting traditional surveillance data (ie, emergency room visits and death records) with other data sources allows for better characterization of disaster-related morbidity and mortality. Poison center data can be used during a disaster to detect outbreaks, monitor trends, track particular exposures, and characterize the epidemiology of the event. This timely and accurate information can be used to inform public health decision making during a disaster and mitigate future disaster-related morbidity and mortality.

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