Provision of safe water in the United States is vital to protecting public health (1). Public health agencies in the U.S. states and territories* report information on waterborne disease outbreaks to CDC through the National Outbreak Reporting System (NORS) (https://www.cdc.gov/healthywater/surveillance/index.html). During 2013–2014, 42 drinking water–associated† outbreaks were reported, accounting for at least 1,006 cases of illness, 124 hospitalizations, and 13 deaths. Legionella was associated with 57% of these outbreaks and all of the deaths. Sixty-nine percent of the reported illnesses occurred in four outbreaks in which the etiology was determined to be either a chemical or toxin or the parasite Cryptosporidium. Drinking water contamination events can cause disruptions in water service, large impacts on public health, and persistent community concern about drinking water quality. Effective water treatment and regulations can protect public drinking water supplies in the United States, and rapid detection, identification of the cause, and response to illness reports can reduce the transmission of infectious pathogens and harmful chemicals and toxins.

To provide information about drinking water–associated waterborne disease outbreaks in the United States in which the first illness occurred in 2013 or 2014 (https://www.cdc.gov/healthywater/surveillance/drinking-surveillance-reports.html), CDC analyzed outbreaks reported to the CDC Waterborne Disease and Outbreak Surveillance System through NORS (https://www.cdc.gov/nors/about.html) as of December 31, 2015. For an event to be defined as a waterborne disease outbreak, two or more cases must be linked epidemiologically by time, location of water exposure, and illness characteristics; and the epidemiologic evidence must implicate water exposure as the probable source of illness. Data requested for each outbreak include 1) the number of cases, hospitalizations, and deaths; 2) the etiologic agent (confirmed or suspected); 3) the implicated water system; 4) the setting of exposure; and 5) relevant epidemiologic and environmental data needed to understand the outbreak occurrences and for determining the deficiency classification. One previously unreported outbreak with onset date of first illness in 2012 is presented but is not included in the analysis of outbreaks that occurred during 2013–2014.

Public health officials from 19 states reported 42 outbreaks associated with drinking water during the surveillance period (Table 1) (https://www.cdc.gov/healthywater/surveillance/drinking-water-tables-figures.html). These outbreaks resulted in at least 1,006 cases of illness, 124 hospitalizations (12% of cases), and 13 deaths. At least one etiologic agent was identified in 41 (98%) outbreaks. Counts of etiologic agents in this report include both confirmed and suspected etiologies, which differs from previous surveillance reports. Legionella was implicated in 24 (57%) outbreaks, 130 (13%) cases, 109 (88%) hospitalizations, and all 13 deaths (Table 1). Eight outbreaks caused by two parasites resulted in 289 (29%) cases, among which 279 (97%) were caused by Cryptosporidium, and 10 (3%) were caused by Giardia duodenalis. Chemicals or toxins were implicated in four outbreaks involving 499 cases, with 13 hospitalizations, including the first reported outbreaks (two outbreaks) associated with algal toxins in drinking water.

The most commonly reported outbreak etiology was Legionella (57%), making acute respiratory illness the most common predominant illness type reported in outbreaks (Table 2). Thirty-five (83%) outbreaks were associated with public (i.e., regulated), community or noncommunity water systems,† and three (7%) were associated with unregulated,

---

* Outbreak reports can be submitted by public health agencies in the U.S. states, District of Columbia, Guam, Puerto Rico, Marshall Islands, Federated States of Micronesia, Northern Mariana Islands, Palau, and U.S. Virgin Islands.
† Drinking water, also called potable water, is water for human consumption (e.g., drinking, bathing, showering, hand-washing, teeth brushing, food preparation, dishwashing, and maintaining oral hygiene) and includes water collected, treated, stored, or distributed in public and individual water systems, as well as bottled water.

§ Waterborne disease outbreaks are assigned one or more deficiency classifications based on available data. The deficiencies provide information regarding how the water became contaminated, characteristics of the water system, and factors leading to waterborne disease outbreaks. Outbreaks are assigned one or more deficiency classifications based on available data. https://www.cdc.gov/healthywater/surveillance/deficiency-classification.html.

¶ Community and noncommunity water systems are public water systems that have ≥15 service connections or serve an average of ≥25 residents for ≥60 days per 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.

\[\text{†} \]
### TABLE 1. Waterborne disease outbreaks associated with drinking water (N = 42), by state/jurisdiction and month of first case onset — Waterborne Disease and Outbreak Surveillance System, United States, 2013–2014

| State/Jurisdiction | Month | Year | Etiology* | Predominant illness† | No. of cases | No. of hospitalizations§ | No. of deaths¶ | Type of water system*** | Water source | Setting |
|--------------------|-------|------|-----------|----------------------|--------------|--------------------------|---------------|--------------------------|-------------|---------|
| Alaska             | Aug   | 2014 | Giardia duodenalis†† | AGI               | 5             | 0                        | 0             | Community                | River/Stream | Community/Municipality |
| Arizona            | Jan   | 2014 | Norovirus (S)      | AGI               | 4             | 0                        | 0             | Transient, noncommunity | Unknown     | Camp/Cabin Setting     |
| Florida            | Sep   | 2013 | L. pneumophila serogroup 1 | ARI               | 4             | 4                        | 0             | Community                | Well        | Hospital/Health care   |
| Florida            | Nov   | 2013 | L. pneumophila serogroup 1 | ARI               | 4             | 4                        | 0             | Community                | Other       | Other               |
| Florida            | Apr   | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Well        | Hotel/Motel/Lodge/Inn  |
| Florida            | Jun   | 2014 | L. pneumophila serogroup 1 | ARI               | 3             | 2                        | 0             | Community                | Unknown     | Long-term care facility |
| Arizona            | Jan   | 2014 | Norovirus (S)      | AGI               | 2             | 0                        | 0             | Community                | Unknown     | Hotel/Motel/Lodge/Inn  |
| Indiana            | Jul   | 2013 | Cryptosporidium sp. | AGI               | 7             | 0                        | 0             | Community                | Unknown     | Mobile home park       |
| Indiana            | Nov   | 2014 | Unknown            | AGI               | 3             | 0                        | 0             | Community                | Unknown     | Apartment/Condo       |
| Kansas             | June  | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Unknown     | Hospital/Health care   |
| Maryland           | Nov   | 2012 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Well        | Hotel/Motel/Lodge/Inn  |
| Maryland           | Feb   | 2013 | Nitrite**          | AGI, Neuro        | 14            | 0                        | 0             | Lake/Reservoir/Impoundment | Indoor workplace/Office |
| Maryland           | Apr   | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Lake/Reservoir/Impoundment | Apartment/Condo |
| Maryland           | Jul   | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 1                        | 0             | Community                | Well        | Hotel/Motel/Lodge/Inn  |
| Maryland           | Aug   | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | River/Stream | Prison/Jail (Juvenile/Adult) |
| Michigan           | Jun   | 2014 | L. pneumophila serogroup 1 | ARI               | 45            | 45                       | 7             | Community                | River/Stream | Hospital/Health care, Community/ Municipality††† |
| Montana            | Jul   | 2014 | Norovirus (Gi-Pe-Gil-A Sydney) | AGI               | 62            | 0                        | 0             | Transient, noncommunity | Well        | Hotel/Motel/Lodge/Inn  |
| New York           | Jul   | 2013 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Lake/Reservoir/Impoundment | Well        | Hospital/Health care   |
| New York           | Jun   | 2014 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Community                | Well        | Hospital/Health care   |
| North Carolina     | Dec   | 2013 | L. pneumophila serogroup 1 | ARI               | 3             | 2                        | 0             | Community                | Unknown     | Long-term care facility |
| North Carolina     | Dec   | 2013 | L. pneumophila serogroup 1 | ARI               | 7             | 3                        | 0             | Community                | Unknown     | Long-term care facility |
| North Carolina     | May   | 2014 | L. pneumophila serogroup 1 | ARI               | 7             | 6                        | 1             | Community                | Other       | Long-term care facility |
| North Carolina     | Jun   | 2014 | L. pneumophila serogroup 1 | ARI               | 3             | 3                        | 0             | Community                | Unknown     | Long-term care facility |
| North Carolina     | Jul   | 2014 | L. pneumophila serogroup 1 | ARI               | 3             | 2                        | 1             | Community                | Unreported   | Long-term care facility |
| Ohio               | Apr   | 2013 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 1             | Community                | Unknown     | Long-term care facility |
| Ohio               | Sep   | 2013 | Cyanobacterial toxin††† | AGI               | 6             | 0                        | 0             | Community                | Lake/Reservoir/Impoundment | Community/Municipality |
| Ohio               | Jul   | 2014 | L. pneumophila serogroup 1 | ARI               | 14            | 4                        | 0             | Community                | River/Stream | Long-term care facility |
| Ohio               | Aug   | 2014 | Cyanobacterial toxin††† | AGI               | 110           | 0                        | 0             | Community                | Lake/Reservoir/Impoundment | Community/Municipality |
| Ohio               | Oct   | 2014 | Cryptosporidium sp. (S)††† | AGI               | 100           | 0                        | 0             | Individual               | River/Stream | Farm/Agricultural setting |
| Ohio               | Dec   | 2014 | Viral, unknown (S) | AGI               | 2             | 0                        | 0             | Commercially bottled     | Unknown     | Private residence      |
| Oregon             | Jun   | 2013 | Cryptosporidium parum IIaA15G2R1 | AGI               | 119           | 2                        | 0             | Community                | Lake/Reservoir/Impoundment | Community/Municipality |
| Oregon             | Sep   | 2014 | L. pneumophila serogroup 1 | ARI               | 4             | 4                        | 1             | Community                | Well        | Apartment/Condo       |
| Pennsylvania       | Dec   | 2013 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 0             | Unknown                  | Hospital/Health care   |
| Pennsylvania       | Feb   | 2014 | L. pneumophila serogroup 1 | ARI               | 5             | 5                        | 0             | Community                | River/Stream | Long-term care facility |
| Pennsylvania       | Oct   | 2013 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 1             | Community                | Lake/Reservoir/Impoundment | Long-term care facility |
| Rhode Island       | Apr   | 2013 | L. pneumophila serogroup 1 | ARI               | 2             | 2                        | 1             | Community                | Lake/Reservoir/Impoundment | Long-term care facility |

See table footnotes on the next page.
TABLE 1. (Continued) Waterborne disease outbreaks associated with drinking water (N = 42), by state/jurisdiction and month of first case onset—Waterborne Disease and Outbreak Surveillance System, United States, 2013-2014

| State/Jurisdiction | Month | Year | Etiology* | Predominant illness† | No. of cases | No. of hospitalizations§ | No. of deaths§ | Type of water system** | Water source | Setting                          |
|--------------------|-------|------|-----------|----------------------|--------------|--------------------------|---------------|-------------------------|-------------|---------------------------------|
| Tennessee          | Jul    | 2013 | Campylobacter jejuni | AGI | 3  | 0  | 0  | Transient, noncommunity†††† | Spring       | Camp/Cabin setting             |
| Tennessee          | Jun    | 2014 | Campylobacter jejuni | AGI | 12 | 0  | 0  | Nontransient, noncommunity | Well         | Camp/Cabin setting: Community/Municipality |
| Virginia           | Jun    | 2013 | Campylobacter jejuni | AGI | 19 | 0  | 0  | Individual               | Well         | Farm/Agricultural setting      |
| West Virginia      | Jan    | 2014 | 4-Methylcyclohexanemethanol (MCHM) | AGI | 369 | 13 | 0  | Community               | River/Stream | Community/Municipality         |
| Wisconsin          | Aug    | 2014 | Giardia duodenalis | AGI | 3  | 0  | 0  | Nontransient, noncommunity | Other        | National forest                 |
| Wisconsin          | Sep    | 2014 | Campylobacter jejuni | AGI | 5  | 0  | 0  | Individual               | Well         | Private residence               |

Abbreviations: AGI = acute gastrointestinal illness; ARI = acute respiratory illness; L. pneumophila = Legionella pneumophilia; Neuro = neurologic illnesses, conditions, or symptoms (e.g., meningitis); S = suspected.

* Etiologies listed are confirmed, unless indicated as suspected. For multiple-etiologic outbreaks, etiologies are listed in alphabetical order.
† 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 was also zero or for instances where reports are missing hospitalization data.
¶ Value was set to “missing” in reports where zero deaths were reported and the number of persons for whom information was available was also zero or for instances where reports are missing data on associated deaths.
** Community and noncommunity water systems are public water systems that have ≥15 service connections or serve ≥25 residents for ≥60 days per 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.
†† Classification of all reported Giardia cases has changed from Giardia intestinalis to Giardia duodenalis to align with laboratory standards.
††† Setting is listed as “other” because implicated facility houses both independent living and assisted living facilities.
‡‡ This count was not included in the analysis of the current report. This outbreak occurred in 2012 and was not reported in the previous drinking water outbreak report.
§§§ Patients’ hemoglobin levels ranged from 1.6% to 32.3%. Water was determined to be the source rather than food because all cases had direct exposure to water. Of the 14 cases, five used the water to make oatmeal or cream of wheat.
¶¶¶ This is the first drinking water–associated outbreak of this etiology reported to the National Outbreak Reporting System.
§§§§ Microcyclist was detected in finished water samples from a community water system; levels exceeded state thresholds and resulted in a “Do not drink” advisory.
***** Cryptoosporidium was detected in water samples but not in any clinical specimens.
††††† This system is registered as a community system as a result of the outbreak investigation.
§§§§§ Illnesses were associated with exposure to 4-methylcyclohexanemethanol following a documented industrial spill into water supplying a public water system. However, individual levels of exposure could not be quantified in clinical specimens. Propylene glycol phenyl ether was also present in the spill at low concentrations.

Individual systems. Fourteen outbreaks occurred in drinking water systems with groundwater sources and an additional 14 occurred in drinking water systems with surface water sources. The most commonly cited deficiency, which led to 24 (57%) of the 42 drinking water–associated outbreaks, was the presence of Legionella in drinking water systems. In addition, 143 (14%) cases were associated with seven (17%) outbreak reports that had a deficiency classification indicating “unknown or insufficient information.”

Among 1,006 cases attributed to drinking water–associated outbreaks, 50% of the reported cases were associated with chemical or toxin exposure, 29% were caused by parasitic infection (either Cryptoosporidium or Giardia), and 13% were caused by Legionella infection (Table 2). Seventy-five percent of cases were linked to community water systems. Outbreaks in water systems supplied solely by surface water accounted for most cases (79%). Of the 1,006 cases, 86% originated from outbreaks in which the predominant illness was acute gastrointestinal illness. Three (7%) outbreaks in which treatment was not expected to remove the contaminant were associated with a chemical or toxin and resulted in 48% of all outbreak-associated cases.

Discussion

Water treatment processes, regulations, and rapid response to illness outbreaks continue to reduce the transmission of pathogens, reduce exposure to chemicals and toxins, and protect the public drinking water supplies in the United States. Outbreaks reported during this surveillance period include the first reports of drinking water–associated outbreaks caused by harmful algal blooms as well as the continued challenges of preventing and controlling illnesses and outbreaks caused by Legionella and Cryptoosporidium. Outbreaks in community water systems caused by chemical spills (West Virginia) (2), harmful algal blooms (Ohio), Cryptoosporidium (Oregon) (3), and Legionella (Michigan) demonstrated that diverse contaminants can cause
### TABLE 2. Rank order (most common to least common) of etiology, water system, water source, predominant illness, and deficiencies associated with 42 drinking water outbreaks and 1,006 outbreak-related cases of illness — United States, 2013–2014

| Characteristic/Rank | Etiology | Cases (N = 1,006) | Water system* | Predominant illness§ | Deficiency¶ |
|---------------------|----------|------------------|---------------|----------------------|------------|
| **Etiology**        |          | Outbreaks (N = 42) | Category No. (%) | Category No. (%) | Category No. (%) |
| Etiology            |          |                  |                |                      |             |
| 1                   | Bacteria, *Legionella* | 24 (57.1) | Community | 30 (71.4) | ARI | 24 (57.1) |
| 2                   | Parasites | 8 (19.1) | Noncommunity | 5 (11.9) | AGI | 17 (40.5) |
| 3                   | Chemical/Toxin | 4 (9.5) | Individual | 3 (7.1) | AGI; Neuro | 1 (2.4) |
| 4                   | Viruses | 3 (7.1) | Noncommunity | 12 (28.6) | Treatment not expected to remove contaminant | 3 (7.1) |
| 5                   | Bacteria, non-*Legionella* | 1 (2.4) | Unknown | 12 (28.6) | Treatment deficiency | 3 (7.1) |
| 6                   | Multiple bacteria | 1 (2.4) | Unknown | 12 (28.6) | Untreated ground water*** | 3 (7.1) |
| 7                   | Unknown | 1 (2.4) | Unknown | 12 (28.6) | Distribution system†† | 1 (2.4) |
| **Water system***   |          |                  |                |                      |             |
| 1                   | Community | 30 (71.4) | Community | 759 (75.4) | ARI | 862 (85.7) |
| 2                   | Noncommunity | 5 (11.9) | Individual | 124 (12.3) | AGI | 130 (12.9) |
| 3                   | Individual | 3 (7.1) | Noncommunity | 115 (11.4) | AGI; Neuro | 14 (1.4) |
| 4                   | Unknown | 3 (7.1) | Unknown | 39 (3.9) | Treatment not expected to remove contaminant | 1 (2.4) |
| 5                   | Bottled | 1 (2.4) | Bottled | 2 (0.2) | Treatment deficiency | 1 (2.4) |
| **Water source**    |          |                  |                |                      |             |
| 1                   | Ground water | 14 (33.3) | Surface water | 795 (79.0) | Legionella spp. in drinking water system** | 23 (54.8) |
| 2                   | Surface water | 14 (33.3) | Ground water | 157 (15.6) | Treatment not expected to remove contaminant | 143 (14.2) |
| 3                   | Unknown | 12 (28.6) | Unknown | 39 (3.9) | Legionella spp. in drinking water system | 126 (12.5) |
| 4                   | Mixed† | 1 (2.4) | Mixed | 12 (1.2) | Treatment deficiency | 119 (11.8) |
| 5                   | Unreported | 1 (2.4) | Unreported | 3 (0.3) | Untreated ground water*** | 70 (7.0) |
| **Predominant illness§** |          |                  |                |                      |             |
| 1                   | ARI | 24 (57.1) | AGI | 862 (85.7) | Treatment not expected to remove contaminant | 485 (48.2) |
| 2                   | AGI | 17 (40.5) | ARI | 130 (12.9) | Legionella spp. in drinking water system | 126 (12.5) |
| 3                   | AGI; Neuro | 1 (2.4) | AGI; Neuro | 14 (1.4) | Treatment deficiency | 119 (11.8) |
| **Deficiency¶**     |          |                  |                |                      |             |
| 1                   | Legionella spp. in drinking water system** | 23 (54.8) | Treatment not expected to remove contaminant | 485 (48.2) | Treatment not expected to remove contaminant | 485 (48.2) |
| 2                   | Unknown/Insufficient information†† | 7 (16.7) | Unknown/Insufficient information | 143 (14.2) | Legionella spp. in drinking water system | 126 (12.5) |
| 3                   | Multiple§§ | 3 (7.1) | Legionella spp. in drinking water system | 126 (12.5) | Treatment deficiency | 119 (11.8) |
| 4                   | Treatment not expected to remove contaminant††† | 3 (7.1) | Untreated ground water*** | 70 (7.0) | Multiple | 42 (4.2) |
| 5                   | Distribution system††† | 1 (2.4) | Distribution system | 7 (0.7) | Premise plumbing system | 14 (1.4) |
| 6                   | Premises plumbing system§§§ | 1 (2.4) | Premise plumbing system | 14 (1.4) | Treatment deficiency | 119 (11.8) |
| 7                   | Treatment deficiency¶¶¶ | 1 (2.4) | Distribution system | 7 (0.7) | Distribution system | 7 (0.7) |
| 8                   | Unreported | 1 (2.4) | Treatment deficiency | 119 (11.8) | Treatment deficiency | 119 (11.8) |

**Abbreviations: AGI = acute gastrointestinal illness; ARI = acute respiratory illness; Neo = neurologic illnesses, conditions, or symptoms (e.g., meningitis).**

* Community and noncommunity water systems are public water systems that have ≥15 service connections or serve an average of ≥25 residents for ≥60 days per 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.

† Includes outbreaks with mixed water sources (i.e., ground water and surface water).

§ 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. [https://www.cdc.gov/healthywater/surveillance/deficiency-classification.html](https://www.cdc.gov/healthywater/surveillance/deficiency-classification.html).

** 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 drinking water system.

†† Deficiency 99. Unknown/Insufficient information.

§§ Multiple deficiency classifications were assigned to three outbreaks. One outbreak had deficiency 2, 3 one had 3, 4, and one had 5a, 7 (deficiency in building/home-specific water treatment after the water meter or property line).

¶¶ Deficiency 13a. Current treatment processes not expected to remove a chemical contaminant: ground water.

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

††† 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).

§§§ Deficiency 6. Drinking water, contamination of water at points not under the jurisdiction of a water utility or at the point of use: Plumbing system deficiency after the water meter or property line (e.g., cross-connection, backflow, or corrosion products).

¶¶¶ Deficiency 3. Treatment deficiency (e.g., temporary interruption of disinfection, chronically inadequate disinfection, or inadequate or no filtration).
interruptions in water service, illnesses, and persistent community concern about drinking water quality. Outbreaks in community water systems can trigger large and complex public health responses because of their potential for causing communitywide illness and decreasing the availability of safe water for community members, businesses, and critical services (e.g., hospitals). These outbreaks highlight the importance of public health and water utility preparedness for emergencies related to contamination from pathogens, chemicals, and toxins.

Legionella continues to be the most frequently reported etiology among drinking water–associated outbreaks (4). All of the outbreak-associated deaths reported during this surveillance period as well as all of the outbreaks reported in hospital/health care settings or long-term care facilities, were caused by Legionella. A review of 27 Legionnaires’ disease outbreak investigations in which CDC participated during 2000–2014 identified at least one water system maintenance deficiency in all 23 investigations for which this information was available, indicating that effective water management programs in buildings at increased risk for Legionella growth and transmission (e.g., those with more than 10 stories or that house susceptible populations) can reduce the risk for Legionnaires’ disease (5,6). Although Legionella was detected in drinking water, multiple routes of transmission beyond ingestion of contaminated water more likely contributed to these outbreaks, such as aerosolization from domestic or environmental sources. Cryptosporidium was the second most common cause of both outbreaks and illnesses, demonstrating the continued threat from this chlorine-tolerant pathogen when drinking water supplies are contaminated. Existing drinking water regulations and filtration systems targeted to control Cryptosporidium help protect public health in community water systems that are primarily served by surface water sources or groundwater sources under the influence of surface water (7). Through the Epidemiology and Laboratory Capacity for Infectious Diseases (ELC) Cooperative Agreement, CDC has recently begun a laboratory-based cryptosporidiosis surveillance system in the United States, CryptoNet, to better track laboratory-based cryptosporidiosis surveillance system in the United States, CryptoNet, to better track

The findings in this report are subject to at least three limitations. First, 17% of drinking water–associated outbreak reports could not be assigned a specific deficiency classification other than “unknown or insufficient information,” because of a lack of information. Furthermore, the deficiency classification most frequently reported (“presence of Legionella in drinking water systems”) does not provide insight into the specific factors contributing to Legionella amplification and transmission. Second, the detection and investigation of outbreaks might be incomplete. Because of universal exposure to water, linking illness to drinking water is inherently difficult through traditional outbreak investigation methods (e.g., case-control and cohort studies) (10). Finally, reporting capabilities and requirements vary among states and localities. Therefore, outbreak surveillance data likely underestimate actual occurrence of outbreaks and should not be used to estimate the actual number of outbreaks or cases of waterborne disease.

Public health surveillance is necessary to detect waterborne disease and outbreaks, and to continue to monitor health trends associated with drinking water exposure. Despite resource constraints, 19 states reported drinking water–associated outbreaks for 2013–2014 compared with 14 for the previous reporting period (4). In this reporting cycle, more reported outbreaks and cases were caused by parasites and chemicals than by non-Legionella bacteria, and more cases were reported from community systems than from individual systems. Most of the outbreaks and illnesses reported in this period were in community systems, which serve larger numbers of persons; outbreaks in these systems can sicken entire communities. Although individual, private water systems likely serve fewer persons than community systems, they can still result in relatively large numbers of illnesses. One outbreak reported during 2013–2014 in an individual system led to 100 estimated illnesses associated with a wedding. The public health challenges highlighted here underscore the need for rapid detection, identification of the cause, and response when drinking water is contaminated by infectious pathogens, chemicals, or toxins to prevent and control waterborne illness and outbreaks.

Acknowledgments

State, territory, and local waterborne disease coordinators, epidemiologists, and environmental health personnel; Bryanna Cikesh, Allison Miller, Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Jessica Smith, Sooji Lee, Albert Barskey, Chris Edens, Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, CDC.

Conflict of Interest

No conflicts of interest were reported.
Summary

What is already known about this topic?
Waterborne disease and outbreaks associated with drinking water continue to occur in the United States. CDC collects data on waterborne disease outbreaks submitted from all states and territories through the National Outbreak Reporting System.

What is added by this report?
During 2013–2014, a total of 42 drinking water–associated outbreaks were reported to CDC, resulting in at least 1,006 cases of illness, 124 hospitalizations, and 13 deaths. Legionella was responsible for 57% of outbreaks and 13% of illnesses, and chemicals/toxins and parasites together accounted for 29% of outbreaks and 79% of illnesses. Eight outbreaks caused by parasites resulted in 289 (29%) cases, among which 279 (97%) were caused by Cryptosporidium and 10 (3%) were caused by Giardia duodenalis. Chemicals or toxins were implicated in four outbreaks involving 499 cases, with 13 hospitalizations, including the first outbreaks associated with algal toxins.

What are the implications for public health practice?
Continued public health surveillance is necessary to detect waterborne disease and monitor health trends associated with drinking water exposure. When drinking water is contaminated by infectious pathogens, chemicals, or toxins, public health agencies need to provide rapid detection, identification of the cause, and response to prevent and control waterborne illness and outbreaks. Effective water management programs in buildings at increased risk for Legionella growth and transmission can reduce the risk for disease from drinking water pathogens.

References

1. Cutler D, Miller G. The role of public health improvements in health advances: the twentieth-century United States. Demography 2005;42:1–22. https://doi.org/10.1353/dem.2005.0002
2. Whelton AJ, McMillan L, Connell M, et al. Residential tap water contamination following the Freedom Industries chemical spill: perceptions, water quality, and health impacts. Environ Sci Technol 2015;49:813–23. https://doi.org/10.1021/es5040969
3. DeSilva MB, Schafer S, Kendall Scott M, et al. Communitywide cryptosporidiosis outbreak associated with a surface water-supplied municipal water system—Baker City, Oregon, 2013. Epidemiol Infect 2016;144:274–84. https://doi.org/10.1017/S0950268815001831
4. Beer KD, Gargano JW, Roberts VA, et al. Surveillance for waterborne disease outbreaks associated with drinking water—United States, 2011–2012. MMWR Morb Mortal Wkly Rep 2015;64:842–8. https://doi.org/10.15585/mmwr.mm6431a2
5. Garrison LE, Kunz JM, Cooley LA, et al. Vital signs: deficiencies in environmental control identified in outbreaks of Legionnaires’ disease—North America, 2000–2014. MMWR Morb Mortal Wkly Rep 2016;65:576–84. https://doi.org/10.15585/mmwr.mm6522e1
6. CDC. Developing a water management program to reduce Legionella growth and spread in buildings: a practical guide to implementing industry standards. Atlanta, GA: US Department of Health and Human Services, CDC; 2017. https://www.cdc.gov/legionella/maintenance/wmp-toolkit.html
7. US Environmental Protection Agency. National primary drinking water regulations. Long Term 1 Enhanced Surface Water Treatment Rule. 40 C.F.R. Parts 9, 141, and 142 (2002). https://www.gpo.gov/fdsys/pkg/FR-2002-01-14/pdf/02-409.pdf
8. Hlavsa MC, Roellig DM, Seabolt MH, et al. Using molecular characterization to support investigations of aquatic facility–associated outbreaks of cryptosporidiosis—Alabama, Arizona, and Ohio, 2016. MMWR Morb Mortal Wkly Rep 2017;66:493–7. https://doi.org/10.15585/mmwr.mm6619a2
9. US Environmental Protection Agency. Drinking water health advisory for cyanobacterial toxins. Washington, DC: US Environmental Protection Agency; 2015; https://www.epa.gov/ground-water-and-drinking-water/recommendations-public-water-systems-manage-cyanotoxins-drinking
10. Tostmann A, Boussen T, Oliver I. Investigation of outbreaks complicated by universal exposure. Emerg Infect Dis 2012;18:1717–22. https://doi.org/10.3201/eid1811.111180