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National Preparedness Month — September 2019

Every September, CDC, along with partners in government, private and public health, and academia observes National Preparedness Month, a public service reminder of the importance of personal and community preparedness for all events (*1*). This year, CDC's Center for Preparedness and Response has published a CDC Digital Media Toolkit (https://www.cdc.gov/cpr/npm/npm2019.htm) regarding personal health preparedness, including how to build an emergency supplies kit. In addition to food and water, an emergency supplies kit should include 1) personal needs (supplies necessary to protect physical, mental, and emotional health); 2) an emergency supply of prescription medications and medical supplies; 3) important paperwork including documentation of medical coverage, property ownership, and identity; and 4) backup and alternative power sources for mobile phones and medical devices.

Personal health preparedness is about being able to care for and protect individual and family health in an emergency. Large-scale events, like hurricanes and floods, can cause widespread destruction and long-lasting power outages and strain public health and health care systems. Community preparedness is equally important. This issue of *MMWR* includes a report on participation in a community preparedness training in New York City as a model for other U.S. cities (*2*). Additional information on how to prepare your health for emergencies is available at https://www.cdc.gov/prepyourhealth and #PrepYourHealth on Twitter.

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Participation in Community Preparedness Programs in Human Services Organizations and Faith-Based Organizations — New York City, 2018

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Community-based organizations have a long history of engagement with public health issues; these relationships can contribute to disaster preparedness (*1*,*2*). Preparedness training improves response capacity and strengthens overall resilience (*1*). Recognizing the importance of community-based organizations in community preparedness, the Office of Emergency Preparedness and Response in New York City's (NYC's) Department of Health and Mental Hygiene (DOHMH) launched a community preparedness program in 2016 (*3*), which engaged two community sectors (human services and faith-based). To strengthen community preparedness for public health emergencies in human services organizations and faith-based organizations, the community preparedness program conducted eight in-person preparedness trainings. Each training

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focused on preparedness topics, including developing plans for 1) continuity of operations, 2) emergency management, 3) volunteer management, 4) emergency communications, 5) emergency notification systems, 6) communication with persons at risk, 7) assessing emergency resources, and 8) establishing dedicated emergency funds (*2*,*3*). To evaluate training effectiveness, data obtained through online surveys administered during June–September 2018 were analyzed using multivariate logistic regression. Previously described preparedness indicators among trained human services organizations and faith-based organizations were compared with those of organizations that were not trained (*3*). Participation in the community preparedness program training was associated with increased odds of meeting preparedness indicators. NYC's community preparedness program can serve as a model for other health departments seeking to build community preparedness through partnership with community-based organizations.

NYC DOHMH's community preparedness program is based on recommendations from the Federal Emergency Management Agency and CDC to engage with community partners to prepare for disasters (*1*,*2*,*4*). In 2016, NYC implemented a sector-based community preparedness program beginning with the human services and faith-based sectors. The Human Services Council and the New York Disaster Interfaith Services were selected through a competitive process to serve as lead organizations for the human services and faith-based sectors, respectively. The principal role of the human services sector is to provide social services to communities, whereas that of the faith-based sector is to provide spiritual guidance. The sector lead organizations build and strengthen partnerships within their constituents through emergency planning with community organizations to provide connections with the public health preparedness and recovery structure (*1*–*4*). The community preparedness program, in tandem with the sector lead organizations, works to expand community relationships within sectors; foster emergency planning; offer trainings; build communication capacity; and provide linkages with the local preparedness infrastructure.

DOHMH and the sector lead organizations invited 595 human services organizations and faith-based organizations within their memberships via e-mail to attend eight in-person half- to full-day preparedness trainings during April 2017–May 2018. Of these, 444 organizations attended at least one training. The trainings covered approaches for strengthening organization preparedness across key domains, including community resilience, incident management, information management, and surge management (*4*). Trainings covered continuity of operations development, communications, emergency planning, NYC City Incident Management Systems, active shooter guidance, and targeted grassroots-level preparedness (*5*). Training participants were also briefed on the NYC government's plan to address citywide emergencies and multiple large-scale incidents, highlighting the roles and responsibilities of human services organizations and faith-based organizations

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as community partners during emergencies. This report presents evaluation data collected following implementation of training content.

Data obtained through online surveys sent to 850 human service organizations and 1,000 faith-based organizations during June–September 2018 (after the trainings) compared preparedness indicators among human services organizations and faith-based organizations that participated in any of the trainings with those that had not participated in any trainings. E-mail reminders were sent to targeted responders every 2 weeks to encourage participation. Multivariate logistic regression was used to estimate the odds of meeting preparedness indicators among trained human services organization and faith-based organizations compared with those that were not trained, controlling for multiple organization-specific characteristics. P-values <0.05 were considered statistically significant. All analyses were conducted using SAS (version 9.4; SAS Institute).

Overall, 115 (13.5%) human service organizations and 185 (18.5%) faith-based organizations completed the survey. Of the 115 human services organizations responding to the survey, 61 (53%) participated in at least one community preparedness program training (range = 1–8). After controlling for agency/governance type, number of staff members, number of volunteers, client volume, operating budget, borough, and religious affiliation, if any, organizations that participated in at least one community preparedness program training had significantly increased odds of having plans for continuity of operations (adjusted odds ratio [AOR] = 45.7, p<0.001), emergency management (AOR = 12.8, p<0.001), volunteer management (AOR = 6.3, p = 0.007), and emergency communications (AOR = 17.3, p<0.001) than did those that did not participate in any training (Table 1). Community preparedness program training also significantly increased the odds of having emergency notification systems (AOR = 8.7, p<0.001), inventoried emergency resources (AOR = 9.8, p<0.001), and the ability to communicate with clients at risk (AOR = 15.6, p<0.001) before, during, and after an emergency.

Among the 185 faith-based organizations that responded to the survey, 57 (31%) participated in at least one training (range = 1–6). After controlling for judicatory operation, religious affiliation, clergy size, congregation size, client volume, budget, and borough, participation in at least one community preparedness program training significantly increased the odds of having plans for continuity of operations (AOR = 2.5, p = 0.037), emergency management (AOR = 7.2, p<0.001), volunteer management (AOR = 4.5, p = 0.004), and emergency communications (AOR = 2.8, p = 0.011) in faith-based organizations (Table 2). Community preparedness training also significantly increased the odds of having an emergency notification system (AOR = 3.4, p = 0.001); inventoried emergency resources (AOR = 4.5, p<0.001); the ability to communicate with persons at risk (AOR = 2.1, p = 0.043) before, during, and after an emergency; and dedicated emergency funds (AOR = 3.8, p = 0.013).

Summary

What is already known about this topic?

Human services organizations and faith-based organizations have a long history of engagement in public health issues and can contribute to building community disaster preparedness.

What is added by this report?

New York City (NYC) organizations that participated in community preparedness program training had significantly increased odds of having plans for continuity of operations, emergency management, volunteer management, and emergency communication than did those that did not participate in training.

What are the implications for public health practice?

The NYC community preparedness program can serve as a model for other health departments considering training community-based organizations to support community preparedness for responding to public health disasters.

Discussion

In many instances, community-based organizations are the first to provide critical recovery services to their communities after a disaster (*1*). It is important that as trusted neighborhood partners, these organizations maintain sufficient levels of preparedness such as those examined in this survey (*2*–*4*). These findings suggest that focused preparedness training might enhance organizational capacity for developing a written plan for continuity of operations that identifies essential services and clearly outlines roles and responsibilities needed to maintain essential operations. In addition, the trainings contributed to more organizations planning for emergency and volunteer management in the event of a disaster, and trainings improved organizations' planning for emergency communications.

Having documented continuity of operations plans can ensure that community-based organizations are able to maintain essential services following a disaster. Plans should include how volunteers, who frequently contribute to a community-based organization's daily operations, are recruited and integrated during an emergency response. Because many community-based organizations are trusted information hubs for their service catchment areas, delineating strategies that facilitate the communication of timely and accurate information during an emergency could reduce uncertainty and confusion for staff members and their constituents (*2*). In addition, community-based organizations are encouraged to designate resources and allocate funding for specific use during emergencies to continue to provide essential services.

TABLE 1. Participation in community preparedness program training among human services organizations (N = 115) — New York City, 2018

Preparedness component in place	No. (%) responding "yes"		Adjusted odds ratio* (95% CI)	P-value
	Participated in any training (n = 61)	Did not participate in any training (n = 54)		
Continuity of operations plan	48 (79)	13 (24)	45.7 (10.9–191.6)	<0.001
Emergency management plan	51 (84)	22 (41)	12.8 (3.4–48.0)	<0.001
Plan for using volunteers	21 (34)	4 (7)	6.3 (1.7–24.2)	0.007
Emergency communications plan	50 (82)	18 (33)	17.3 (5.2–57.6)	<0.001
Emergency notifications system	40 (66)	18 (33)	8.7 (3.1–24.8)	<0.001
At-risk population communication	49 (80)	20 (37)	15.6 (5.1–47.6)	<0.001
Inventory of emergency resources†	42 (69)	12 (22)	9.8 (3.7–26.0)	<0.001
Dedicated emergency funds§	14 (23)	6 (11)	3.7 (1.0–14.0)	0.051

Abbreviation: CI = confidence interval.
* Adjusted odds ratios estimated by logistic regression model compare odds of "yes" among participants in any training with no training. Models controlled for agency/governance type, staff member size, volunteers, client volume, operating budget, borough, and religious affiliation. P-values <0.05 were considered statistically significant.
† Emergency resources include transportation, radios, emergency food supplies, and other essential emergency supplies.
§ Organizations have dedicated funding for use during emergencies.

TABLE 2. Participation in community preparedness program training among faith-based organizations (N = 185) — New York City, 2018

Preparedness component in place	No. (%) responding "yes"		Adjusted odds ratio* (95% CI)	P-value
	Participated in any training (n = 57)	Did not participate in any training (n = 128)		
Continuity of operations plan	20 (35)	14 (11)	2.5 (1.06–6.07)	0.037
Emergency management plan	18 (32)	8 (6)	7.2 (2.8–18.3)	<0.001
Plan for using volunteers	15 (26)	8 (6)	4.5 (1.6–12.4)	0.004
Emergency communications plan	23 (40)	20 (16)	2.8 (1.3–6.1)	0.011
Emergency notifications system	31 (54)	27 (21)	3.4 (1.6–7.3)	0.001
At-risk population communication	32 (56)	45 (35)	2.1 (1.0–4.1)	0.043
Inventory of emergency resources†	22 (39)	14 (11)	4.5 (2.0–10.0)	<0.001
Dedicated emergency funds§	10 (18)	7 (5)	3.8 (1.3–10.8)	0.013

Abbreviation: CI = confidence interval.
* Adjusted odds ratios estimated by logistic regression model compare odds of "yes" among participants in any training with no training. Models controlled for judicatory operation, religious affiliation, clergy size, congregation size, client volume, budget, and borough. P-values <0.05 were considered statistically significant.
† Emergency resources include transportation, radios, emergency food supplies, and other essential emergency supplies.
§ Organizations have dedicated funding for use during emergencies.

The findings in this report are subject to at least two limitations. First, survey participants were not randomly selected and response rates were low (*6*,*7*). Human services organizations and faith-based organizations were only invited to complete the online surveys by e-mail, with reminder e-mails sent every 2 weeks, and no incentives were provided. Employing multiple invitation methods and incentives might have improved survey response rates (*6*,*7*). Second, results were not adjusted for any potential selection or nonresponse bias. Therefore, results might not be generalizable to human services organizations and faith-based organizations outside NYC. Nonetheless, results indicate that NYC's community preparedness program training might improve preparedness in both human services and faith-based sectors.

Community-based organizations can serve as bridges between public health systems and communities and between communities and persons within those communities. Organizations' familiarity with local communities puts them in a position to identify and address specific requirements for responding to public health emergencies based on their knowledge of available resources, the population, and community needs (*1*,*2*,*8*,*9*). Participation in community preparedness training was associated with higher preparedness levels among NYC human services organizations and faith-based organizations. The NYC community preparedness program model might serve as an example for local health departments seeking methods to engage communities and strengthen readiness for an increasing range and intensity of disasters (*3*). Having community-based organizations meet preparedness standards might increase critical support to many socially and economically diverse communities during emergencies and increase the possibility of saving lives and reducing morbidity following a large-scale disaster.

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Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016

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Approximately 700 women die in the United States each year as a result of pregnancy or its complications, and significant racial/ethnic disparities in pregnancy-related mortality exist (*1*). Data from CDC's Pregnancy Mortality Surveillance System (PMSS) for 2007–2016 were analyzed. Pregnancy-related mortality ratios (PRMRs) (i.e., pregnancy-related deaths per 100,000 live births) were analyzed by demographic characteristics and state PRMR tertiles (i.e., states with lowest, middle, and highest PRMR); cause-specific proportionate mortality by race/ethnicity also was calculated. Over the period analyzed, the U.S. overall PRMR was 16.7 pregnancy-related deaths per 100,000 births. Non-Hispanic black (black) and non-Hispanic American Indian/Alaska Native (AI/AN) women experienced higher PRMRs (40.8 and 29.7, respectively) than did all other racial/ethnic groups. This disparity persisted over time and across age groups. The PRMR for black and AI/AN women aged ≥30 years was approximately four to five times that for their white counterparts. PRMRs for black and AI/AN women with at least some college education were higher than those for all other racial/ethnic groups with less than a high school diploma. Among state PRMR tertiles, the PRMRs for black and AI/AN women were 2.8–3.3 and 1.7–3.3 times as high, respectively, as those for non-Hispanic white (white) women. Significant differences in cause-specific proportionate mortality were observed among racial/ethnic populations. Strategies to address racial/ethnic disparities in pregnancy-related deaths, including improving women's health and access to quality care in the preconception, pregnancy, and postpartum periods, can be implemented through coordination at the community, health facility, patient, provider, and system levels.

PMSS was established in 1986 by CDC and the American College of Obstetricians and Gynecologists to better understand the causes of death and risk factors associated with pregnancy-related deaths. Methodology of PMSS has been described previously (*2*). Briefly, CDC requests that all states, the District of Columbia, and New York City identify deaths during or within 1 year of pregnancy and send corresponding death certificates, linked birth or fetal death certificates, and additional data when available. Medically trained epidemiologists review information and determine the relatedness to pregnancy and cause for each death. A death was considered pregnancy-related if it occurred during or within 1 year of pregnancy and was caused by a pregnancy complication, a chain of events initiated by pregnancy, or aggravation of an unrelated condition by the physiologic effects of pregnancy. U.S. natality files were the source of live birth data (*3*).

PRMRs were analyzed by age group, highest level of education, and calendar year for women who were non-Hispanic white, black, AI/AN, Asian or Pacific Islander (A/PI), and Hispanic. Per the PMSS assurance of confidentiality, state-specific data are not authorized to be released. States were anonymously classified by PRMR and grouped into lowest, middle, and highest tertiles by PRMR; the PRMR was calculated by race/ethnicity per state tertile. Disparity ratios (comparisons of PRMR between two racial/ethnic groups) were calculated by five 2-year intervals, demographic characteristics, and state PRMR tertiles. White decedents were the referent group because they represented the largest racial/ethnic group. Cause-specific proportionate mortality was classified in 10 mutually exclusive categories,* and differences by race/ethnicity were identified using chi-squared tests. SAS statistical software (version 9.4; SAS Institute) was used for the analyses.

During 2007–2016, a total of 6,765 pregnancy-related deaths occurred in the United States (PRMR = 16.7 per 100,000 births). PRMRs were highest among black (40.8) and AI/AN (29.7) women; these rates were 3.2 and 2.3 times the PRMR for white women (12.7) (Table 1). From 2007–2008 to 2015–2016, the overall PRMR increased slightly from 15.0 to 17.0. The disparity ratios did not change significantly over time.

PRMR increased with maternal age; the black:white disparity was lowest among women aged <20 years (1.5) and highest among those aged 30–34 years (4.3); the AI/AN:white disparity was lowest among women aged 20–24 years (1.2) and was

* Cause of death coding includes the following 10 mutually exclusive categories: hemorrhage; infection; amniotic fluid embolism; thrombotic pulmonary or other embolism (i.e., air, septic, or fat); hypertensive disorders of pregnancy (i.e., preeclampsia or eclampsia); anesthesia complications; cerebrovascular accidents; cardiomyopathy; other cardiovascular conditions (e.g., congenital heart disease, ischemic heart disease, cardiac valvular disease, hypertensive heart disease, and congestive heart failure); and other noncardiovascular medical conditions (e.g., endocrine, hematologic, immunologic, and renal). Deaths caused by hypertension that were not preeclampsia, eclampsia, or gestational hypertension were categorized in the "other cardiovascular conditions" category. Deaths caused by cerebrovascular accidents that were a result of preeclampsia or eclampsia were classified in the "hypertensive disorders of pregnancy" category; otherwise, deaths were classified in the "cerebrovascular accidents" category.

TABLE 1. Pregnancy-related mortality ratios (PRMRs) (pregnancy-related deaths per 100,000 live births) and disparity ratios by age group, education, tertile of states, and race/ethnicity* — United States, 2007–2016†

Characteristic	Total PRMR	White PRMR	Black PRMR	Black: white disp. ratio	AI/AN PRMR	AI/AN: white disp. ratio	A/PI PRMR	A/PI: white disp. ratio	Hispanic PRMR	Hispanic: white disp. ratio
Total	**16.7**	**12.7**	**40.8**	**3.2**	**29.7**	**2.3**	**13.5**	**1.1**	**11.5**	**0.9**
Age group (yrs)										
<20	10.9	10.8	16.8	1.5	19.5	1.8	—§	—	6.7	0.6
20–24	12.2	9.6	26.3	2.7	11.6	1.2	7.2	0.7	7.0	0.7
25–29	13.3	9.3	37.0	4.0	25.2	2.7	9.5	1.0	9.6	1.0
30–34	15.8	11.3	48.6	4.3	41.2	3.7	12.5	1.1	12.6	1.1
35–39	27.7	20.5	80.7	3.9	104.2	5.1	18.8	0.9	22.6	1.1
≥40	65.2	51.5	189.7	3.7	—	—	36.6	0.7	44.0	0.9
Education completed										
Less than high school	21.6	25.0	45.6	1.8	50.8	2.0	18.7	0.7	12.6	0.5
High school	27.4	25.2	59.1	2.3	43.7	1.7	22.9	0.9	11.2	0.4
Some college	16.4	11.7	41.0	3.5	32.0	2.7	15.4	1.3	9.4	0.8
College graduate or higher	10.9	7.8	40.2	5.2	—	—	13.2	1.7	9.3	1.2
Period										
2007–2008	15.0	11.5	35.6	3.1	26.9	2.3	11.4	1.0	10.8	0.9
2009–2010	17.3	12.8	41.6	3.2	30.7	2.4	13.6	1.1	12.8	1.0
2011–2012	16.8	12.4	44.3	3.6	38.4	3.1	11.6	0.9	10.4	0.8
2013–2014	17.6	13.5	42.1	3.1	30.3	2.2	15.8	1.2	12.0	0.9
2015–2016	17.0	13.2	40.8	3.1	21.9	1.7	14.7	1.1	11.6	0.9
State-level PRMR tertile										
Lowest PRMR	10.7	8.7	26.0	3.0	28.9	3.3	11.9	1.4	9.7	1.1
Middle PRMR	15.4	11.0	36.9	3.3	33.9	3.1	14.2	1.3	11.7	1.1
Highest PRMR	21.9	16.6	45.9	2.8	28.8	1.7	15.8	0.9	13.2	0.8

Abbreviations: AI/AN = American Indian/Alaska Native; A/PI = Asian/Pacific Islander.
* Blacks, whites, AI/AN, and A/PI were non-Hispanic; Hispanic women might be of any race.
† 25 pregnancy-related deaths with unknown race/ethnicity were included in the total analyses but not presented in an individual column; two pregnancy-related deaths with unknown age were excluded from age analyses; 687 pregnancy-related deaths with unknown educational levels were excluded from education analyses.
§ Dashes indicate fewer than 10 deaths; these results were suppressed because ratios might be unreliable.

highest among women aged 35–39 years (5.1). Racial/ethnic disparities were present at all education levels. The PRMR among black women with a completed college education or higher was 1.6 times that of white women with less than a high school diploma. Among women with a college education or higher, the PRMR for black women was 5.2 times that of their white counterparts. The black:white disparity ratio in the PRMR for the states in the lowest, middle, and highest tertiles was 3.0, 3.3, and 2.8, respectively.

Cardiovascular conditions (including cardiomyopathy, other cardiovascular conditions, and cerebrovascular accidents), other noncardiovascular medical conditions, and infection were leading causes of pregnancy-related deaths. The proportion of pregnancy-related deaths attributed to each of 10 mutually exclusive causes varied by race/ethnicity (Table 2). Cardiomyopathy, thrombotic pulmonary embolism, and hypertensive disorders of pregnancy contributed to a significantly higher proportion of pregnancy-related deaths among black women than among white women. Hemorrhage and hypertensive disorders of pregnancy contributed to a higher proportion of pregnancy-related deaths among AI/AN women than among white women.

Discussion

Racial/ethnic disparities in pregnancy-related mortality were evident in 2007 and continued through 2016, with significantly higher PRMRs among black and AI/AN women than among white, A/PI, and Hispanic women. The PRMR for black and AI/AN women aged ≥30 years was approximately four to five times that of their white counterparts. Even in states with the lowest PRMRs, and among groups with higher levels of education, significant disparities persisted, demonstrating that the disparity in pregnancy-related mortality for black and AI/AN women is a complex national problem.

Multiple factors contribute to pregnancy-related mortality and to racial/ethnic disparities. Previous analyses found that for each pregnancy-related death, an average of three to four contributing factors were identified at multiple levels, including community, health facility, patient/family, provider, and system (*1*). Thirteen state maternal mortality review committees reported 60% of pregnancy-related deaths were preventable, and there were no significant differences in preventability by race/ethnicity (*1*). Differences in proportionate causes of death among black and AI/AN women might reflect differences in access to care, quality of care, and prevalence of chronic diseases (*4*).

TABLE 2. Cause-specific pregnancy-related mortality, by race/ethnicity — Pregnancy Mortality Surveillance System, United States, 2007–2016

Cause of death	Proportionate cause of death by race/ethnicity* No. (%) attributed to each cause					Total deaths
	White	Black	AI/AN	A/PI	Hispanic	
Hemorrhage	250 (9.1)	237 (9.7)	23 (19.7)†	66 (19.5)†	173 (15.8)†	**752 (11.1)**
Infection	418 (15.2)	235 (9.7)§	10 (8.5)§	51 (15.0)	183 (16.7)	**900 (13.3)**
Amniotic fluid embolism	147 (5.3)	106 (4.4)	3 (2.6)	51 (15.0)†	58 (5.3)	**365 (5.4)**
Thrombotic pulmonary or other embolism	246 (8.9)	265 (10.9)†	9 (7.7)	11 (3.2)§	88 (8.0)	**624 (9.2)**
Hypertensive disorders of pregnancy	184 (6.7)	200 (8.2)†	15 (12.8)†	21 (6.2)	106 (9.7)†	**528 (7.8)**
Anesthesia complications	7 (0.3)	14 (0.6)	0 (0.0)	3 (0.9)	6 (0.5)	**30 (0.4)**
Cerebrovascular accidents	207 (7.5)	148 (6.1)§	6 (5.1)	37 (10.9)†	92 (8.4)	**490 (7.2)**
Cardiomyopathy	288 (10.4)	345 (14.2)†	17 (14.5)	21 (6.2)§	75 (6.8)§	**748 (11.1)**
Other cardiovascular conditions	465 (16.9)	393 (16.2)	13 (11.1)	38 (11.2)§	124 (11.3)§	**1,035 (15.3)**
Other noncardiovascular medical conditions	384 (13.9)	343 (14.1)	16 (13.7)	26 (7.7)§	130 (11.9)	**903 (13.3)**
Unknown	160 (5.8)	146 (6.0)	5 (4.3)	14 (4.1)	61 (5.6)	**390 (5.8)**
Total	**2,756**	**2,432**	**117**	**339**	**1,096**	**6,765¶**

Abbreviations: AI/AN = American Indian/Alaska Native; A/PI = Asian/Pacific Islander.
* Black, white, AI/AN, and A/PI women were non-Hispanic; Hispanic women could be of any race.
† Significantly higher proportion of pregnancy-related deaths compared with that among white women, p<0.05.
§ Significantly lower proportion of pregnancy-related deaths compared with that among white women, p<0.05.
¶ Twenty-five pregnancy-related deaths with unknown race/ethnicity were included in the total but not elsewhere in the table.

Chronic diseases associated with increased risk for pregnancy-related mortality (e.g., hypertension) are more prevalent and less well controlled in black women (*5*). Ensuring access to quality care, including specialist providers, during preconception, pregnancy, and the postpartum period is crucial for all women to identify and manage chronic medical conditions (*4*). Systemic factors (e.g., gaps in health care coverage and preventive care, lack of coordinated health care, and social services) and community factors (e.g., securing transportation for medical visits and inadequate housing) have also been identified as contributors to pregnancy-related deaths (*1*). Addressing these factors and ensuring that pregnant women at high risk for complications receive care in facilities prepared to provide the required level of specialized care can improve outcomes.[†,§] In addition, innovative delivery of care models in the preconception, pregnancy, and postpartum periods might be further evaluated for their potential to reduce maternal disparities.

Quality of care likely has a role in pregnancy-related deaths and associated racial disparities. A national study of five specific pregnancy complications found a similar prevalence of complications among black and white women, but a significantly higher case-fatality rate among black women (*6*). Studies have suggested that black women are more likely than are white women to receive obstetric care in hospitals that provide lower quality of care (*7*). Hospitals and health care systems can implement standardized protocols and training in quality improvement initiatives, ensuring implementation in facilities that serve disproportionately affected communities. Quality improvement efforts, such as perinatal quality collaboratives[¶] that facilitate a change in the culture of care provision, implement standards of care,[**] and rapidly use data to identify opportunities for improvement, can improve the quality of care received by all pregnant and postpartum women.

Implicit racial bias has been reported in the health care system and can affect patient-provider interactions, treatment decisions, patient adherence to recommendations, and patient health outcomes (*8*). This report's findings demonstrate that black and AI/AN women have a more accelerated trajectory in age-specific PRMRs compared with white women. This might be related to the "weathering" hypothesis, which proposed that black women experience earlier deterioration of health because of the cumulative impact of exposure to psychosocial, economic, and environmental stressors (*9*). Identifying and addressing implicit bias and structural racism in health care and community settings, engaging communities in prevention efforts, and supporting community-based programs that build social support and resiliency would likely improve patient-provider interactions, health communication, and health outcomes (*4*).

Reducing disparities in pregnancy-related mortality requires addressing multifaceted contributors. Ensuring robust comprehensive data collection and analysis through

† https://www.cdc.gov/reproductivehealth/maternalinfanthealth/cdc-locate/index.html.
§ https://www.acog.org/About-ACOG/ACOG-Departments/LOMC?IsMobileSet=false.
¶ https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pqc.htm.
** https://safehealthcareforeverywoman.org/patient-safety-bundles/.

Summary

What is already known about this topic?

Approximately 700 women die annually in the United States as a result of pregnancy or its complications; racial/ethnic disparities exist.

What is added by this report?

During 2007–2016, black and American Indian/Alaska Native women had significantly more pregnancy-related deaths per 100,000 births than did white, Hispanic, and Asian/Pacific Islander women. Disparities persisted over time and across age groups and were present even in states with the lowest pregnancy-related mortality ratios and among groups with higher levels of education. The cause-specific proportion of pregnancy-related deaths varied by race/ethnicity.

What are the implications for public health practice?

Identifying factors that drive differences in pregnancy-related deaths and implementing prevention strategies to address them could reduce racial/ethnic disparities in pregnancy-related mortality. Strategies to address racial/ethnic disparities in pregnancy-related deaths, including improving women's health and access to quality care in the preconception, pregnancy, and postpartum periods, can be implemented through coordination at the community, health facility, patient and family, health care provider, and system levels.

state and local maternal mortality review committees, which thoroughly review pregnancy-related deaths and make actionable prevention recommendations, offer the best opportunity for identifying priority strategies to reduce disparities in pregnancy-related mortality.[††]

The findings in this report are subject to at least three limitations. First, PMSS predominantly uses death certificates and linked birth or fetal death certificates to determine the pregnancy-relatedness of each death. Errors in reported pregnancy status on death certificates have been described, potentially leading to overestimation of the number of pregnancy-related deaths (*10*). Second, pregnancy-relatedness cannot generally be determined in PMSS for cancer-related deaths or injury deaths such as drug overdoses, suicides, or homicides, and thus, these are often not included in the PRMR calculated from PMSS data. Finally, small cohort sizes precluded the reporting of some factors by race/ethnicity; in addition, there might be inconsistencies in the reporting of race/ethnicity when death certificates were used for classification.[§§]

Most pregnancy-related deaths can be prevented, and significant racial/ethnic disparities in pregnancy-related mortality need to be addressed. Further identification and evaluation of factors contributing to racial/ethnic disparities are crucial to inform and implement prevention strategies that will effectively reduce disparities in pregnancy-related mortality, including strategies to improve women's health and access to quality care in the preconception, pregnancy, and postpartum periods. Addressing this complex national problem requires coordination and collaboration among community organizations, health facilities, patients and families, health care providers, and health systems.

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[††] https://reviewtoaction.org.

[§§] Whenever possible, data for race and Hispanic origin were obtained from linked birth certificates, which are self-reported; however, when not available, data for specified race or Hispanic-origin were obtained from death certificates.

Impact of Public Health Interventions on Drinking Water–Associated Outbreaks of Hepatitis A — United States, 1971–2017

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Hepatitis A virus (HAV) is an RNA virus primarily transmitted via the fecal-oral route and, in rare cases, causes liver failure and death in infected persons. Although drinking water–associated hepatitis A outbreaks in the United States are rarely reported (*1*), HAV was the most commonly reported etiology for outbreaks associated with untreated ground water during 1971–2008 (*2*), and HAV can remain infectious in water for months (*3*). This report analyzes drinking water–associated hepatitis A outbreaks reported to the Waterborne Disease and Outbreak Surveillance System (WBDOSS) during 1971–2017. During that period, 32 outbreaks resulting in 857 cases were reported, all before 2010. Untreated ground water was associated with 23 (72%) outbreaks, resulting in 585 (68.3%) reported cases. Reported outbreaks significantly decreased after introduction of Advisory Committee on Immunization Practices (ACIP) hepatitis A vaccination recommendations* and U.S. Environmental Protection Agency's (USEPA) public ground water system regulations.† Individual water systems, which are not required to meet national drinking water standards,§ were the only contaminated drinking water systems to cause the last four reported hepatitis A outbreaks during 1995–2009. No waterborne outbreaks were reported during 2009–2017. Water testing and treatment are important considerations to protect persons who use these unregulated systems from HAV infection.

U.S. states and territories have voluntarily reported waterborne disease outbreaks to WBDOSS since 1971.¶ Waterborne hepatitis A outbreaks (1971–2017) reported as of March 13, 2018, were reviewed. An outbreak of hepatitis A was defined as two or more cases of HAV infection epidemiologically linked by time and location of water exposure. To compare occurrence with other waterborne exposure pathways, outbreaks reviewed included those caused by drinking, recreational, environmental (i.e., nondrinking, nonrecreational water), or undetermined water exposures.** As described previously (*1*), data reviewed included location; date of first illness; estimated number of primary cases, hospitalizations, and deaths; water system type according to USEPA Safe Drinking Water Act definitions (i.e., community, noncommunity, and individual); setting of exposure; drinking water sources (i.e., ground water, surface water, and unknown); and water system characteristics.†† Community and noncommunity water systems are public water systems that have 15 or more service connections or serve an average of 25 or more 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. Individual water systems are small systems (e.g., private wells

* ACIP issued hepatitis A vaccination recommendations in 1996 to populations at risk (https://www.cdc.gov/mmwr/preview/mmwrhtml/00048084.htm). In 1999, ACIP recommendations were expanded to western states with high incidence of hepatitis A (https://www.cdc.gov/mmwr/preview/mmwrhtml/rr4812a1.htm). In 2006, hepatitis A vaccine became part of the routine childhood immunization schedule (https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5507a1.htm).

† USEPA's 1989 Total Coliform Rule and Surface Water Treatment Rule, 2013 Revised Total Coliform Rule, and 2006 Ground Water Rule provide regulations for public ground water systems at risk for contamination. The 2006 Ground Water Rule requires certain public water systems using ground water sources and not providing 4-log virus treatment to monitor ground water sources for indicators of fecal contamination and to provide corrective actions for those sources where these indicators are detected (https://www.epa.gov/dwreginfo/ground-water-rule). Monitoring of source waters under the Ground Water Rule is triggered by the presence of total coliforms in the drinking water distribution system as monitored under the Revised Total Coliform Rule. The Total Coliform Rule of 1989 (along with its 2013 revision) requires monitoring of microbial indicators for the potential for fecal contamination (https://www.epa.gov/dwreginfo/revised-total-coliform-rule-and-total-coliform-rule). USEPA published the Revised Total Coliform Rule in 2013. The 1989 Surface Water Treatment Rule includes identification of ground water systems that are under the direct influence of surface water (https://www.epa.gov/dwreginfo/surface-water-treatment-rules). Systems under the Surface Water Treatment Rule are required to filter and disinfect water sources, although some water systems are allowed to use disinfection only for surface water sources that meet criteria for water quality and watershed protection. States have 3 years to implement USEPA rules from the date of promulgation.

§ National primary drinking water regulations, 40 C.F.R. Sect. 141 (1998).

¶ Outbreak reports can be submitted by public health agencies in the U.S states, District of Columbia, Federated States of Micronesia, Guam, Marshall Islands, Northern Mariana Islands, Palau, Puerto Rico, and U.S. Virgin Islands https://www.cdc.gov/healthywater/surveillance/tracking-systems.html.

** Drinking water, also called potable water, is water for human consumption (e.g., drinking, bathing, showering, handwashing, tooth 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. More information on recreational, environmental, and other water exposures is available at https://www.cdc.gov/nors/pdf/CDC_5212_guidance.pdf.

†† Outbreak reports through 2014 have been assigned water system characteristics according to information from previous reviews by CDC and USEPA. The characteristics provide information regarding how the water became contaminated and factors leading to waterborne disease outbreaks. https://www.cdc.gov/healthywater/surveillance/deficiency-classification.html.

§§ https://www.epa.gov/dwreginfo/information-about-public-water-systems.

and springs) not owned or operated by a water utility that have fewer than 15 connections or serve fewer than 25 persons. The number of outbreaks before and after public health interventions were compared; chi-squared tests were used to identify significant (p-value<0.05) differences. Data were analyzed using SAS software (version 9.4; SAS Institute) and visualized in ArcGIS (version 10.6.1; Environmental Systems Research Institute).

Thirty-two drinking water–associated hepatitis A outbreaks were reported to CDC during 1971–2017; the last one occurred in 2009 (Table). These drinking water–associated outbreaks accounted for 857 cases (range = 2–50), with no reported deaths. Data on number of deaths were unavailable for three outbreaks. Data on hospitalizations were unavailable for all outbreaks. Outbreaks occurred in 18 states, all in the lower continental United States (Figure 1). One environmental outbreak (1975) and one recreational water outbreak (1989) were reported during this period, but were excluded from this analysis.

The most commonly reported water system type associated with an outbreak was individual, accounting for 13 of 32 (41%) outbreaks and 257 of 857 (30.0%) cases, followed by community (10 [31%] outbreaks; 241 [28.1%] cases) and

TABLE. Hepatitis A drinking water–associated outbreaks (N = 32), by year and month of first case onset — Waterborne Disease and Outbreak Surveillance System, United States, 1971–2017

Year	Month	State	No. of cases*	Type of water system†	Setting	Drinking water source	Drinking water description	Water system characteristic§
1971	Jun	Arkansas	98	Noncommunity	Store/Shop	Ground water	Well	No treatment
1971	Jul	New Jersey	22	Noncommunity	Camp/Cabin setting	Ground water	Well	No treatment
1971	Aug	Oklahoma	6	Individual	Unknown	Ground water	Well	No treatment
1971	Sep	North Carolina	2	Individual	Private residence	Ground water	Well	No treatment
1971	Nov	Oklahoma	50	Community	Community/Municipality	Ground water	Spring	Treatment deficiency
1971	Nov	Texas	3	Individual	Farm/Agricultural setting	Ground water	Well	No treatment
1972	May	Ohio	9	Community	Mobile home park	Ground water	Unknown	Distribution system deficiency
1972	Jul	Ohio	12	Community	Unknown	Ground water	Spring	No treatment
1972	Jul	Pennsylvania	5	Noncommunity	Camp/Cabin setting	Ground water	Well	No treatment
1972	Aug	Alabama	9	Community	Community/Municipality	Ground water	Spring	No treatment
1972	Oct	Alabama	50	Noncommunity	School/College/University	Ground water	Spring	Treatment deficiency
1973	Feb	Alabama	50	Community	Community/Municipality	Ground water	Well	Treatment deficiency
1973	Jul	Ohio	35	Noncommunity	Park	Ground water	Spring	No treatment
1977	Jul	South Carolina	47	Noncommunity	Factory/Industrial facility	Unknown	Unknown	Distribution system deficiency
1980¶	Jul	Wisconsin	12	Individual	Factory/Industrial facility	Ground water	Well	No treatment
1980	Aug	Pennsylvania	48	Noncommunity	Community/Municipality	Ground water	Well	Treatment deficiency
1982	Jun	Georgia	10	Individual	Child care facility	Ground water	Well	No treatment
1982	Jul	Georgia	35	Community	Mobile home park	Ground water	Well	No treatment
1982	Nov	Kentucky	58	Community	Community/Municipality	Ground water	Spring	No treatment
1983	Jun	Tennessee	8	Noncommunity	Church/Place of Worship	Ground water	Spring	No treatment
1983	Sep	Kentucky	150	Individual	Community/Municipality	Ground water	Well	No treatment
1983	Nov	California	6	Community	American Indian reservation	Surface water	River/Stream	Treatment deficiency
1984	Sep	Massachusetts	7	Individual	Private residence	Ground water	Well	No treatment
1988	Sep	Washington	9	Community	Mobile home park	Ground water	Well	Treatment deficiency
1990	May	Pennsylvania	22	Individual	Private residence	Ground water	Well	No treatment
1990	Nov	Pennsylvania	3	Community	Community/Municipality	Ground water	Well	Treatment deficiency
1992	Apr	Missouri	46	Noncommunity	School/College/University	Ground water	Well	No treatment
1992	Jun	Washington	10	Individual	Private residence	Ground water	Well	No treatment
1995	Sep	Tennessee	8	Individual	Private residence	Ground water	Spring and Well	No treatment
2006	Jul	North Carolina	16	Individual	Private residence	Ground water	Spring	No treatment
2008	Mar	Tennessee	9	Individual	Community/Municipality	Ground water	Well	No treatment
2009	Jul	Maine	2	Individual	Private residence	Ground water	Well	No treatment

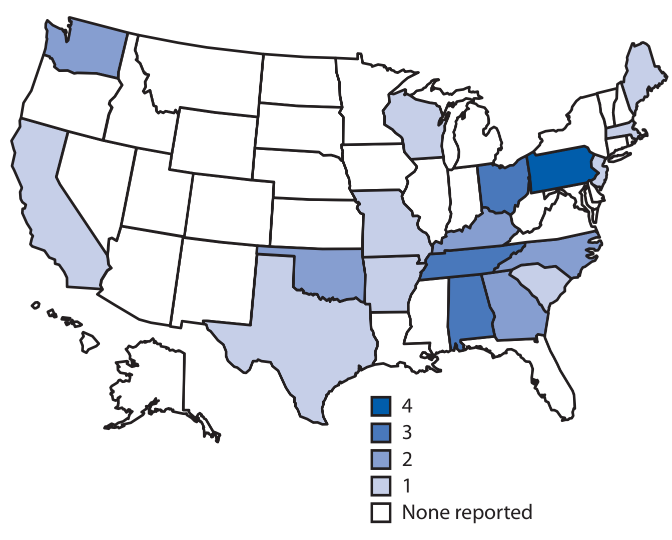
* Number of estimated primary cases.

† Community and noncommunity water systems are public water systems that have 15 or more service connections or serve an average of 25 or more 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 or more of the same persons for ≥6 months of the year but not year-round (e.g., factories and schools). Transient systems provide water to places in which persons do not remain for long periods (e.g., restaurants, highway rest stations, and parks). Individual water systems are small systems not owned or operated by a water utility that have fewer than 15 connections or serve fewer than 25 persons.

§ Waterborne disease outbreak reports through 2014 have been assigned one or more water system characteristics according to information from previous reviews by CDC and USEPA. These characteristics summarize information about how the water became contaminated and factors leading to waterborne disease outbreaks https://www.cdc.gov/healthywater/surveillance/deficiency-classification.html. Characteristics described here include 1) no treatment (untreated ground water); 2) treatment deficiency (e.g., temporary interruption of disinfection, chronically inadequate disinfection, or inadequate or no filtration); and 3) distribution system deficiency (e.g, storage issues such as cross-connection, backflow, contamination of water mains during construction or repair).

¶ This outbreak was assigned two etiologies (hepatitis A virus and an unidentified agent causing acute gastrointestinal illness).

FIGURE 1. Reported drinking water–associated hepatitis A outbreaks (N = 32), by state — Waterborne Disease and Outbreak Surveillance System, United States, 1971–2017



noncommunity (9 [28%] outbreaks; 359 [41.9%] cases). All individual water systems with outbreaks were supplied by private wells or springs. The majority of all drinking water outbreaks and cases were associated with systems supplied by ground water (30 [94%] outbreaks; 804 [93.8%] cases) and with an absence of water treatment (23 [72%] outbreaks; 585 [68.3%] cases).

The incidence of reported drinking water–associated hepatitis A outbreaks significantly decreased after introduction of the 1989 USEPA Total Coliform and Surface Water Treatment Rules (77% decline from 1971–1989 [24 outbreaks] to 1990–2017 [eight]; p = 0.003), the 1996 ACIP hepatitis A vaccination recommendations (87% decline from 1971–1996 [29] to 1997–2017 [three]; p<0.001), and the 2006 Ground Water Rule and expanded ACIP vaccine recommendations (78% decline from 1971–2006 [30] to 2007–2017 [two]; p = 0.038) (Figure 2). From 1995 through 2009, all four hepatitis A drinking water–associated outbreaks, resulting in 35 cases, were attributed to individual water systems using untreated ground water sources. No water-associated hepatitis A outbreaks have been reported since July 2009.

Discussion

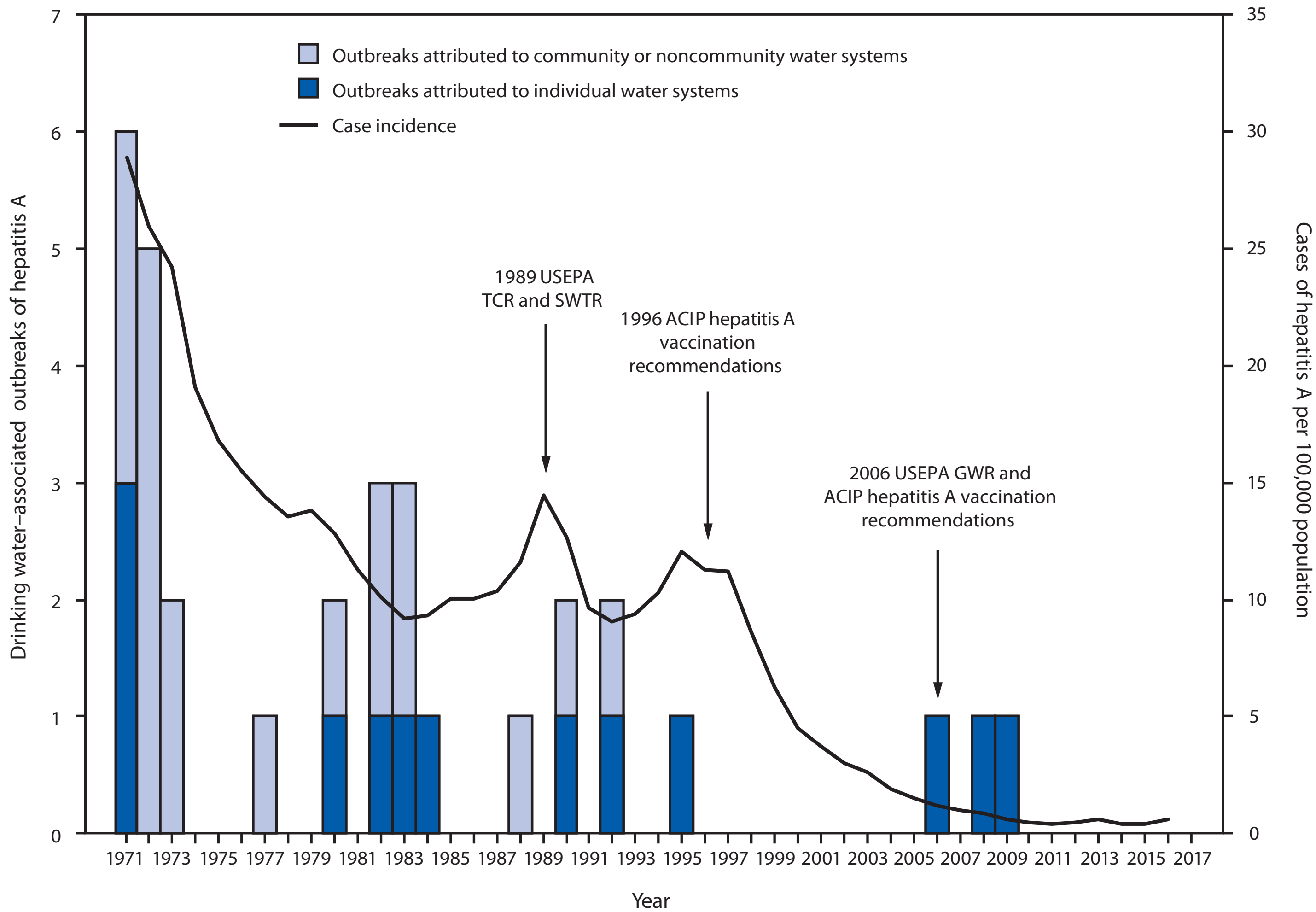
Reported drinking water–associated hepatitis A outbreaks have declined since reporting began in 1971, and none have been reported since 2009, mirroring the overall decline in U.S. cases (*4*,*5*). Vaccination for hepatitis A, combined with USEPA regulations that require testing and, where necessary, corrective actions or treatment for drinking water supplies, likely played a role in reducing reported hepatitis A drinking water–associated outbreaks.

Vaccination efforts have led to significant changes in hepatitis A epidemiology (*4*,*6*,*7*). HAV infection rates in the United States have decreased since the introduction of hepatitis A vaccine in 1995 (*4*,*5*). Vaccine recommendations were originally targeted to children in communities with high rates of hepatitis A infections west of the Mississippi and other groups at risk (e.g., international travelers, men who have sex with men, illicit drug users, persons with clotting factor disorders, and persons with occupational risk). By 2006, routine hepatitis A vaccination was recommended for all children aged ≥1 year regardless of geographic area of residence (*5*). Although vaccination was never recommended for users of individual ground water systems, this group likely benefited from the recommendations targeting children and other groups at risk. Incidence of HAV infection is now lowest among persons aged 0–19 years (*4*). However, the proportion of HAV-associated hospitalizations steadily increased during 1999–2011, likely because of more severe disease in older adults, with persons aged ≥80 years experiencing the highest rates of infection (*6*). The number of hepatitis A cases in the United States reported to CDC increased by 294% during 2016–2018, compared with the period 2013–2015 (*8*), primarily because of community-wide outbreaks in persons reporting homelessness or drug use (*7*). ACIP recommends vaccination to persons who use drugs and recently expanded recommendations to persons experiencing homelessness.¶¶

Reported drinking water–associated hepatitis A outbreaks were most commonly linked to individual water systems that used wells with untreated ground water. Recreational and environmental outbreaks were only reported twice, suggesting that drinking water is a more common waterborne exposure pathway for hepatitis A. Nearly 43 million U.S. residents, or 13% of the population, are served by individual water systems, primarily from ground water sources (https://pubs.er.usgs.gov/publication/cir1441). Untreated ground water sources were associated with 30% of all drinking water–associated outbreaks reported to CDC during 1971–2008 (*1*). The USEPA Total Coliform and Surface Water Treatment Rules of 1989 and Ground Water Rule of 2006 provide enhanced safety measures for public water systems using ground water sources and might have contributed to the absence of reported hepatitis A outbreaks linked to community water sources since 1990. However, federal regulations do not apply to individual water systems, which often have inadequate or no water treatment (*9*). Private wells or springs were the only

¶¶ https://www.cdc.gov/mmwr/volumes/68/wr/mm6806a6.htm.

FIGURE 2. Reported drinking water–associated hepatitis A outbreaks (N = 32), by year, and case incidence of reported hepatitis A virus infections, by year — United States, 1971–2017* and 1971–2016†



Abbreviations: ACIP = Advisory Committee on Immunization Practices; GWR = Ground Water Rule; SWTR = Surface Water Treatment Rule; TCR = Total Coliform Rule; USEPA = U.S. Environmental Protection Agency.
* Waterborne Disease and Outbreak Surveillance System.
† National Notifiable Disease Surveillance System. Adapted from Murphy, TV, Denniston MM, Hill HA, et al. (https://www.cdc.gov/hepatitis/statistics/SurveillanceRpts.htm).

contaminated drinking water systems to cause the last four reported hepatitis A outbreaks during 1995–2009. CDC recommends that owners of private wells test their water annually for indicators of fecal contamination (https://www.cdc.gov/healthywater/drinking/private/wells/testing.html). Factors contributing to fecal contamination of ground water include nearby septic systems or sewage, weather patterns (e.g., heavy rainfall), improper well construction and maintenance, surface water seepage, and hydrogeologic formations (e.g., karst limestone) that allow for rapid pathogen transport (*2*,*9*).

The findings in this report are subject to at least three limitations. First, waterborne hepatitis A outbreak reporting is through a passive, voluntary surveillance system; health departments have varying capacity to detect, investigate, and report outbreaks, which might result in incomplete data on outbreak occurrence and characteristics within and across jurisdictions. Thus, outbreak surveillance data might underestimate the actual number of drinking water–associated hepatitis A outbreaks and might underreport information regarding health outcomes such as cases of illness. Second, attributing the source of an outbreak to individual water systems can be particularly difficult because hepatitis A can also be spread through person-to-person transmission within a household. Finally, outbreak data before 2009 did not include case-specific information; thus, demographic factors, including age, could not be assessed.

Drinking water–associated hepatitis A outbreaks have declined and essentially stopped, likely in large part because of the introduction of an efficacious vaccine as part of the

Summary

What is already known about this topic?

Waterborne hepatitis A outbreaks have been reported to CDC. Person-to-person transmission of hepatitis A has increased in recent years.

What is added by this report?

Reported drinking water–associated hepatitis A outbreaks have declined since introduction of universal childhood vaccination recommendations and public drinking water regulations. However, unvaccinated persons who use water from untreated private wells remain at risk.

What are the implications for public health practice?

Public health officials should raise awareness of risks associated with untreated ground water among users of private wells and of options for private well testing and treatment. Water testing and treatment are important considerations to protect persons who use these unregulated systems from HAV infection.

routine childhood immunization program and microbial drinking water regulations for public water systems. The degree to which these interventions have contributed to the decline in outbreaks is uncertain. However, waterborne outbreak surveillance data is not yet finalized for 2018, and the recent increase in person-to-person transmission of hepatitis A (*7*,*8*) has the potential to cause a resurgence in waterborne outbreaks through increased fecal HAV contamination of private ground water supplies. Outbreak data suggest that individual water systems, primarily those systems drawing untreated ground water from wells, pose the highest risk for causing drinking water–associated hepatitis A outbreaks. These systems are not regulated by USEPA; CDC recommends that owners evaluate their well water quality at least yearly. If indicators of fecal contamination are detected, remediation and treatment of private well water is recommended. Guidance on private well testing and treatment solutions for microbial contamination is provided by USEPA (https://www.epa.gov/privatewells/protect-your-homes-water) and CDC (https://www.cdc.gov/healthywater/drinking/private/wells/index.html). Although the current nationwide outbreak of hepatitis A is not water-associated, considering ground water as a possible transmission route is warranted during community-wide outbreaks of hepatitis A. Ground water can be contaminated with HAV during community transmission of hepatitis A, increasing the risk for persons using untreated water. Public health education about the risks associated with drinking untreated ground water from individual systems, as well as relevant safety measures (i.e., water testing, water treatment, and vaccination), is needed to prevent future drinking water–associated hepatitis A outbreaks.

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Notes from the Field

Hantavirus Pulmonary Syndrome — Denver, Colorado, 2018

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On February 16, 2018, a previously healthy woman aged 47 years sought treatment at the emergency department of a hospital in Denver, Colorado, for acute onset of chest pain, shortness of breath, tachypnea, fever (103.9°F [40.0°C]), and hypoxemia. Five days earlier, she had developed fever, nausea, vomiting, muscle pains, and diarrhea, associated with progressive dyspnea. A chest radiograph at admission revealed interstitial markings bilaterally. Twelve hours after arrival she was intubated and mechanically ventilated and transferred to the intensive care unit for management of hypoxic respiratory failure, disseminated intravascular coagulation, and shock. The patient had thrombocytopenia, hemoconcentration, and elevated liver enzymes. She was initially treated with broad-spectrum antimicrobials and supportive care. Because the patient had clinically compatible symptoms and suggestive laboratory findings for hantavirus infection, on hospital day 3, specimens were collected and sent for testing. On hospital day 11, results of a hantavirus enzyme-linked immunosorbent assay by a commercial laboratory were positive for antihantavirus immunoglobulin G (IgG) and IgM. Serologic testing for Sin Nombre virus, performed by the Colorado Department of Public Health and Environment Laboratory, was positive for IgM and negative for IgG, consistent with acute Sin Nombre virus infection. Hantavirus pulmonary syndrome was confirmed, and antibiotics were stopped; the patient recovered after a 13-day hospitalization.

Sin Nombre virus was identified as a cause of hantavirus pulmonary syndrome in the United States in 1993; the hantavirus pulmonary syndrome case-fatality rate is approximately 38% (*1*). Sin Nombre virus is typically transmitted by inhalation of contaminated rodent urine or droppings; infected persons can experience symptoms 1–8 weeks after exposure (*1*). Treatment is supportive (*2*).

The patient resided and worked in an apartment building in an urban area of Denver, where she performed plumbing, flooring, and maintenance tasks. Four weeks before her illness, she had cleaned an area after ceiling tiles had fallen. She only reported a single day trip to a casino in Gilpin County, Colorado, taken 6 weeks before her illness. She did not report any activities during that trip that would have put her at risk for contracting hantavirus. Twelve days after onset of the patient's illness, Denver Health and the Colorado Department of Public Health and Environment personnel conducted an environmental investigation at her home and place of employment. All areas of the patient's apartment unit, laundry room, basement, and trash chute were inspected, and no evidence of rodent activity was identified. Two days later, during a second visit, personnel examined the originally inspected areas, as well as the garage entry area, maintenance room, and electrical power supply with a black light; no rodents or rodent droppings were seen during either inspection but could have been present earlier. The patient did state that building tenants had reported seeing mice during construction on multiple occasions, although the time frame was not specified.

This is the first reported case of apparent locally acquired hantavirus pulmonary syndrome in Denver, an urban environment. Since 1993, one hantavirus pulmonary syndrome case was identified in Denver in a patient who reported travel to an area with endemic Sin Nombre virus during the incubation period (*3*). During 1993–2018, a total of 115 hantavirus pulmonary syndrome cases were identified among Colorado residents (*3*). No reports of rodents having been tested for Sin Nombre virus in the Denver metropolitan area could be found.

Sin Nombre virus is typically acquired during spring or summer; however, in Colorado, cases have been identified throughout the year, including in this patient who became ill during winter (*3*). Although hantavirus-infected rodents have been reported in urban areas, humans rarely acquire the disease in these environments (*2*–*5*). Because urban transmission can occur, clinicians in arid urban environments such as Denver should consider hantavirus pulmonary syndrome in patients with compatible symptoms and possible rodent exposure, even in the absence of recent travel to a rural area (*6*).

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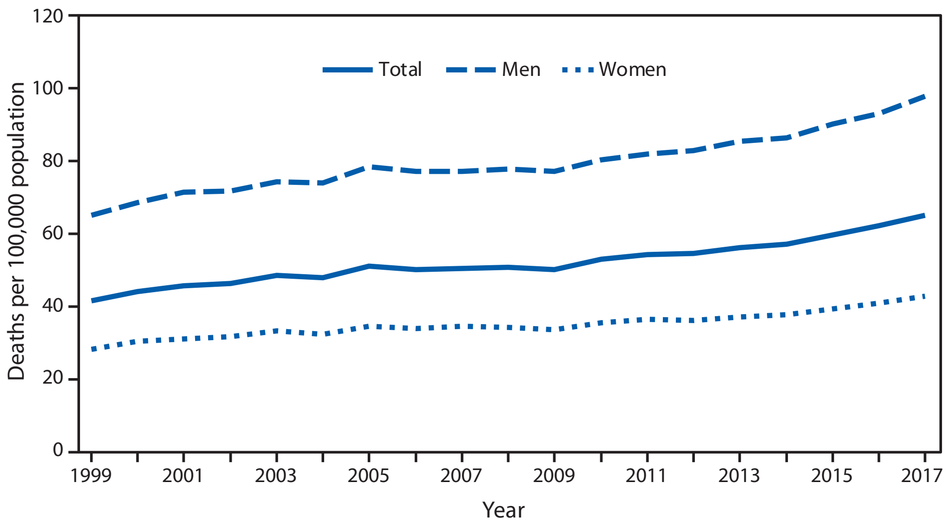
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* for Parkinson Disease† Among Adults Aged ≥65 Years — National Vital Statistics System, United States, 1999–2017



* Deaths per 100,000 population, age-adjusted to 2000 U.S. standard population.
† Deaths for Parkinson disease were identified using *International Classification of Diseases, Tenth Revision* underlying cause of death codes G20-G21.

From 1999 to 2017, age-adjusted death rates for Parkinson disease among adults aged ≥65 years increased from 41.7 to 65.3 per 100,000 population. Among men, the age-adjusted death rate increased from 65.2 per 100,000 in 1999 to 97.9 in 2017. Among women, the rate increased from 28.4 per 100,000 in 1999 to 43.0 in 2017. Throughout 1999–2017, the death rates for Parkinson disease for men were higher than those for women.

Source: National Center for Health Statistics, National Vital Statistics System, Mortality Data 1999–2017. https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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