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National Preparedness Month — September 2013

Each September since 2004, the Federal Emergency Management Agency (FEMA) has observed National Preparedness Month. During September, FEMA and various local, state, and federal agencies encourage U.S. residents to become better prepared for emergencies and disasters. Approximately 3,000 organizations, including the American Red Cross, Citizen Corps, and CDC (*1*), are scheduling events and activities this month in support of the preparedness initiative.

On this 10th anniversary of National Preparedness Month, CDC also is recognizing the first decade of activity of its Emergency Operations Center (*2*). Staffed around the clock, 365 days of the year, the center is a state-of-the-art command facility from which scientists and emergency personnel monitor and coordinate CDC's response to a wide range of public health threats (*3*).

All persons can take important steps to prepare themselves, their families, and loved ones for a possible disaster. CDC has various tools and checklists to help everyone "be ready" at home, at places of work and worship, and within the larger community (*4*). Additional information regarding emergency preparedness and response is available at http://www.cdc.gov/phpr.

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CDC's Emergency Management Program Activities — Worldwide, 2003–2012

In 2003, recognizing the increasing frequency and complexity of disease outbreaks and disasters and a greater risk for terrorism, CDC established the Emergency Operations Center (EOC), bringing together CDC staff members who respond to public health emergencies to enhance communication and coordination. To complement the physical EOC environment, CDC implemented the Incident Management System (IMS) (*1,2*), a staffing structure and set of standard operational protocols and services to support and monitor CDC program-led responses to complex public health emergencies. The EOC and IMS are key components of CDC's Emergency Management Program (EMP) (*3*), which applies emergency management principles to public health practice. To enumerate activities conducted by the EMP during 2003–2012, CDC analyzed data from daily reports and activity logs. The results of this

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Continuing Education examination available at http://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

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What is already known on this topic?

Since 2003, CDC's Emergency Management Program (EMP) has implemented standard incident management protocols and procedures and established an emergency operations center (EOC) to support field investigation, information interchange, and logistics functions required to effectively respond to complex public health emergencies.

What is added by this report?

During 2003–2012, the EOC had 55 activations and 109 utilizations. The EMP responded to a wide range of domestic and international emergencies, including infectious disease outbreaks and natural and man-made disasters.

What are the implications for public health practice?

Public health agencies' use of standardized, centralized, and structured systems and protocols, such as EOCs and Incident Management Systems, can improve emergency response capability and provide increased health security.

analysis determined that, during 2003–2012, the EMP fully activated the EOC and IMS on 55 occasions to support responses to infectious disease outbreaks, natural disasters, national security events (e.g., conventions, presidential addresses, and international summits), mass gatherings (e.g., large sports and social events), and man-made disasters. On 109 other occasions, the EMP was used to support emergency responses that did not require full EOC activation, and the EMP also conducted 30 exercises and drills. This report provides an overview of those 194 EMP activities.

The EMP can access all of CDC's organizational resources, enabling synchronization of public health emergency response activities and communications with international, federal, and state partners. EMP public health response activities are categorized as activations, utilizations, exercises and drills (Figure 1), and public health triage. Activations must be approved by the CDC Director and include use of the IMS, which includes the gathering of key staff members from across CDC to the EOC, coordination of planning and communications, logistics support, and field deployments (e.g., to a hurricane-damaged country) for a comprehensive agency-wide response. Utilization does not always require full EOC activation, but employs EMP services to meet the needs of the situation, such as call center operations, development of plans and situational awareness products, and travel assistance. Exercises and drills include full-scale emergency response exercises (deployment of staff and materiel to support a scenario that mimics a real emergency), tabletop exercises (discussion of a scenario), and drills (tests of a single response function). At all times, public health triage is used with telephone call and e-mail requests, linking CDC subject matter experts and resources with key partners, such as state and local health departments, other federal agencies, and public health practitioners.

During activations and exercises, IMS staff structures and protocols are used to support a standardized but flexible approach to CDC's public health response. Use of the IMS response model allows CDC to stay consistent with the

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incident command structure used by other agencies (*4*). The CDC center, institute, or office with primary responsibility for the public health problem being addressed (e.g., infectious disease or natural disaster) leads the response using the support structure and resources coordinated by the EMP.

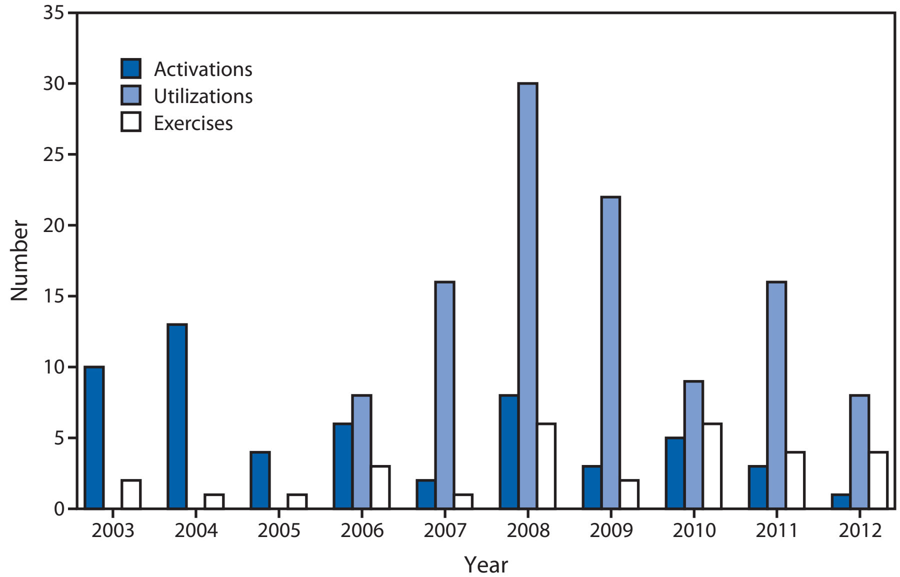
During 2003–2012, CDC supported 55 activations, with an average activation period of 52.9 days (1–394 days [excluding the ongoing polio activation]). The most common type of activation was for infectious disease outbreaks (22, 40.0%), including seven (31.8%) associated with respiratory illness. Natural disasters accounted for 16 (29.0%) of the activations, most commonly hurricanes (11, 68.8%). In addition, the EOC and IMS were activated to support the response to nine man-made disasters, seven national security events, and one mass gathering (Table). The longest activation to date has been the ongoing support of the international polio eradication campaign (643 days as of September 6, 2013).

Forty-one (74.6%) of the 55 activations were for responses occurring within the United States (Table). During this period, the activations for infectious disease outbreak responses most often were initiated in December; natural disaster activations occurred most commonly in August (Figure 2). Support functions were used 109 times for public health events not requiring activation (Figure 1). These included support for infectious disease outbreak investigations (52 times, 47.7%), natural disasters (31, 28.4%), monitoring of national security events (17, 15.6%) and mass gatherings (nine, 8.3%). The most common utilization events were for foodborne disease outbreaks (25). Among the 109 utilizations, 72 (66.1%) occurred in the United States (Table). The average duration of all utilizations was 10 days (range: 1–92 days).

The EMP either coordinated or was an integral participant in 30 full-scale or tabletop exercises and drills during this 10-year period. Twelve (40%) of the exercises and drills used terrorism event scenarios to test public health system response capabilities. In addition to these 30 exercises and drills, the EMP provided support for many exercises and drills conducted by its federal, state, and local emergency response partners.

Another important service offered by the EMP is its availability 24 hours a day, 365 days of the year to international and domestic partners for referral of telephone and e-mail requests for technical assistance and public health consultation. During 2004–2012, EOC watch officers triaged an average of 23,303 requests per year (range: 14,633–38,812).

FIGURE 1. Number of activations, utilizations, and exercises, by year initiated — Emergency Management Program, CDC, 2003–2012



The EMP provides technical assistance to multiple countries interested in learning more about EOC operations and use of the IMS. In 2013, the EMP sponsored its first five international emergency management fellows. The EMP also supports the Global Health Security Demonstration Project, an initiative conducted in partnership with the governments of Vietnam and Uganda and the World Health Organization, to build capacity for surveillance and detection and response to epidemics. The project has focused on developing plans to build additional EOCs and emergency response capability and to provide laboratory and information technology infrastructure to support global health security.

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Editorial Note

Preparing for and protecting against public health threats is a key aspect of CDC's mission, both domestically and around the world. The EMP has been used regularly for response to public health threats, including full activation of the EOC and use of the IMS structure or use of selected EMP support services, over the past 10 years. Simultaneously, the EMP has increased the number of drills and exercises that it supports to aid CDC programs in planning and preparedness activities. In recent

TABLE. Number of public health emergency activities (N = 194), by type, cause, and location — Emergency Management Program, CDC, 2003–2012

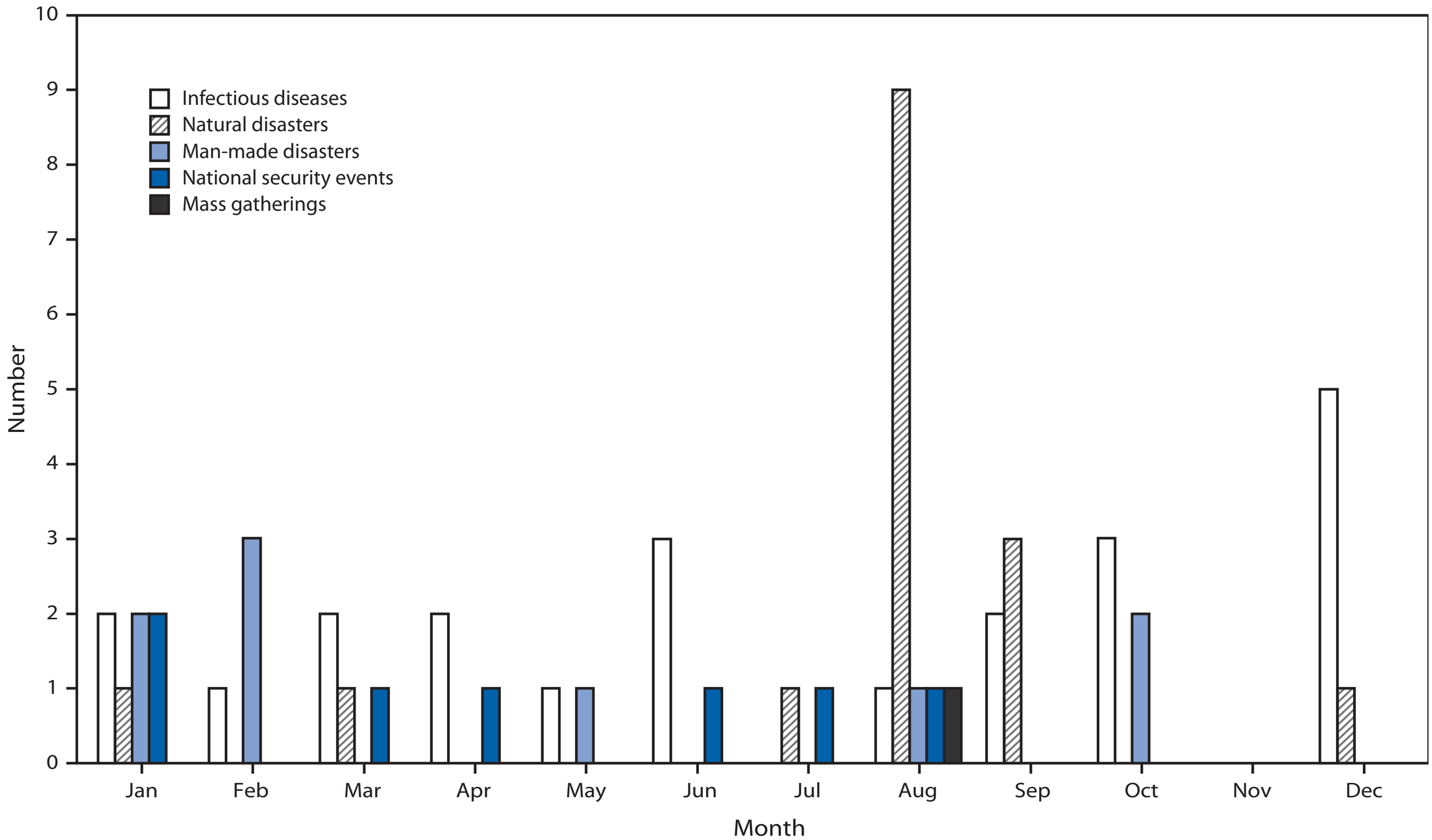
	Location			
Activity type/Cause	**Within United States**	**Outside United States**	**Both**	**Total**
Activations (n = 55)				
Infectious disease (40.0%)	**14**	**6**	**2**	**22**
Respiratory	3	2	2	**7**
Foodborne	7	0	0	**7**
Vaccine preventable	1	2	0	**3**
Viral hemorrhagic fever	0	1	0	**1**
Fungal	1	0	0	**1**
Vectorborne	1	0	0	**1**
Waterborne	0	1	0	**1**
Zoonotic	1	0	0	**1**
Natural disaster (29.0%)	**12**	**3**	**1**	**16**
Hurricane	10	0	1	**11**
Earthquake	0	3	0	**3**
Tropical storm	2	0	0	**2**
Man-made disaster (16.4%)	**8**	**0**	**1**	**9**
Bioterrorism	3	0	0	**3**
Space debris	1	0	1	**2**
Toxic spill	2	0	0	**2**
Blackout	1	0	0	**1**
Wildfire	1	0	0	**1**
National security event (12.7%)	**7**	**0**	**0**	**7**
Mass gathering (1.8%)	**0**	**1**	**0**	**1**
Total	**41**	**10**	**4**	**55**
Utilizations (n = 109)				
Infectious disease (47.7%)	**28**	**24**	**0**	**52**
Foodborne	18	7	0	**25**
Viral hemorrhagic fever	0	8	0	**8**
Waterborne	2	5	0	**7**
Respiratory	3	3	0	**6**
Vectorborne	2	1	0	**3**
Vaccine preventable	3	0	0	**3**
Natural disaster (28.4%)	**23**	**8**	**0**	**31**
Flood	6	3	0	**9**
Tropical storm	6	0	0	**6**
Earthquake	0	3	0	**3**
Hurricane	2	1	0	**3**
Volcano	2	1	0	**3**
Tornado	2	0	0	**2**
Ice storm	2	0	0	**2**
Unusual substance	2	0	0	**2**
Wildfire	1	0	0	**1**
National security event (15.6%)	**15**	**2**	**0**	**17**
Mass gathering (8.3%)	**6**	**3**	**0**	**9**
Total	**72**	**37**	**0**	**109**
Exercises and drills (n = 30)				
Full-scale exercise (66.7%)	**15**	**0**	**5**	**20**
Terrorism	7	0	0	**7**
Infectious disease	1	0	4	**5**
Multiple scenarios	4	0	0	**4**
Natural disaster	3	0	0	**3**
Man-made disaster	0	0	1	**1**
Tabletop exercise (26.7%)	**6**	**0**	**2**	**8**
Terrorism	4	0	1	**5**
Infectious disease	1	0	1	**2**
Natural disaster	1	0	0	**1**
Drill, not specified (6.7%)	**2**	**0**	**0**	**2**
Total	**23**	**0**	**7**	**30**

years, the protocols and services provided by the EMP have been modified in response to findings from after-action evaluations and surveys (Division of Emergency Operations, Office of Public Health Preparedness and Response, CDC, unpublished data, 2003–2012) to better meet the special needs of public health responses. Results from a 2011 EMP stakeholder survey (Division of Emergency Operations, Office of Public Health Preparedness and Response, CDC, unpublished data, 2011) indicated increasing awareness of the benefits of using the EMP for public health emergency response. Survey results also indicated the need for additional staff training in the use of the IMS for responses.

The uniqueness of emergency events and the multiple factors that influence their course make it challenging to measure the effectiveness of the EMP. Measures of performance and cost effectiveness associated with preparedness and response have not been clearly defined. In 2012, to assess and strengthen the emergency response, CDC began working toward agencywide accreditation by the Emergency Management Accreditation Program (EMAP). Participation in EMAP has allowed the EMP to begin to identify metrics to assess performance and the cost effectiveness of response activities.

Continued review of the EMP activations, utilizations, and exercises and drills will help CDC better understand and address the needs of its stakeholders, both domestic and international. Further evaluation of the effectiveness of the EMP and training in the use of the EOC and IMS protocols is needed for continued program improvements. Identifying and addressing the challenges faced by CDC staff members when engaged in EMP activities will improve CDC's ability to respond effectively and further strengthen the nation's health security.

FIGURE 2. Number of activations (N = 55), by month initiated and cause — Emergency Management Program, CDC, 2003–2012



Acknowledgments

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Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water and Other Nonrecreational Water — United States, 2009–2010

Despite advances in water management and sanitation, waterborne disease outbreaks continue to occur in the United States. CDC collects data on waterborne disease outbreaks submitted from all states and territories* through the Waterborne Disease and Outbreak Surveillance System.† During 2009–2010, the most recent years for which finalized data are available, 33 drinking water–associated outbreaks were reported, comprising 1,040 cases of illness, 85 hospitalizations, and nine deaths. *Legionella* accounted for 58% of outbreaks and 7% of illnesses, and *Campylobacter* accounted for 12% of outbreaks and 78% of illnesses. The most commonly identified outbreak deficiencies§ in drinking water-associated outbreaks were *Legionella* in plumbing¶ systems (57.6%), untreated ground water (24.2%), and distribution system deficiencies (12.1%), suggesting that efforts to identify and correct these deficiencies could prevent many outbreaks and illnesses associated with drinking water. In addition to the drinking water outbreaks, 12 outbreaks associated with other nonrecreational water** were reported, comprising 234 cases of illness, 51 hospitalizations, and six deaths. *Legionella* accounted for 58% of these outbreaks, 42% of illnesses, 96% of hospitalizations, and all deaths. Public health, regulatory, and industry professionals can use this information to target prevention efforts against pathogens, infrastructure problems, and water sources associated with waterborne disease outbreaks.

This report includes drinking water–associated outbreaks and other, nonrecreational waterborne disease outbreaks, in which the first illness occurred in 2009 or 2010. Outbreaks were reported to the Waterborne Disease and Outbreak Surveillance System through the electronic National Outbreak Reporting System†† as of October 3, 2012. Two criteria must be met for an event to be defined as a waterborne disease outbreak: 1) two or more persons must be linked epidemiologically by time, location of water exposure, and illness characteristics; and 2) the epidemiologic evidence must implicate water as the probable source of illness. Data requested for each outbreak include 1) the number of illnesses, hospitalizations, and deaths; 2) the etiologic agent (confirmed or suspected); 3) the implicated water system; 4) deficiencies contributing to the outbreak; and 5) the setting of exposure.

During 2009–2019, public health officials from 17 states reported 33 drinking water outbreaks (Table 1). The outbreaks resulted in 1,040 illnesses, 85 hospitalizations (8.2% of cases), and nine deaths. At least one etiologic agent was identified in all but one drinking water outbreak; *Legionella* was implicated in 19 outbreaks, 72 illnesses, 58 hospitalizations, and eight deaths, and *Campylobacter* was implicated in four single-etiology outbreaks involving 812 illnesses, 17 hospitalizations, and no deaths, as well as two multiple-etiology outbreaks resulting in 17 illnesses. The number and etiologies of drinking water outbreaks reported every year since 1971 were considered for comparison (Figure).

The etiologies, water systems, water sources, illnesses, and deficiencies identified for drinking water outbreaks and outbreak-associated cases were ranked in order of frequency (Table 2). *Legionella* caused the majority of outbreaks (57.6%); whereas non-*Legionella* bacteria caused the majority of illnesses (81.8%). The majority of outbreaks (75.8%) and outbreak-associated illnesses (79.4%) were linked to community water systems.§§ The majority of outbreaks (51.5%) and most illnesses (97.3%) occurred in systems that used ground water sources. The majority of outbreaks (57.6%) involved acute respiratory illness, whereas most outbreak-associated illnesses were acute gastrointestinal illness (92.6%). By deficiency categories, *Legionella* spp. in plumbing systems was present in the majority of outbreaks (19 [57.6%]); in three *Legionella* outbreaks, additional deficiencies in building-specific water

* Outbreak reports can be submitted by public health agencies in U.S states, the District of Columbia, Guam, Puerto Rico, the Marshall Islands, the Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Palau, and the U.S. Virgin Islands.

† A description of the Waterborne Disease and Outbreak Surveillance System is available at http://www.cdc.gov/healthywater/surveillance/index.html.

§ Outbreaks are assigned one or more deficiency classifications based on available data. The classifications provide information about how the water became contaminated, water system characteristics, and factors leading to waterborne disease outbreaks. A full description of CDC deficiency classification is available at http://www.cdc.gov/healthywater/surveillance/deficiency-classification.html.

¶ "Plumbing" refers to the pipes that are within a building or within a service line leading into a building, distinguished from the distribution system of pipes that comprise the water supply.

** Nonrecreational category includes outbreaks involving water not intended for drinking and water of unknown intended use, but does not include recreational water exposures, which are reported separately.

†† A description of the National Outbreak Reporting System is available at http://www.cdc.gov/nors/about.html. This reporting platform allows states to submit reports of waterborne, foodborne, animal-to-person, person-to-person, and unknown outbreaks to CDC. The Waterborne Disease and Outbreak Surveillance System transitioned from a paper-based system to electronic reporting through the National Outbreak Reporting System in 2009; this is the first report of data collected in the electronic system.

§§ Public water systems include community and noncommunity water systems, which have ≥15 service connections or serve an average of ≥26 residents for ≥60 days a year. A community water system serves year-round residents of a community, subdivision, or mobile home park. A noncommunity water system serves an institution, industry, camp, park, hotel, or business.

TABLE 1. Characteristics of waterborne disease outbreaks associated with drinking water (N = 33) and other nonrecreational water* (N = 12), by state/jurisdiction — Waterborne Disease and Outbreak Surveillance System, United States, 2009–2010

Exposure category and state/jurisdiction	Month	Year	Etiology	Predominant illness[†]	No. of cases	No. of hospital-izations[§]	No. of deaths[¶]	Water system**	Water source	Setting
Drinking water										
Florida	Jul	2009	*Legionella* sp.	ARI	2	2	0	Community	Well	Membership club
Idaho	May	2009	*Campylobacter* sp., *Giardia intestinalis*	AGI	7	0	0	Community	Well	Private residence
Maine	Jul	2009	Hepatitis A	Hep	2			Individual/Private	Well	Private residence
Maryland	Sep	2009	*Legionella pneumophila* serogroup 1, Knoxville 1	ARI	10	9	1	Community	Lake/Reservoir	Apartment/Condo
Nevada	Dec	2009	*Legionella pneumophila* serogroup 1	ARI	10	1	0	Community	Lake/Reservoir	Hotel/Motel
New York	Apr	2009	*Legionella pneumophila* serogroup 1	ARI	3	3	2	Community	Lake/Reservoir	Hospital/Health care
New York	Dec	2009	*Legionella pneumophila* serogroup 1	ARI	3	3	1	Community	Lake/Reservoir	Hospital/Health care
South Carolina	Jul	2009	*Legionella pneumophila* serogroup 1	ARI	3	3	0	Community	Ground water	Hotel/Motel
Utah	Jun	2009	*Legionella pneumophila* serogroup 1	ARI	5	5	0	Community	Well, spring	Hotel/Motel
Utah	Aug	2009	*Giardia intestinalis*	AGI	8	0	0	Community[††]	Well, surface water	Subdivision/Neighborhood
California	Jun	2010	Norovirus	AGI	47			Transient noncommunity	Well	Restaurant/Cafeteria
Georgia	Apr	2010	*Legionella pneumophila* serogroup 1	ARI	4	4	0	Community	Well, spring	Hotel/Motel
Illinois	Nov	2010	Unidentified[§§]	AGI; other[¶¶]	3	3	0	Commercially bottled	Unidentified	Church/Place of worship
Maryland	Aug	2010	*Legionella pneumophila* serogroup 1	ARI	2	2	0	Community	Surface water	Personal care home***
Minnesota	Jun	2010	*Giardia intestinalis*	AGI	6	0	0	Transient noncommunity	Well	State park
Missouri	Feb	2010	*Campylobacter jejuni*	AGI	16	5	0	Community	Well	Community/Municipality
Missouri	Mar	2010	*Campylobacter* sp.	AGI	67	4	0	Community	Well	Community/Municipality
Missouri	Apr	2010	*Escherichia coli* O157:H7	AGI	28	4	0	Community[†††]	Well	Membership club
Missouri	Nov	2010	*Escherichia coli* O157:H7	AGI	11	3	1	Individual/Private	Well	Private residence
Montana	Jul	2010	*Campylobacter jejuni*	AGI	101	6	0	Nontransient noncommunity	Well	Resort
Nevada	Dec	2010	*Legionella pneumophila* serogroup 1	ARI	4	2	1	Community	Well, river/stream	Hotel/Motel
New York	Apr	2010	*Legionella pneumophila* serogroup 1	ARI	3	3	1	Community	Lake/Reservoir	Hospital/Health care[§§§]
New York	Jun	2010	*Legionella pneumophila* serogroup 1	ARI	3	3	0	Community	Lake/Reservoir	Prison/Jail
New York	Jul	2010	*Legionella pneumophila* serogroup 1	ARI	2	2	0	Community	Lake/Reservoir	Hospital/Health care[¶¶¶]
New York	Jul	2010	*Legionella pneumophila* serogroup 1	ARI	5	3		Community	Lake/Reservoir	Hospital/Health care
Ohio	Feb	2010	*Legionella pneumophila*	ARI	3	3	0	Community	Unidentified	Long-term care facility
Pennsylvania	May	2010	*Legionella pneumophila* serogroup 1	ARI	3	3	1	Community****	Well	Personal care home
Pennsylvania	Jun	2010	*Legionella pneumophila* serogroup 1	ARI	2	2	0	Community	River/Stream	Apartment/Condo
Pennsylvania	Jul	2010	*Campylobacter jejuni*, *Cryptosporidium* sp.	AGI	10	0	0	Individual/Private	Well	Private residence
Utah	Apr	2010	*Campylobacter jejuni*	AGI	628	2	0	Community[††]	Well, spring	Community/Municipality
Utah	Aug	2010	*Legionella pneumophila* serogroup 1, Camperdown 1	ARI	2	2	1	Community	Spring, creek	Hotel/Motel

See table footnotes on page 716.

TABLE 1. (*Continued*) Characteristics of waterborne disease outbreaks associated with drinking water (N = 33) and other nonrecreational water* (N = 12), by state/jurisdiction — Waterborne Disease and Outbreak Surveillance System, United States, 2009–2010

Exposure category and state/ jurisdiction	Month	Year	Etiology	Predominant illness†	No. of cases	No. of hospital- izations§	No. of deaths¶	Water system**	Water source	Setting
Drinking water (*continued*)										
Utah	Dec	2010	*Legionella pneumophila* serogroup 1	ARI	3	3	0	Community	Well, surface water	Assisted living/ Rehab
Vermont	Jan	2010	*Cryptosporidium* sp.	AGI	34	0	0	Individual/ Private	Well	Vacation rental house
Other nonrecreational water*										
Alabama	Apr	2009	*Campylobacter jejuni*	AGI	11	0	0	Wilderness/ Natural water source	River/Stream	Backcountry
Illinois	Sep	2009	*Legionella pneumophila* serogroup 1	ARI	8	8	2	Unknown	Ornamental fountain, spa, irrigation††††	Assisted living/ Rehab
Missouri	Jul	2009	Unidentified	AGI	75	0	0	Wilderness/ Natural water source	Spring	Camp/Cabin
New York	Aug	2009	*Giardia intestinalis*	AGI	26	1	0	Wilderness/ Natural water source	Spring	Public outdoor area
Ohio	Sep	2009	*Legionella* sp.	ARI	2	2	0	Unknown	Unknown	Long-term care facility
Idaho	Jul	2010	*Campylobacter jejuni*	AGI	3	0	0	Wilderness/ Natural water source	River/Stream	Backcountry
Michigan	Jul	2010	*Legionella pneumophila* serogroup 1	ARI	64	17	0	Cooling/Air conditioning	Cooling tower	Military facility
Mississippi	Jun	2010	*Legionella pneumophila* serogroup 1	ARI	9	6	1	Cooling/Air conditioning	Cooling tower	Hotel/Motel
Nevada	Jun	2010	*Giardia intestinalis*	AGI	20	1	0	Irrigation	Puddle/ Canal/ Swamp	Public outdoor area
New York	Nov	2010	*Legionella pneumophila* serogroup 1	ARI	4	4	0	Industrial/ Occupational	Mist/Steam device	Factory/ Industrial facility
Texas	May	2010	*Legionella pneumophila* serogroup 1	ARI	4	4	3	Unknown	Unknown	Long-term care facility
Wisconsin	Feb	2010	*Legionella pneumophila* serogroup 1	ARI	8	8	0	Ornamental	Ornamental fountain	Hospital/Health care

Abbreviations: AGI = acute gastrointestinal illness; ARI = acute respiratory illness; Hep = hepatitis; Other = undefined; illnesses, conditions, or symptoms that cannot be categorized as gastrointestinal, respiratory, ear-related, eye-related, skin-related, neurologic, hepatitis, or caused by leptospirosis.

* Nonrecreational category includes outbreaks involving water not intended for drinking and water of unknown intent but does not include recreational water exposures, which are reported separately.

† The category of illness reported by ≥50% of ill respondents. All legionellosis outbreaks were categorized as ARI.

§ Value was set to missing in reports where zero hospitalizations were reported and the number of persons for whom information was available also was zero.

¶ Value was set to missing in reports where zero deaths were reported and the number of persons for whom information was available also was zero.

** Community and noncommunity water systems are public water systems that have ≥15 service connections or serve an average of ≥25 residents for ≥60 days a year. A community water system serves year-round residents of a community, subdivision, or mobile home park. A noncommunity water system serves an institution, industry, camp, park, hotel, or business and can be nontransient or transient. Nontransient systems serve ≥25 of the same persons for >6 months of the year but not year-round (e.g., factories and schools), whereas transient systems provide water to places in which persons do not remain for long periods of time (e.g., restaurants, highway rest stations, and parks). Individual water systems are small systems not owned or operated by a water utility that have <15 connections or serve <25 persons.

†† A cross-connection between potable and nonpotable water sources resulting in backflow was a suspected or confirmed factor in this outbreak.

§§ Etiology unidentified: contamination of water with sodium hydroxide suspected based upon incubation period, symptoms, outbreak investigation, and laboratory findings.

¶¶ The other symptoms reported were chemical esophagitis and burns in mouth.

*** Facility had an onsite disinfection system that was not operational at the time of the outbreak.

††† Setting was a recreational facility with multiple buildings. A private well that was originally used for a residence was reclassified as a community water system as a result of the outbreak investigation.

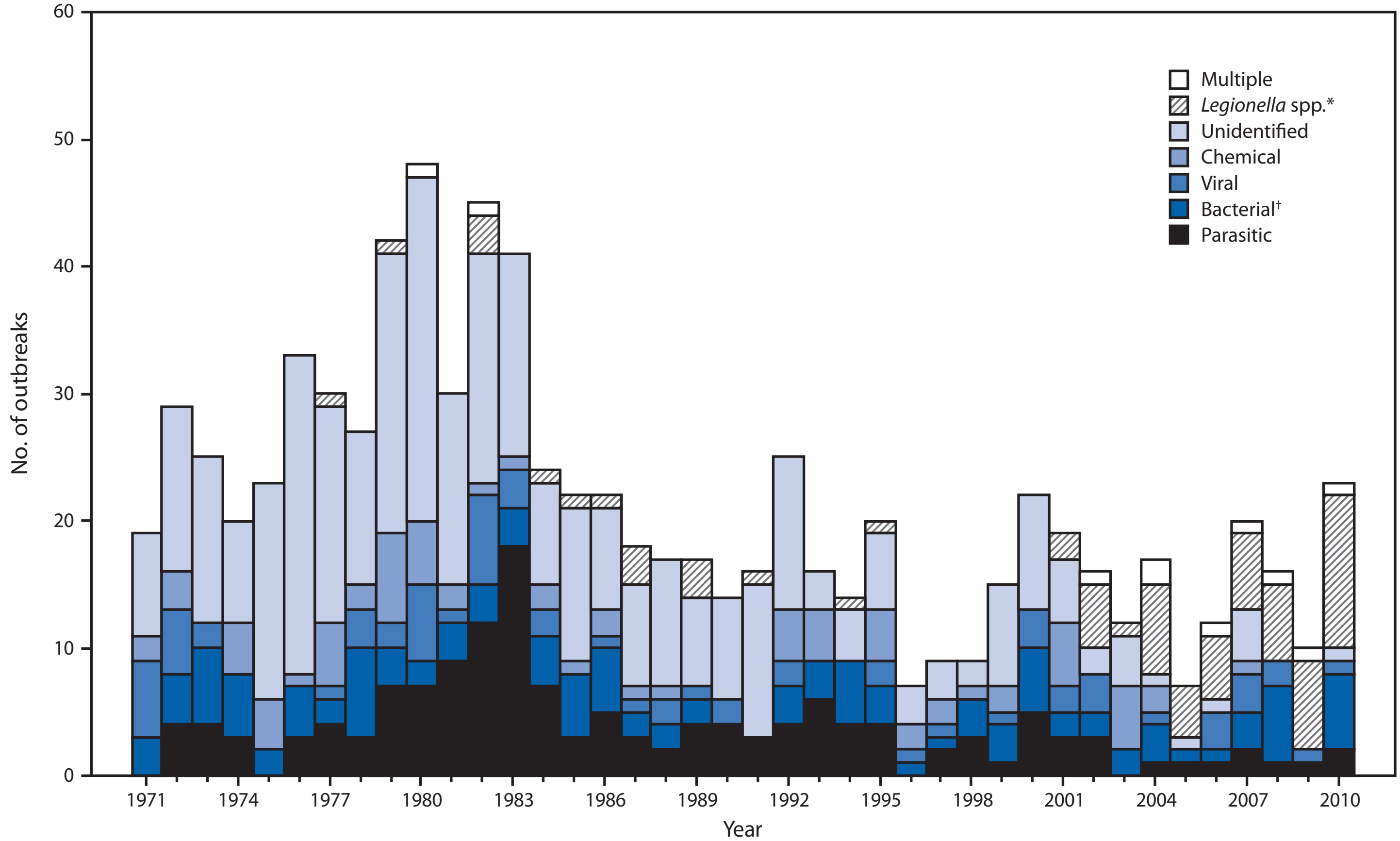
§§§ The facility had an onsite chlorine dioxide system; however, there were indicators that the system was not being monitored properly at the time of the outbreak.

¶¶¶ The facility had an onsite chlorine dioxide system and was being monitored for *Legionella*.

**** Reported contributing factors included a temporary disruption in disinfection and a cross-connection between potable and nonpotable water sources resulting in backflow.

†††† Multiple water sources within the facility were identified as possible exposures in this outbreak.

FIGURE. Number of waterborne disease outbreaks associated with drinking water (N = 851), by year and etiology — United States, 1971–2010



* Legionnaires' disease outbreaks were first reported to the Waterborne Disease and Outbreak Surveillance System in 2001; Legionnaires' disease outbreaks before 2001 were added retrospectively during the 2007–2008 reporting period.
† Includes all bacteria except *Legionella*.

treatment or plumbing systems were noted. Untreated ground water deficiency (i.e., contamination of ground water at the source) was identified in eight (24.2%) outbreaks, distribution system deficiency alone was identified in four (12.1%) outbreaks, and both deficiencies were identified in one outbreak (3.0%). Together, distribution system and untreated ground water deficiencies accounted for 965 (92.8%) of all outbreak-associated illnesses. All five outbreaks assigned a distribution system deficiency (i.e., distribution system or untreated ground water and distribution system) occurred in systems using ground water or mixed ground and surface water supplies; of these, three occurred in systems supplying unchlorinated ground water. Two of the distribution system-associated outbreaks (one in an unchlorinated supply) resulted from cross-connections (i.e., direct connections between piped water systems containing potable and nonpotable water).

In addition to the drinking water outbreaks, public health officials from 11 states reported 12 outbreaks associated with other nonrecreational water exposure (Table 1). The outbreaks included seven outbreaks of *Legionella* spp. resulting in 99 illnesses and six deaths. The water sources and settings for these outbreaks included cooling towers at a military facility and a hotel/motel setting, a mist/steam device in an industrial facility, an ornamental fountain in a health-care facility, and unidentified water exposures in long-term care, assisted-living, or rehabilitation facilities. The remaining outbreaks involved *Campylobacter* (two), *Giardia* (two), and acute gastrointestinal illness of unknown etiology (one) from ingesting water in various outdoor settings.

Reported by

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TABLE 2. Etiology, water system,* water source, predominant illness,† and deficiencies§ associated with drinking water outbreaks (N = 33) and outbreak-related cases (N = 1,040), ranked in order of frequency — Waterborne Disease and Outbreak Surveillance System, United States, 2009–2010

		Outbreaks (N = 33)			Cases (N = 1,040)		
Characteristic	**Rank**	**Category**	**No.**	**(%)**	**Category**	**No.**	**(%)**
Etiology							
	1	*Legionella*	19	(57.6)	Bacteria, non-*Legionella*	851	(81.8)
	2	Bacteria, non-*Legionella*	6	(18.2)	*Legionella*	72	(6.9)
	3	Parasites	3	(9.1)	Viruses	49	(4.7)
	4	Multiple¶	2	(6.1)	Parasites	48	(4.6)
	5	Viruses	2	(6.1)	Multiple¶	17	(1.6)
	6	Chemical**	1	(3.0)	Chemical**	3	(0.3)
Water system*							
	1	Community††	25	(75.8)	Community††	826	(79.4)
	2	Individual	4	(12.1)	Noncommunity	154	(14.8)
	3	Noncommunity	3	(9.1)	Individual	57	(5.5)
	4	Bottled	1	(3.0)	Bottled	3	(0.3)
Water source							
	1	Ground water††	17	(51.5)	Ground water††	974	(93.7)
	2	Surface water	10	(30.3)	Surface water	43	(4.1)
	3	Mixed§§	4	(12.1)	Mixed§§	17	(1.6)
	4	Unknown	2	(6.1)	Unknown	6	(0.6)
Predominant illness†							
	1	ARI	19	(57.6)	AGI	963	(92.6)
	2	AGI	12	(36.4)	ARI	72	(6.9)
	3	Multiple¶¶	1	(3.0)	Multiple¶¶	3	(0.3)
	4	Viral hepatitis***	1	(3.0)	Viral hepatitis***	2	(0.2)
Deficiency§							
	1	*Legionella* spp. in plumbing system††† §§§	19	(57.6)	Distribution system¶¶¶	710	(68.3)
	2	Untreated ground water****	8	(24.2)	Untreated ground water****	154	(14.8)
	3	Distribution system¶¶¶	4	(12.1)	Untreated ground water and distribution system††††	101	(9.7)
	4	Untreated ground water and distribution system††††	1	(3.0)	*Legionella* spp. in plumbing system††† §§§	72	(6.9)
	5	Point of use (bottled)§§§§	1	(3.0)	Point of use (bottled)§§§§	3	(0.3)

Abbreviations: AGI = acute gastrointestinal illness; ARI = acute respiratory illness.

* Public water systems include community and noncommunity water systems that have ≥15 service connections or serve an average of ≥26 residents for ≥60 days a year. A community water system serves year-round residents of a community, subdivision, or mobile home park. A noncommunity water system serves an institution, industry, camp, park, hotel, or business.

† The category of illness reported by ≥50% of ill respondents. All legionellosis outbreaks were categorized as ARI.

§ Outbreaks are assigned one or more deficiency classifications. Deficiency names have been shortened to fit. A full description of CDC deficiency classification is available at http://www.cdc.gov/healthywater/surveillance/deficiency-classification.html.

¶ Two outbreaks had multiple etiologic agent types. In one outbreak, the etiologies were *Camplyobacter* sp. (i.e., bacterium) and *Giardia intestinalis* (i.e., parasite). In a second outbreak, the etiologies were *Campylobacter jejuni* (i.e., bacterium) and *Cryptosporidium* sp. (i.e., parasite).

** Etiology unidentified: contamination of water with sodium hydroxide suspected based upon incubation period, symptoms, outbreak investigation, and laboratory findings.

†† Ten outbreaks (763 cases) were in community water systems that used a ground water source exclusively. Of these, three outbreaks (111 cases) were in systems that were documented as not treating the water with a disinfectant, five outbreaks (645 cases) were in systems that added chlorine as a disinfectant, and two outbreaks (seven cases) had no information on disinfection documented.

§§ Includes outbreaks with mixed water sources (i.e., ground water and surface water). Three legionellosis outbreaks were associated with mixed source community water systems. One giardiasis outbreak was associated with a mixed source community water system.

¶¶ Symptoms for one outbreak caused by suspected chemical ingestion were categorized as AGI and other. The other symptoms reported were chemical esophagitis and burns in mouth.

*** Hepatitis symptoms are categorized separately. One outbreak of viral hepatitis was caused by hepatitis A.

††† Deficiency 5A. Drinking water; contamination of water at points not under the jurisdiction of a water utility or at the point of use: *Legionella* spp. in water system, drinking water.

§§§ Multiple deficiencies were assigned to three *Legionella* outbreaks. In two outbreaks, which contributed five cases, there was a deficiency in building/home-specific water treatment. In one outbreak, which contributed three cases, there was a treatment deficiency outside of the building/home as well as a deficiency in the plumbing system.

¶¶¶ Deficiency 4. Drinking water; contamination of water at/in the water source, treatment facility, or distribution system: distribution system deficiency, including storage (e.g., cross-connection, backflow, and contamination of water mains during construction or repair). The four outbreaks involving distribution system deficiency included three outbreaks in systems using only ground water sources and one outbreak in a system using both ground and surface water. Two of the three ground water systems disinfected with chlorine, one ground water system and the system using ground and surface water did not disinfect.

**** Deficiency 2. Drinking water; contamination of water at/in the water source, treatment facility, or distribution system: untreated ground water.

†††† Outbreak involved both Deficiency 2 and Deficiency 4. Outbreak occurred in a nontransient, noncommunity water system using a ground water source that was not treated with a disinfectant.

§§§§ Deficiency 11C. Drinking water; contamination of water at points not under the jurisdiction of a water utility or at the point of use: contamination at point of use, commercially bottled water.

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Editorial Note

Since the early 20th century, water treatment processes and regulations have vastly reduced the transmission of illnesses through public drinking water supplies in the United States (*1*). The outbreaks reported during this surveillance period highlight several emerging and persisting public health challenges associated with drinking water systems. First, *Legionella* is the most frequently reported etiology among drinking water and other nonrecreational outbreaks. Fourteen of the 15 deaths reported were caused by *Legionella*, underscoring the need for improved *Legionella* control and mitigation methods. Second, the large proportion of outbreaks associated with untreated ground water (e.g., well water) indicates that additional efforts are needed to monitor ground water sources and protect them from contamination and to ensure that adequate, continuous disinfection is used when indicated by the results of monitoring and risk analyses (*2*). Finally, the large proportion (78%) of illnesses observed in outbreaks involving distribution system deficiencies emphasizes the importance of protecting, maintaining, and improving the public drinking water distribution system infrastructure (*3*) because these deficiencies can lead to widespread illness.

The total number of drinking water outbreaks reported during 2009–2010 (33) is similar to the number in previous 2-year intervals (e.g., 36 outbreaks during 2007–2008) (*4*). Although *Legionella* historically has been the most frequently reported etiology among drinking water outbreaks, during 2009–2010 *Legionella* comprised over half of reported drinking water outbreaks for the first time. In addition, *Legionella* also caused the majority of other nonrecreational water outbreaks (seven of 12). *Legionella* outbreaks are particularly challenging to prevent and control, in part because the organism multiplies in plumbing systems within buildings, which usually fall outside of regulatory oversight (*5,6*). Two of the 19 reported *Legionella* outbreaks occurred at health-care facilities where treatment systems to control *Legionella* growth had been installed, underscoring the limited effectiveness of engineering controls in complex plumbing systems.

In contrast to the emerging issue of *Legionella*, the problem of untreated ground water deficiencies in public and individual water systems persists. Full implementation of the Ground Water Rule, a federal regulation that aims to provide increased protection against microbial pathogens in public water systems that use ground water sources, might reduce the number of ground water outbreaks in public systems (*2*). However, this regulation does not address private wells, which the Environmental Protection Agency lacks the authority to regulate, emphasizing the continued need for education and outreach to private well owners to prevent outbreaks (*7,8*).

What is already known on this topic?

Despite advances in water management and sanitation, waterborne disease outbreaks continue to occur in the United States. CDC collects data on waterborne disease outbreaks submitted from all states and territories through the Waterborne Disease and Outbreak Surveillance System.

What is added by this report?

During 2009–2010, a total of 33 drinking water–associated outbreaks were reported to CDC, resulting in 1,040 cases of illness, 85 hospitalizations, and nine deaths. *Legionella* accounted for 58% of outbreaks and 7% of illnesses, and *Campylobacter* accounted for 12% of outbreaks and 78% of illnesses. The most commonly identified outbreak deficiencies were *Legionella* in plumbing systems (57.6%), untreated ground water (24.2%), and distribution system deficiencies (12.1%).

What are the implications for public health practice?

Efforts to identify and correct the deficiencies implicated in drinking water–related outbreaks, particularly deficiencies in distribution systems and untreated ground water systems, could prevent many outbreaks and illnesses. Additional research is needed to understand the interventions that are most effective for controlling growth of *Legionella* and reducing outbreaks of legionellosis.

Distribution system deficiencies continue to be a major contributor to drinking water outbreaks and outbreak-associated illnesses. Three outbreaks occurred in systems supplying unchlorinated water; if a disinfectant residual had been present, pathogens introduced by the distribution system deficiency might have been inactivated before the water reached consumers. Two outbreaks resulted from cross-connections between potable and nonpotable water pipes. The piecemeal nature of some infrastructure development might contribute to the occurrence of these cross-connections, highlighting the importance of distribution system monitoring and adherence to guidelines for the prevention of backflow of nonpotable water into the potable water supply (*5,9*).

The findings in this report are subject to at least two limitations. First, detection, investigation, and reporting of outbreaks are incomplete, and the level of surveillance and reporting activity varies across states and localities. Linking illness to drinking water is inherently difficult through outbreak investigation methods (e.g., case-control and cohort studies) because most persons have daily exposure to tap water (*10*). Environmental investigations provide information on deficiencies that contribute to outbreaks and strengthen evidence implicating drinking water as a common source of infection; however, capacity to conduct these investigations and report the results also differs by state and locality, and might change over time. For these reasons, outbreak surveillance should not be used to estimate the total number of illnesses from waterborne disease because most cases of waterborne disease are believed to occur sporadically or as part of outbreaks that are never recognized. Second, changes in the surveillance system occurred during this cycle, namely implementation of electronic reporting of waterborne disease outbreaks and the assignment of multiple deficiency categories for *Legionella* outbreaks. These changes do not affect the internal validity of the data in this report but might limit the ability to interpret trends in the number of outbreaks and deficiencies across reporting periods.

As observed in recent years, the proportion of outbreaks in the federally regulated portions of public water systems has declined, although these still contribute the majority of outbreak-associated illnesses. Deficiencies at points not under the jurisdiction of water utilities (e.g., private wells and plumbing systems) continue to cause illness. In addition, challenges with aging water infrastructure are ongoing, and efforts to understand the number of illnesses associated with drinking water distribution system deficiencies are needed. Partnerships between state and local public health agencies, as well as cooperation and coordination among epidemiologists, laboratorians, and environmental health specialists within agencies, are needed to optimize investigation and reporting of waterborne disease outbreaks. Additional information about the waterborne disease outbreaks reported during 2009–2010 is available at http://www.cdc.gov/healthywater/surveillance/drinking-surveillance-reports.html.

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Vital Signs: Avoidable Deaths from Heart Disease, Stroke, and Hypertensive Disease — United States, 2001–2010

On September 3, 2013, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Abstract

Background: Deaths attributed to lack of preventive health care or timely and effective medical care can be considered avoidable. In this report, avoidable causes of death are either preventable, as in preventing cardiovascular events by addressing risk factors, or treatable, as in treating conditions once they have occurred. Although various definitions for avoidable deaths exist, studies have consistently demonstrated high rates in the United States. Cardiovascular disease is the leading cause of U.S. deaths (approximately 800,000 per year) and many of them (e.g., heart disease, stroke, and hypertensive deaths among persons aged <75 years) are potentially avoidable.

Methods: National Vital Statistics System mortality data for the period 2001–2010 were analyzed. Avoidable deaths were defined as those resulting from an underlying cause of heart disease (ischemic or chronic rheumatic), stroke, or hypertensive disease in decedents aged <75 years. Rates and trends by age, sex, race/ethnicity, and place were calculated.

Results: In 2010, an estimated 200,070 avoidable deaths from heart disease, stroke, and hypertensive disease occurred in the United States, 56% of which occurred among persons aged <65 years. The overall age-standardized death rate was 60.7 per 100,000. Rates were highest in the 65–74 years age group, among males, among non-Hispanic blacks, and in the South. During 2001–2010, the overall rate declined 29%, and rates of decline varied by age.

Conclusions: Nearly one fourth of all cardiovascular disease deaths are avoidable. These deaths disproportionately occurred among non-Hispanic blacks and residents of the South. Persons aged <65 years had lower rates than those aged 65–74 years but still accounted for a considerable share of avoidable deaths and demonstrated less improvement.

Implications for Public Health Practice: National, state, and local initiatives aimed at improving health-care systems and supporting healthy behaviors are essential to reducing avoidable heart disease, stroke, and hypertensive disease deaths. Strategies include promoting the ABCS (aspirin when appropriate, blood pressure control, cholesterol management, and smoking cessation), reducing sodium consumption, and creating healthy environments.

Introduction

In the 1970s, a method for measuring the quality of medical care through identifying "untimely and unnecessary" deaths was proposed (*1*). This concept has since been expanded to include deaths attributed to lack of preventive health care (i.e., preventing cardiovascular events by addressing risk factors) or timely and effective medical care (i.e., treating patients who have cardiovascular conditions); these deaths are defined as avoidable (*2*). Although no standard method for measuring avoidable deaths exists, Canada (*3*), the United Kingdom (*4*), and the European Union (*5*) have introduced avoidable death measures for their surveillance systems. In several previous studies, the United States ranked higher in avoidable death rates compared with other industrialized countries (*6*).

Heart disease is the leading cause of death in the United States, and cardiovascular disease accounts for nearly 30% of all deaths annually (nearly 800,000 deaths) (*7*). Many heart disease and stroke deaths could be avoided through improvements in lifestyle behaviors, treatment of risk factors, and addressing the social determinants of health (i.e., economic and social conditions that influence the health of individuals and communities). Unhealthy lifestyle behaviors (e.g., tobacco use, inadequate physical activity, poor diet, and excessive alcohol use) coupled with uncontrolled hypertension, elevated cholesterol, and obesity account for 80% of ischemic heart disease mortality and approximately 50% of stroke mortality in high-income countries such as the United States (*8*). Hypertension is the single most important risk factor for stroke, and its control is essential to reducing death from stroke (*8*). Additional medical interventions, such as secondary prevention and evidence-based procedures to treat ischemic heart disease and stroke, have been shown to reduce deaths in the United States (*9,10*).

This report describes the epidemiology of avoidable deaths from heart disease, stroke, and hypertensive disease in the United

States, presents trends in avoidable death rates for these causes, and documents geographic disparities by state and county.

Methods

Mortality data from the National Vital Statistics System for the period 2001–2010 were analyzed. Bridged-race July 1 population estimates produced by the U.S. Census Bureau in collaboration with the National Center for Health Statistics were compiled using intercensal estimates for the period 2001–2009 and postcensal estimates for 2010.

In this report, avoidable deaths include all deaths among persons aged <75 years with an underlying cause of ischemic heart disease (*International Classification of Diseases, 10th Revision* [ICD-10] codes I20–I25), cerebrovascular disease (stroke) (I60–I69), hypertensive disease (I10–I15), or chronic rheumatic heart disease (I05–I09) (*2*). The analyses were limited to persons aged <75 years because the life expectancy of the total U.S. population in 2010 was 78.7, and 100% of these deaths in persons aged <75 years were considered to be preventable in accordance with previous analyses (*3–5*). Age-standardized death rates were calculated by sex, race/ethnicity,* and the decedent's state of residence at time of death, and trends were analyzed for the period 2001–2010 using joinpoint regression to calculate the average annual percentage change (AAPC). Rate comparisons were made using rate ratios (RRs). County-level rates for combined years 2008–2010 were calculated using a spatial empirical Bayesian smoothing technique to enhance the stability of the rates (*11*).

Results

In 2010, the total number of avoidable deaths from heart disease, stroke, and hypertensive disease was 200,070, and the death rate was 60.7 per 100,000 population (Table 1). Death rates in 2010 were highest in the oldest age group (65–74 years) (401.5 per 100,000) and lowest in the youngest age group (0–34 years) (1.9 per 100,000); however, 56% of the deaths (n = 112,329) occurred among those aged <65 years. Avoidable deaths were higher among males (83.7 per 100,000) than females (39.6) and blacks (107.3) compared with other races/ethnicities. Rates for blacks and American Indians/Alaska Natives were statistically significantly higher than those for whites (RR = 1.9 and 1.2, respectively), whereas rates for Hispanics and Asian/Pacific Islanders were significantly lower (RR = 0.8 and 0.6, respectively).

From 2001 to 2010, the avoidable death rate from heart disease, stroke, and hypertensive disease decreased 29%. The AAPC shows that rates decreased sharply for the 65–74 years age group (AAPC = -5.1), declined more gradually in the 55–64 years age group (AAPC = -3.3), declined minimally in the 35–54 years age group (AAPC = -0.8), and did not change in the youngest age group (Table 1). Declines occurred among both sexes and all race/ethnicity groups. Temporal trends for blacks and whites from 2001 to 2010 showed a decrease over time for all groups; however, black males consistently experienced the highest avoidable death rates throughout the period, and black females showed rates similar to white males (Figure 1).

By state, avoidable deaths from heart disease, stroke, and hypertensive disease in 2010 ranged from 36.3 to 99.6 per 100,000 population in Minnesota and the District of Columbia, respectively, a greater than two-fold difference (Table 2). All states experienced declines in rates for these avoidable causes during 2001–2010, ranging from an AAPC of -1.6 in Wyoming to an AAPC of -6.1 in New Hampshire. By county, the highest avoidable death rates in combined years 2008 to 2010 were concentrated primarily in the southern Appalachian region and much of Tennessee, Arkansas, Mississippi, Louisiana, and Oklahoma, whereas the lowest rates were located in the West, Midwest, and Northeast census regions† (Figure 2). Within states, substantial variation often occurred in the county rates, with some states experiencing a fourfold difference in death rates among counties (e.g., Colorado, Virginia, Kentucky, and Maryland).

Conclusions and Comment

Avoidable death rates from heart disease, stroke, and hypertensive disease in the United States vary by age, race/ethnicity, sex, place, and time. In 2010, an estimated 200,070 avoidable deaths from these causes occurred in the United States. Although the highest death rate occurred among those aged 65–74 years, the younger age groups (aged <65 years) still experienced a substantial number of avoidable deaths and a relatively slower rate of decline during 2001–2010. The avoidable death rate among blacks was nearly twice that of whites. Counties with the highest avoidable death rates were located primarily in the South census region.

The overall decrease in deaths from ischemic heart disease (the largest contributing cause of the avoidable deaths measured) can be attributed to both improvements in risk factors and changes in cardiac treatments (*9*). The variation

* Persons of Hispanic ethnicity might be of any race or combination of races. Persons identified as any of the other racial/ethnic categories were non-Hispanic.

† *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

TABLE 1. Number and rate of avoidable deaths* from heart disease, stroke, and hypertensive disease, by age, sex, and race/ethnicity — United States, 2001 and 2010

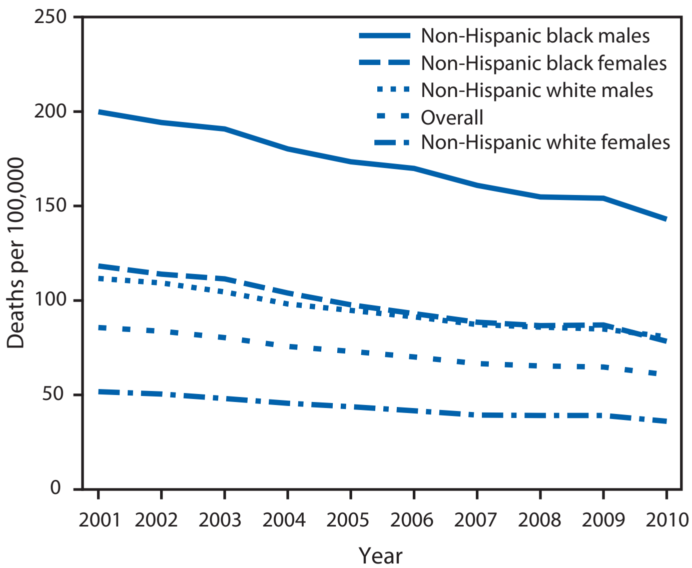
Characteristic	2001 No.	2001 Rate†	2001 (95% CI)	2010 No.	2010 Rate†	2010 (95% CI)	2010 Rate ratio	Average annual % change 2001 to 2010
Total	**227,961**	**85.7**	**(85.4–86.1)**	**200,070**	**60.7**	**(60.4–61.0)**	**—**	**-3.8§**
Age group (yrs)								
0–34	2,858	2.0	(2.0–2.1)	2,765	1.9	(1.8–2.0)	Referent	0.4¶
35–54	46,426	55.0	(54.5–55.5)	43,884	51.0	(50.6–51.5)	26.8§	-0.8§
55–64	61,015	243.0	(241.1–245.0)	65,680	178.6	(177.2–180.0)	94.0§	-3.3§
65–74	117,662	640.0	(636.4–643.7)	87,741	401.5	(398.8–404.1)	211.3§	-5.1§
Sex								
Males	146,189	116.9	(116.3–117.5)	132,215	83.7	(83.2–84.2)	Referent	-3.7§
Females	81,772	57.9	(57.5–58.3)	67,855	39.6	(39.3–39.9)	0.5§	-4.1§
Race/Ethnicity and sex								
White, non-Hispanic	168,732	80.4	(80.0–80.7)	142,448	57.8	(57.5–58.1)	Referent	-3.6§
Males	111,265	111.7	(111.0–112.4)	96,451	80.9	(80.3–81.4)	—	-3.5§
Females	57,467	51.7	(51.3–52.2)	45,997	36.1	(35.7–36.4)	—	-3.9§
Black, non-Hispanic	40,398	154.0	(152.5–155.6)	37,348	107.3	(106.2–108.5)	1.9§	-3.9§
Males	23,050	199.8	(197.2–202.5)	22,417	143.0	(141.1–144.9)	—	-3.6§
Females	17,348	118.3	(116.5–120.0)	14,931	78.4	(77.2–79.7)	—	-4.4§
Hispanic**	12,884	68.2	(67.0–69.4)	13,855	45.4	(44.7–46.2)	0.8§	-4.5§
Males	8,205	93.0	(91.0–95.1)	9,175	63.2	(61.8–64.5)	—	-4.3§
Females	4,679	46.8	(45.4–48.1)	4,680	29.7	(28.8–30.6)	—	-5.1§
AI/AN, non-Hispanic**	1,368	86.9	(82.1–91.6)	1,498	66.9	(63.5–70.4)	1.2§	-3.0§
Males	851	113.5	(105.7–121.4)	965	90.0	(84.2–95.8)	—	-2.5§
Females	517	63.1	(57.6–68.6)	533	45.9	(42.0–49.9)	—	-3.8§
Asian/Pacific Islander, non-Hispanic**	4,579	50.5	(49.0–52.0)	4,921	33.6	(32.6–34.5)	0.6§	-4.3§
Males	2,818	67.9	(65.3–70.4)	3,207	47.3	(45.7–49.0)	—	-3.7§
Females	1,761	36.0	(34.3–37.7)	1,714	21.9	(20.9–23.0)	—	-5.4§

Abbreviations: CI = confidence interval; AI/AN = American Indian/Alaska Native.
* Avoidable deaths from heart disease, stroke, and hypertensive disease are defined as all deaths occurring in persons aged <75 years with an underlying cause of ischemic heart disease, cerebrovascular disease, hypertensive disease, or chronic rheumatic heart disease.
† Per 100,000 population. Rates are age-standardized to the U.S. standard 2000 population except for age-specific rates.
§ Statistically different from zero at alpha = 0.05.
¶ Results based on small numbers.
** Numbers and rates for AI/ANs, Hispanics, and Asians/Pacific Islanders might be underreported because of coding issues on death certificates.

in age-specific rates of decline for avoidable deaths from heart disease, stroke, and hypertensive disease, with slower declines in the younger age group, could have resulted from multiple factors. Differential temporal trends in the percentage of adults without health insurance by age group are one possibility. Whereas the percentage of adults aged 18–64 years with no health insurance increased from 17% in 2001 to 22% in 2010, it remained at ≤2% among adults aged ≥65 years (because of Medicare coverage in this population) (*12*). Although avoidable death rates in those aged ≥35 years have declined over this interval, the increase in percentage without insurance among the younger age groups might have limited their access to preventive screenings and early treatment of high blood pressure and elevated cholesterol and, therefore, contributed to their slower decline in rates (*13,14*). Age-specific differences in risk factor management also might have contributed to the slower decline in the younger age group. Compared with persons aged ≥60 years, during 2009–2010, adults aged 18–39 years with high blood pressure experienced lower rates of treatment (43.5% versus 83.6%) and control (28.6% versus 47.0%) and saw no improvements in those rates from 2001 to 2010 (*15*). Furthermore, among persons aged 35–44 years, stroke hospitalizations increased during 2001–2006, whereas they remained constant for those aged 45–54 years and decreased among those aged 55–64 years (*16*). The finding of a slower decline in avoidable deaths in younger age groups in this report highlights the importance of improving prevention, diagnosis, and treatment efforts in younger adults.

Blacks experienced a disproportionate number of avoidable deaths from heart disease, stroke, and hypertensive disease, with nearly twice the rate as whites. Risk for avoidable death is particularly high among black males; in 2010, their rate was approximately 80% higher than that of white males and black females. Compared with whites, blacks have higher prevalence of cardiovascular disease risk factors, including high blood pressure, diabetes, obesity, physical inactivity, low fruit and vegetable consumption, and poor low-density lipoprotein cholesterol control (*13*). In addition, previous studies suggest

FIGURE 1. Age-adjusted rates* of avoidable death from heart disease, stroke, and hypertensive disease† among non-Hispanic blacks and non-Hispanic whites, by sex — United States, 2001–2010



* Rates are age-standardized to the U.S. standard 2000 population.
† Avoidable deaths from heart disease, stroke, and hypertensive disease are defined as all deaths occurring in persons aged <75 years with an underlying cause of ischemic heart disease, cerebrovascular disease, hypertensive disease, or chronic rheumatic heart disease.

that the U.S. black-white disparity in avoidable mortality reflects differences in education, income, living conditions, and access to health care (*2*). Interventions aimed at addressing these social determinants of health in combination with effective treatment and control of risk factors could help reduce black-white disparities in avoidable deaths (*17*).

State-level and county-level differences in avoidable death rates from heart disease, stroke, and hypertensive disease suggest the need for interventions that target areas with the highest rates and work with the resources, policies, and programs already existing in those areas. In 2010, the states with the highest avoidable death rates were located primarily in the South (e.g., District of Columbia, Mississippi, Oklahoma, Tennessee, and Louisiana). The states with the lowest rates were Minnesota, Utah, Colorado, Connecticut, and New Hampshire. During 2001–2010, all states experienced declines in avoidable death rates; however, some of the states that already had the lowest rates saw some of the steepest declines in absolute percentage change and AAPC (e.g., New Hampshire and Rhode Island), whereas some states with the highest rates had the slowest declines (e.g., Oklahoma and Arkansas). Moreover, variation in avoidable deaths exists within states by county (Figure 2). These geographic disparities support the need for local-level policy changes and system-level changes (e.g., promoting community design that increases access to sidewalks and bike lanes, improving the local food environment, enhancing worksite wellness programs, and improving insurance coverage) to improve access to quality health care and enhance or create the physical, social, and built environments needed to support healthy lifestyles (*18*).

The findings in this report are subject to at least four limitations. First, ICD-10 codes might misclassify cause of death, especially for stroke; however, more classification issues typically are experienced among the very old, a population not included in this study (*19*). Second, race and ethnicity might not be reported accurately on death certificates; this typically leads to underreporting of American Indian/Alaska Native, Asian/Pacific Islander, and Hispanic race/ethnicity (*20*). Third, death rate data in this report are based on residency at time of death and not on the state in which a person spent the majority of his or her life. Finally, there is no universally agreed upon definition for avoidable heart disease and stroke deaths, which could limit ability to compare these results with other studies. The strength of the methodology used in this report (*2*) is that it focuses on both preventable and treatable conditions whereas other methodologies might focus on one or the other. Other definitions of avoidable deaths resulting from these causes could lead to differing estimates, but most likely similar trends and associations.

Strong collaboration between health care and public health is critical to reduce the burden of avoidable deaths from heart disease, stroke, and hypertensive disease. The Million Hearts initiative is a national effort working to improve access and quality of care to reduce the incidence of heart disease and stroke through community and clinical prevention strategies. These strategies include promoting the ABCS of heart health (aspirin when appropriate, blood pressure control, cholesterol management, and smoking cessation); use of health information technology (to help doctors track and treat patients with high blood pressure and elevated cholesterol); and team-based care (an evidence-based collaborative model that is more effective in controlling high blood pressure and cholesterol than a single health-care provider working alone), as well as community prevention strategies, including tobacco control and reducing sodium and eliminating trans fats from foods. In addition, state-level and local-level initiatives are working to enhance community and clinical collaborations. For example, the state of Massachusetts is developing an electronic referral system and data exchange to enhance communication between clinicians and community resources such as telephone quitlines for smokers, physical activity supports, and blood pressure self-management to prevent heart disease and stroke risk factors more effectively. The Sodium Reduction in Communities Program is a county-level effort to help reduce sodium in schools, restaurants, and

TABLE 2. Number and rate of avoidable deaths* from heart disease, stroke, and hypertensive disease, by state — United States, 2001 and 2010

	2001			2010			Average annual % change 2001 to 2010§
State	No.	Rate†	(95% CI)	No.	Rate†	(95% CI)	
Alabama	4,290	96.2	(93.3–99.1)	3,998	75.2	(72.8–77.5)	-2.5
Alaska	313	69.8	(61.7–77.9)	359	52.5	(46.9–58.1)	-2.6
Arizona	3,798	75.2	(72.8–77.5)	3,686	52.5	(50.8–54.2)	-3.8
Arkansas	2,910	106.5	(102.6–110.4)	2,849	87.5	(84.2–90.7)	-1.9
California	22,673	79.6	(78.5–80.6)	19,734	54.4	(53.6–55.1)	-4.3
Colorado	2,070	57.0	(54.5–59.5)	2,041	39.9	(38.1–41.7)	-3.9
Connecticut	2,203	66.0	(63.3–68.8)	1,651	41.8	(39.8–43.8)	-5.7
Delaware	682	85.9	(79.4–92.3)	613	59.8	(55.0–64.6)	-3.6
District of Columbia	718	137.8	(127.7–147.9)	580	99.6	(91.4–107.8)	-3.7
Florida	15,317	82.8	(81.5–84.1)	13,143	57.3	(56.3–58.3)	-4.1
Georgia	6,569	93.8	(91.6–96.1)	6,480	66.7	(65.1–68.4)	-4.0
Hawaii	769	63.9	(59.4–68.5)	666	44.1	(40.7–47.5)	-3.6
Idaho	775	67.4	(62.6–72.1)	790	49.0	(45.6–52.5)	-4.2
Illinois	10,096	89.9	(88.2–91.7)	8,182	61.9	(60.6–63.3)	-4.1
Indiana	5,069	88.8	(86.4–91.3)	4,438	64.4	(62.5–66.3)	-3.6
Iowa	2,322	80.3	(77.0–83.6)	1,999	60.4	(57.7–63.1)	-2.8
Kansas	1,797	72.6	(69.2–75.9)	1,521	51.6	(49.0–54.3)	-3.6
Kentucky	3,998	100.7	(97.6–103.9)	3,721	77.5	(74.9–80.0)	-2.8
Louisiana	4,575	111.6	(108.3–114.8)	4,167	87.8	(85.1–90.5)	-2.5
Maine	952	69.7	(65.2–74.1)	743	44.5	(41.3–47.8)	-5.0
Maryland	4,549	92.1	(89.5–94.8)	4,018	65.1	(63.0–67.1)	-3.4
Massachusetts	3,944	65.0	(63.0–67.1)	3,109	43.9	(42.3–45.4)	-4.2
Michigan	8,770	94.0	(92.0–96.0)	7,860	71.3	(69.7–72.9)	-3.1
Minnesota	2,546	57.7	(55.4–59.9)	2,012	36.3	(34.7–37.9)	-4.6
Mississippi	3,307	124.9	(120.6–129.1)	2,974	95.0	(91.5–98.4)	-2.9
Missouri	5,150	93.3	(90.8–95.9)	4,784	72.4	(70.3–74.4)	-2.7
Montana	570	62.1	(57.0–67.2)	623	53.1	(48.9–57.4)	-2.3
Nebraska	968	60.4	(56.6–64.2)	861	46.0	(42.9–49.1)	-3.3
Nevada	1,900	93.1	(88.9–97.3)	1,811	61.5	(58.7–64.4)	-4.0
New Hampshire	884	74.9	(69.9–79.8)	654	42.9	(39.5–46.2)	-6.1
New Jersey	6,321	77.1	(75.2–79.0)	4,933	52.1	(50.6–53.5)	-4.6
New Mexico	1,171	67.8	(63.9–71.7)	1,196	52.1	(49.2–55.1)	-2.8
New York	16,363	89.8	(88.4–91.1)	12,881	62.1	(61.0–63.2)	-3.8
North Carolina	7,443	95.0	(92.9–97.2)	6,730	64.7	(63.2–66.3)	-4.1
North Dakota	478	77.0	(70.1–83.9)	383	53.2	(47.8–58.7)	-4.4
Ohio	10,512	94.8	(93.0–96.6)	8,891	69.1	(67.7–70.6)	-3.5
Oklahoma	3,573	104.9	(101.5–108.4)	3,641	89.8	(86.9–92.8)	-2.6
Oregon	2,227	68.0	(65.1–70.8)	1,888	43.3	(41.4–45.3)	-4.8
Pennsylvania	10,664	82.7	(81.1–84.3)	8,417	58.0	(56.8–59.3)	-3.8
Rhode Island	830	82.0	(76.4–87.6)	597	52.3	(48.1–56.6)	-4.7
South Carolina	3,959	99.8	(96.7–102.9)	3,923	73.8	(71.5–76.2)	-3.5
South Dakota	527	72.9	(66.6–79.1)	468	53.1	(48.2–57.9)	-3.1
Tennessee	6,342	112.7	(109.9–115.4)	6,311	88.8	(86.6–91.0)	-2.9
Texas	16,477	94.3	(92.9–95.8)	15,241	64.4	(63.4–65.4)	-4.3
Utah	846	54.0	(50.3–57.6)	806	36.9	(34.4–39.5)	-3.3
Vermont	396	65.8	(59.3–72.3)	364	47.8	(42.8–52.8)	-3.8
Virginia	5,350	80.4	(78.2–82.6)	4,663	54.6	(53.0–56.2)	-4.2
Washington	3,796	72.7	(70.3–75.0)	3,400	47.1	(45.5–48.7)	-4.5
West Virginia	2,044	101.8	(97.4–106.3)	1,716	74.5	(70.9–78.1)	-3.6
Wisconsin	3,842	75.6	(73.2–78.0)	3,232	52.5	(50.7–54.3)	-3.8
Wyoming	316	66.2	(58.8–73.5)	322	52.8	(46.9–58.7)	-1.6

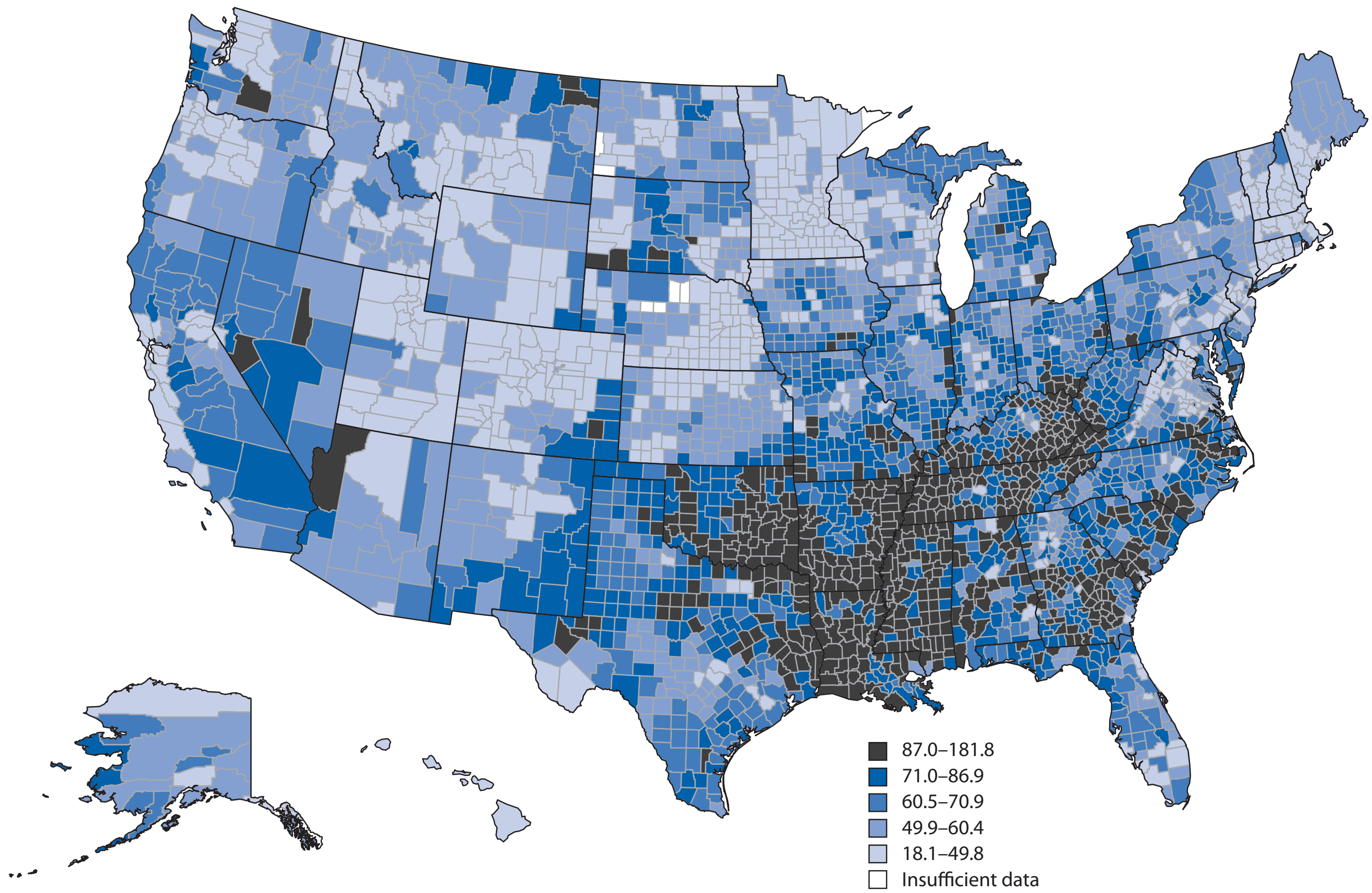
Abbreviation: CI = confidence interval.

* Avoidable deaths from heart disease, stroke, and hypertensive disease are defined as all deaths occurring in persons aged <75 years with an underlying cause of ischemic heart disease, cerebrovascular disease, hypertensive disease, or chronic rheumatic heart disease.

† Per 100,000 population. Rates are age-standardized to the U.S. standard 2000 population.

§ All annual average percentage changes are statistically different from zero at alpha = 0.05.

FIGURE 2. Rates* of avoidable death from heart disease, stroke, and hypertensive disease,† by county — United States, 2008–2010§



* Per 100,000 population. Rates are averaged over the 2008–2010 period and age-standardized to the U.S. standard 2000 population. Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

† Avoidable deaths from heart disease, stroke, and hypertensive disease are defined as all deaths occurring in persons aged <75 years with an underlying cause of ischemic heart disease, cerebrovascular disease, hypertensive disease, or chronic rheumatic heart disease.

§ Additional maps by race/ethnicity and sex are available on the Interactive Atlas for Heart Disease and Stroke at http://nccd.cdc.gov/dhdspatlas.

other venues while also educating the public on sodium reduction (*21*). Reducing sodium in foods can aid in control of high blood pressure. Finally, individuals can work toward reducing their own heart disease and stroke risk. The American Heart Association has defined seven simple steps to a healthier heart to help individuals increase healthy behaviors (*22*). Although this report defined avoidable deaths as those occurring in persons aged <75 years based on life expectancy in the United States, these public health, health-care, community, and patient strategies can help reduce deaths from heart disease and stroke in the United States across all age groups.

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Key Points

- Minimal declines in avoidable deaths from heart disease, stroke, and hypertensive disease occurred in younger age groups (0–34 and 35–54 years) compared with older age groups (55–64 and 65–74 years).
- Non-Hispanic blacks experience a disproportionately large number of avoidable deaths, with nearly twice the rate of avoidable death as non-Hispanic whites.
- Rates of avoidable deaths from heart disease, stroke, and hypertensive disease are highest in the South.
- Additional information is available at http://www.cdc.gov/vitalsigns.

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Notes from the Field

Investigation of a Cluster of Neural Tube Defects — Central Washington, 2010–2013

During August 2012, a health-care provider in central Washington alerted the Washington State Department of Health (DOH) about an excessive number of anencephaly births at a local hospital. After examining referral patterns for high-risk pregnancies in central Washington, DOH identified pregnancies affected by a severe neural tube defect (NTD) in a three-county area. Case findings included a review of area hospital discharge records for *International Classification of Diseases, Ninth Revision* codes 740, 741, 742, or 655.0; vital statistics reports; and perinatology office records. From these sources, 27 confirmed NTD-affected pregnancies occurring during January 2010–January 2013 were identified among women residing in the three-county area. Twenty-three pregnancies were affected by anencephaly, three with spina bifida, and one with encephalocele. The anencephaly rate was 8.4 per 10,000 live births (95% confidence interval [CI] = 4.5–12.0), compared with a national estimate of 2.1 per 10,000 live births (CI = 1.9–2.2) (*1*). In contrast, the rate of spina bifida was 1.3 per 10,000 live births (CI = 0.3–3.8), compared with 3.5 per 10,000 live births nationally (CI = 3.3–3.7) (*1*).

During February 2013, a case-control study was conducted by abstracting prenatal records from the 27 NTD-affected pregnancies and 108 randomly selected control subject pregnancies in women who had received care at the same 13 prenatal clinics. Control subjects were matched to case-patients by the month and year of last menstrual period. Eligibility criteria for control subjects included a pregnancy without an indication of a structural or genetic birth defect during routine prenatal care and prenatal residence in one of the three study counties. Information abstracted from medical records included sociodemographic characteristics, maternal and paternal occupations, maternal smoking and alcohol use, pregnancy health conditions (e.g., anemia, diabetes, or infectious diseases), parity, gravidity, prepregnancy height and weight, and medication use (including over-the-counter remedies, vitamins, and folic acid supplementation). Residential address during pregnancy was used to determine use of public versus private well-water supply.

No statistically significant differences were identified between cases and controls, and a clear cause of the elevated prevalence of anencephaly was not determined. DOH recommended reminding doctors about the importance of folic acid supplementation for women of childbearing age (*2*), and monitoring private well nitrate concentrations because of their potential association with birth defects and other adverse health outcomes (*3*). Active surveillance of new NTD cases began February 2013 and will continue through 2013.

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Notes from the Field

Electronic Cigarette Use Among Middle and High School Students — United States, 2011–2012

Electronic cigarettes, or e-cigarettes, are battery-powered devices that provide doses of nicotine and other additives to the user in an aerosol. Depending on the brand, e-cigarette cartridges typically contain nicotine, a component to produce the aerosol (e.g., propylene glycol or glycerol), and flavorings (e.g., fruit, mint, or chocolate) (*1*). Potentially harmful constituents also have been documented in some e-cigarette cartridges, including irritants, genotoxins, and animal carcinogens (*1*). E-cigarettes that are not marketed for therapeutic purposes are currently unregulated by the Food and Drug Administration, and in most states there are no restrictions on the sale of e-cigarettes to minors. Use of e-cigarettes has increased among U.S. adult current and former smokers in recent years (*2*); however, the extent of use among youths is uncertain.

Data from the 2011 and 2012 National Youth Tobacco Survey (NYTS), a school-based, pencil-and-paper questionnaire given to U.S. middle school (grades 6–8) and high school (grades 9–12) students, were used to estimate the prevalence of ever and current (≥1 day in the past 30 days) use of e-cigarettes, ever and current (≥1 day in the past 30 days) use of conventional cigarettes, and use of both. NYTS consists of a cross-sectional, nationally representative sample of students in grades 6–12 from all 50 states and the District of Columbia (*3*).

During 2011–2012, among all students in grades 6–12, ever e-cigarette use increased from 3.3% to 6.8% ($p<0.05$) (Figure); current e-cigarette use increased from 1.1% to 2.1% ($p<0.05$), and current use of both e-cigarettes and conventional cigarettes increased from 0.8% to 1.6% ($p<0.05$). In 2012, among ever e-cigarette users, 9.3% reported never smoking conventional cigarettes; among current e-cigarette users, 76.3% reported current conventional cigarette smoking.

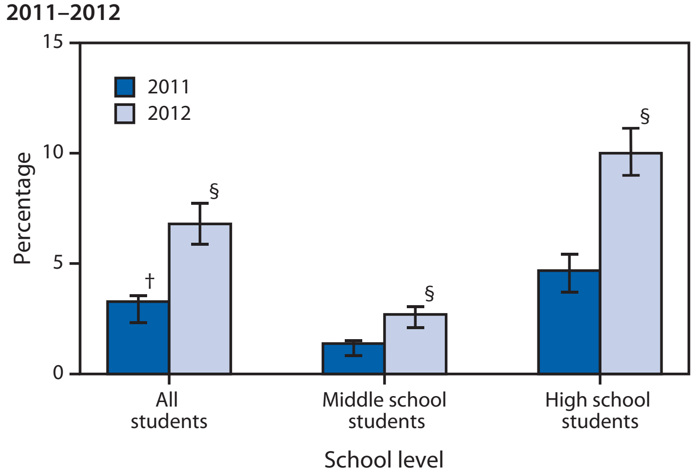
Among middle school students, ever e-cigarette use increased from 1.4% to 2.7% during 2011–2012 ($p<0.05$) (Figure); current e-cigarette use increased from 0.6% to 1.1% ($p<0.05$), and current use of both e-cigarettes and conventional cigarettes increased from 0.3% to 0.7% ($p<0.05$). In 2012, among middle school ever e-cigarette users, 20.3% reported never smoking conventional cigarettes; among middle school current e-cigarette users, 61.1% reported current conventional cigarette smoking.

Among high school students, ever e-cigarette use increased from 4.7% to 10.0% during 2011–2012 ($p<0.05$) (Figure); current e-cigarette use increased from 1.5% to 2.8% ($p<0.05$), and current use of both e-cigarettes and conventional cigarettes increased from 1.2% to 2.2% ($p<0.05$). In 2012, among high school ever e-cigarette users, 7.2% reported never smoking conventional cigarettes; among high school current e-cigarette users, 80.5% reported current conventional cigarette smoking.

E-cigarette experimentation and recent use doubled among U.S. middle and high school students during 2011–2012, resulting in an estimated 1.78 million students having ever used e-cigarettes as of 2012. Moreover, in 2012, an estimated 160,000 students who reported ever using e-cigarettes had never used conventional cigarettes. This is a serious concern because the overall impact of e-cigarette use on public health remains uncertain. In youths, concerns include the potential negative impact of nicotine on adolescent brain development (*4*), as well as the risk for nicotine addiction and initiation of the use of conventional cigarettes or other tobacco products.

CDC and the Food and Drug Administration will continue to explore ways to increase surveillance and research on e-cigarettes. Given the rapid increase in use and youths' susceptibility to social and environmental influences to use tobacco, developing strategies to prevent marketing, sales, and use of e-cigarettes among youths is critical.

FIGURE. Ever electronic cigarette use* among middle and high school students, by year — National Youth Tobacco Survey, United States, 2011–2012



* Ever electronic cigarette use defined as having ever used electronic cigarettes, even just one time.
† 95% confidence interval.
§ Statistically significant difference between 2011 and 2012 (chi-square, $p<0.05$).

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Announcement

Laboratory Quality Improvement Tutorial Available from CDC

Application of Laboratory Medicine Best Practices (LMBP) Initiative A-6 Methods for Laboratory Practitioners, a free, online continuing education course, is now available from CDC. This 1-hour tutorial provides a model for the stepwise design and implementation of quality improvement studies, including how these studies can advance evidence-based laboratory medicine. The format presents access to published journal articles, project planning templates, and informative websites. The course is available at https://www.futurelabmedicine.org/tutorials.

Errata

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In the Recommendations and Reports, "Diagnosis and Management of Q Fever — United States, 2013: Recommendations from CDC and the Q Fever Working Group" on page 6, in Table 2, the following errors occurred.

In the third column, "Children," the recommended treatment of acute Q fever for children aged <8 years with mild or uncomplicated illness, should read as follows: "Doxycycline 2.2 mg/kg per dose twice a day for 5 days (maximum 100 mg per dose). If patient remains febrile past 5 days of treatment: trimethoprim/sulfamethoxazole 4–20 mg/kg**/24 hours (dose based on trimethoprim component) in equally divided doses every 12 hours (maximum: 320 mg trimethoprim per 24 hours)**"

In the fourth column, "Pregnant women," the recommended treatment of acute Q fever for pregnant women should read as follows: "Trimethoprim/sulfamethoxazole: 160 mg/800 mg twice a day throughout pregnancy **but not beyond 32 weeks' gestation**[††]

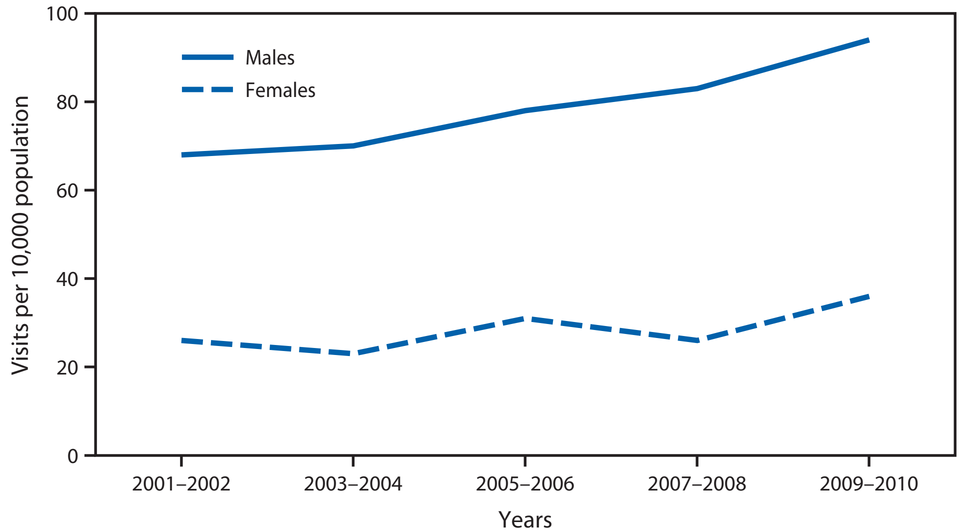
In the [¶] footnote, the following sentence should be added at the end: "**Trimethoprim/sulfamethoxazole is contraindicated in children aged <2 months.**"

In the [††] footnote, the following sentence should be added at the end: "**Trimethoprim/sulfamethoxazole should be discontinued for the final 8 weeks of pregnancy because of the risk for hyperbilirubinemia**."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Rate* of Emergency Department Visits for Alcohol-Related Diagnoses,† by Sex — National Hospital Ambulatory Medical Care Survey, United States, 2001–2002 to 2009–2010



* Rate per 10,000 population, based on 2-year annual average. Rates were calculated using U.S. Census Bureau 2000-based postcensal noninstitutionalized civilian population estimates.

† Defined as any-listed diagnosis codes 291, 303, 305.0, 357.5, 425.5, 535.3, 571.0–571.3, and 790.3, and any-listed cause of injury code E860.0 based on the *International Classification of Diseases, Ninth Edition, Clinical Modification*. Not included are emergency department visits that might be attributed to alcohol use, such as falls, motor vehicle crashes, and other types of injuries/conditions.

From 2001–2002 to 2009–2010, the rate of emergency department visits for alcohol-related diagnoses for males increased 38%, from 68 to 94 visits per 10,000 population. Over the same period, the visit rate for females also increased 38%, from 26 to 36 visits per 10,000 population. Throughout the period, the visit rate for males was higher than the visit rate for females.

Source: CDC. National Hospital Ambulatory Medical Care Survey. Available at http://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm.

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