Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 69 / No. 22
June 5, 2020

Missed Opportunities for Prevention of Congenital Syphilis — United States, 2018

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Congenital syphilis is an infection with *Treponema pallidum* in an infant or fetus, acquired during pregnancy from a mother with untreated or inadequately treated syphilis. Congenital syphilis can cause miscarriage, stillbirth, or early infant death, and infected infants can experience lifelong physical and neurologic problems. Although timely identification and treatment of maternal syphilis during pregnancy can prevent congenital syphilis (*1*,*2*), the number of reported congenital syphilis cases in the United States increased 261% during 2013–2018, from 362 to 1,306. Among reported congenital syphilis cases during 2018, a total of 94 resulted in stillbirths or early infant deaths (*3*). Using 2018 national congenital syphilis surveillance data and a previously developed framework (*4*), CDC identified missed opportunities for congenital syphilis prevention. Nationally, the most commonly missed prevention opportunities were a lack of adequate maternal treatment despite the timely diagnosis of syphilis (30.7%) and a lack of timely prenatal care (28.2%), with variation by geographic region. Congenital syphilis prevention involves syphilis prevention for women and their partners and timely identification and treatment of pregnant women with syphilis. Preventing continued increases in congenital syphilis requires reducing barriers to family planning and prenatal care, ensuring syphilis screening at the first prenatal visit with rescreening at 28 weeks' gestation and at delivery, as indicated, and adequately treating pregnant women with syphilis (*2*). Congenital syphilis prevention strategies that implement tailored public health and health care interventions to address missed opportunities can have substantial public health impact.

Congenital syphilis is a reportable condition in all 50 states and the District of Columbia and is nationally notifiable; case reports are sent voluntarily to CDC through the National Notifiable Diseases Surveillance System. According to the congenital syphilis surveillance case definition, congenital syphilis is 1) a condition affecting stillbirths and infants born to mothers with untreated or inadequately treated syphilis regardless of signs in the infant or 2) a condition affecting an infant with clinical evidence of congenital syphilis including direct detection of *Treponema pallidum* or a reactive nontreponemal syphilis test with signs on physical examination, radiographs, or cerebrospinal fluid analysis (*3*). Rates of congenital syphilis mirror rates of primary and secondary syphilis among women of reproductive age, which approximately doubled during 2014–2018 (*3*). Adequate maternal treatment is defined as completion of a penicillin-based regimen recommended for the mother's stage of syphilis initiated ≥30 days before delivery (*2*). For this analysis, all congenital syphilis prevention opportunities are considered timely if they occurred ≥30 days before delivery, per the surveillance case definition (*3*).

Demographic and clinical characteristics of infants and their mothers were analyzed using Stata statistical software

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(version 11; StataCorp). On the basis of CDC's congenital syphilis prevention framework, each congenital syphilis case was assigned to one of four mutually exclusive missed opportunity categories based on the mother's prenatal care, testing, and treatment history: 1) lack of timely prenatal care with no timely syphilis testing; 2) lack of timely syphilis testing despite timely prenatal care; 3) lack of adequate maternal treatment despite a timely syphilis diagnosis;* or 4) late identification of seroconversion during pregnancy (identified <30 days before delivery). Cases that did not fall into one of the four main missed opportunity categories were categorized as either 1) having signs or symptoms of congenital syphilis despite maternal treatment completion or 2) unable to be classified because of insufficient information reported to CDC. Missed opportunities were quantified nationally by U.S. Census Bureau region† and by race/ethnicity for the highest morbidity regions to identify the most important strategies to prevent congenital syphilis.

Characteristics of Infants with Congenital Syphilis and Their Mothers

Among 1,306 congenital syphilis cases reported during 2018, 685 (52.5%) occurred in the South, 465 (35.6%) in the West, 103 (7.9%) in the Midwest, and 53 (4.1%) in the Northeast Census regions (Table 1). Nationally, 510 (39.1%) mothers of infants with congenital syphilis were non-Hispanic black (black); 411 (31.5%) were Hispanic; 286 (21.9%) were non-Hispanic white (white); and 99 (7.6%) were of another race/ethnicity (non-Hispanic American Indian/Alaska Native [29], non-Hispanic Asian/Pacific Islander [26], or non-Hispanic other or unknown [44]) (Table 1). Approximately half of mothers of infants with congenital syphilis in the Midwest (54.4%) and Northeast (56.6%) had early stages of syphilis (primary, secondary, or early non-primary non-secondary§), compared with those in the South (36.6%) and the West (36.8%). The percentage of congenital syphilis cases that were live-born and symptomatic (33.2% nationally) or stillborn (6.0% nationally) also varied by region.

* For a case of congenital syphilis to be categorized as resulting from this missed opportunity, a pregnant person would 1) need to have evidence of a diagnosis of syphilis during pregnancy with syphilis testing performed ≥30 days before delivery and 2) not have received adequate treatment for syphilis. Those who did not receive adequate treatment had no treatment at all, only received 1 dose when 3 doses were indicated based on maternal staging, received the doses at improper intervals, received the first dose of treatment <30 days before delivery, or were treated with a nonpenicillin–based regimen.

† U.S Census Bureau regions are Northeast, Midwest, South, and West. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf.

§ Primary and secondary syphilis are early stages of syphilis marked by specific clinical characteristics and laboratory evidence. Early non-primary non-secondary syphilis (formerly known as early latent syphilis) is a stage of infection with *T. pallidum* in which the infection occurred within the previous 12 months, but there are no signs or symptoms of primary or secondary syphilis when the infection is identified. https://wwwn.cdc.gov/nndss/conditions/syphilis-early-non-primary-non-secondary/case-definition/2018/.

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2020;69:[inclusive page numbers].

Missed Opportunities for Prevention

Nationally, the most commonly missed prevention opportunity was a lack of adequate maternal treatment despite the timely diagnosis of syphilis during pregnancy (30.7%), followed closely by a lack of timely prenatal care (28.2%) (Table 2). This national pattern was reflected in the South (lack of adequate treatment: 34.3%; lack of prenatal care: 19.9%). In the West, however, the most commonly missed opportunity was a lack of timely prenatal care (41.1%), followed by a lack of adequate maternal treatment despite a timely

TABLE 1. Demographic and clinical characteristics of infants with congenital syphilis and their mothers, by U.S. Census region* — United States, 2018

Characteristic	Census region No. (%†)				
	Total	South	West	Midwest	Northeast
Race/Ethnicity of mother§					
White	**286 (21.9)**	117 (17.1)	130 (28.0)	29 (28.2)	10 (18.9)
Black	**510 (39.1)**	346 (50.5)	86 (18.5)	54 (52.4)	24 (45.3)
Hispanic	**411 (31.5)**	200 (29.2)	194 (41.7)	6 (5.8)	11 (20.7)
American Indian/Alaska Native	**29 (2.2)**	2 (0.3)	23 (4.9)	4 (3.9)	0 (0)
Asian/Pacific Islander	**26 (2.0)**	3 (0.4)	17 (3.7)	5 (4.9)	1 (1.9)
Other/Unknown	**44 (3.4)**	17 (2.5)	15 (3.2)	5 (4.9)	7 (13.2)
Maternal stage of syphilis					
Primary or secondary	**108 (8.3)**	48 (7.0)	43 (9.2)	11 (10.7)	6 (11.3)
Early non-primary non-secondary	**400 (30.6)**	203 (29.6)	128 (27.5)	45 (43.7)	24 (45.3)
Unknown duration or late	**664 (50.8)**	317 (46.3)	283 (60.9)	43 (41.7)	21 (39.6)
Other/Missing	**134 (10.3)**	117 (17.1)	11 (2.4)	4 (3.9)	2 (3.8)
Infant outcomes					
Live-born with signs or symptoms of congenital syphilis¶	**434 (33.2)**	167 (24.4)	198 (42.6)	46 (44.7)	23 (43.4)
Live-born with no documented signs or symptoms of congenital syphilis	**788 (60.3)**	474 (69.2)	236 (50.8)	52 (50.5)	26 (49.1)
Stillborn	**78 (6.0)**	41 (6.0)	29 (6.2)	4 (3.9)	4 (7.5)
Unknown vital status	**6 (0.5)**	3 (0.4)	2 (0.4)	1 (1.0)	0 (0)
Total	**1,306**	**685**	**465**	**103**	**53**

* *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
† Percentages might not sum to 100 because of rounding.
§ Whites, blacks, American Indians/Alaska Natives, Asians/Pacific Islanders, and others/unknown were non-Hispanic; Hispanics could be of any race.
¶ Signs or symptoms of congenital syphilis include any one of the following: condyloma lata, snuffles, syphilitic rash, hepatosplenomegaly, jaundice/hepatitis, pseudoparalysis, or edema on physical exam; long-bone radiograph findings consistent with congenital syphilis; abnormal protein or white blood cell count in the cerebrospinal fluid; reactive venereal disease research laboratory test in the cerebrospinal fluid; direct detection of *Treponema pallidum* by dark field microscopy or special stains.

TABLE 2. Missed congenital syphilis prevention opportunities among mothers of infants with congenital syphilis, by U.S. Census region* — United States, 2018

Missed prevention opportunity	Census region No. (%†)				
	Total	South	West	Midwest	Northeast
No timely prenatal care and no timely syphilis testing	**368 (28.2)**	136 (19.9)	191 (41.1)	25 (24.3)	16 (30.2)
No timely syphilis testing despite receipt of timely prenatal care	**116 (8.9)**	47 (6.9)	55 (11.8)	8 (7.8)	6 (11.3)
No adequate maternal treatment despite a timely syphilis diagnosis	**401 (30.7)**	235 (34.3)	133 (28.6)	26 (25.2)	7 (13.2)
Late identification of seroconversion during pregnancy§	**146 (11.2)**	73 (10.7)	30 (6.5)	22 (21.4)	21 (39.6)
Missed prevention opportunity not identified					
Clinical evidence of congenital syphilis despite maternal treatment completion¶	**46 (3.5)**	33 (4.8)	9 (1.9)	4 (3.9)	0 (0.0)
Insufficient information**	**229 (17.5)**	161 (23.5)	47 (10.1)	18 (17.5)	3 (5.7)
Total	**1,306**	**685**	**465**	**103**	**53**

* *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
† Percentages might not sum to 100 because of rounding.
§ Must have had a negative syphilis test early in pregnancy and a positive syphilis test <30 days before delivery, at day of delivery, or ≤90 days after delivery to be classified as having a seroconversion during pregnancy.
¶ Infant indications of infection include direct detection of *Treponema pallidum* by dark field microscopy or special stains; a reactive nontreponemal test and any one of these signs or symptoms of congenital syphilis: condyloma lata, snuffles, syphilitic rash, hepatosplenomegaly, jaundice/hepatitis, pseudoparalysis, or edema on physical exam; long-bone radiograph findings consistent with congenital syphilis; abnormal protein or white blood cell count in the cerebrospinal fluid; or reactive venereal disease research laboratory test in the cerebrospinal fluid.
** Insufficient information submitted to CDC related to maternal prenatal care, testing, or treatment to categorize.

diagnosis (28.6%). In the Northeast, the most commonly missed opportunity was late identification of seroconversion during pregnancy (39.6%).

Racial/ethnic disparities existed within the highest morbidity regions. In the South, the most commonly missed prevention opportunity among white mothers of infants with congenital syphilis was lack of timely prenatal care (31.6%), whereas among black and Hispanic mothers, lack of adequate maternal treatment (37.0%) was the most common (Table 3). In the West, racial/ethnic differences were less pronounced: regardless of race/ethnicity, >41% of mothers of infants with congenital syphilis lacked timely prenatal care, and >29% lacked adequate treatment despite receipt of a timely syphilis diagnosis.

Discussion

Nationally, the most commonly missed opportunity for preventing congenital syphilis was lack of adequate maternal treatment, likely driven by the high numbers of cases in the South, where this missed opportunity was most prevalent. The most common missed opportunities for preventing congenital syphilis differed by geographic region. In the West, a lack of timely prenatal care was the most commonly missed opportunity, and in the Northeast, late identification of seroconversion was the most common. Regional clinical and demographic differences in mothers of infants with congenital syphilis indicate that different populations are at increased risk and might require different interventions. The high proportion of mothers with early syphilis in certain regions signals recent heterosexual transmission and the potential for future increases in congenital syphilis cases if no intervention occurs. The high proportions of symptomatic and stillborn infants in certain regions might be related to early syphilis among their mothers, given that higher rates of vertical transmission and worse infant outcomes are associated with early syphilis during pregnancy (*5*).

Published analyses of state-level data demonstrate additional heterogeneity in prevalences of missed opportunities and priority interventions. Repeat syphilis testing early in the third trimester was recently identified as the main intervention for preventing congenital syphilis in Florida, Louisiana, and New York City (*6*,*7*). A review of recent congenital syphilis cases in Indiana found that social vulnerabilities, including homelessness, substance abuse, and incarceration, were barriers to receiving timely diagnosis and treatment, despite provider adherence to CDC guidelines (*8*). A California study of missed opportunities for prevention of congenital syphilis identified gaps in multiple steps of the prevention cascade and found that early prenatal care is critical to preventing congenital syphilis and that multifaceted efforts are needed (*9*). Establishment of congenital syphilis case review boards in Louisiana identified specific missed opportunities, including lack of screening and treatment delay (*10*). These data support the need for tailored interventions based on local epidemiology and analysis of missed prevention opportunities.

A national congenital syphilis prevention strategy requires prioritizing interventions to address the root causes of missed

TABLE 3. Missed congenital syphilis prevention opportunities among mothers of infants with congenital syphilis in the South and West U.S. Census regions,* by race/ethnicity† — United States, 2018

	Census region and race/ethnicity No. (%§)					
	South			West		
Missed prevention opportunity	**White**	**Black**	**Hispanic**	**White**	**Black**	**Hispanic**
No timely prenatal care and no timely syphilis testing	37 (31.6)	68 (19.7)	26 (13.0)	56 (43.1)	37 (43.0)	81 (41.8)
No timely syphilis testing despite receipt of timely prenatal care	7 (6.0)	26 (7.5)	14 (7.0)	17 (13.1)	6 (7.0)	23 (11.9)
No adequate maternal treatment despite a timely syphilis diagnosis	28 (23.9)	128 (37.0)	74 (37.0)	38 (29.2)	26 (30.2)	57 (29.4)
Late identification of seroconversion during pregnancy¶	18 (15.4)	34 (9.8)	19 (9.5)	7 (5.4)	4 (4.7)	14 (7.2)
Missed prevention opportunity not identified						
Clinical evidence of congenital syphilis despite adequate maternal treatment completion**	5 (4.3)	17 (4.9)	9 (4.5)	3 (2.3)	2 (2.3)	2 (1.0)
Insufficient information††	22 (18.8)	73 (21.1)	58 (29.0)	9 (6.9)	11 (12.8)	17 (8.8)
Total	**117**	**346**	**200**	**130**	**86**	**194**

* *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

† White and black mothers were non-Hispanic; Hispanic mothers might be of any race.

§ Percentages might not sum to 100 because of rounding.

¶ Must have had negative syphilis test early in pregnancy and a positive syphilis test <30 days before delivery, at day of delivery, or ≤90 days after delivery to be classified as having a seroconversion during pregnancy.

** Infant indications of infection include direct detection of *Treponema pallidum* by dark field microscopy or special stains; a reactive nontreponemal test and any one of these signs or symptoms of congenital syphilis: condyloma lata, snuffles, syphilitic rash, hepatosplenomegaly, jaundice/hepatitis, pseudoparalysis, or edema on physical exam; long bone radiograph findings consistent with congenital syphilis; abnormal protein or white blood cell count in the cerebrospinal fluid; reactive venereal disease research laboratory test in the cerebrospinal fluid.

†† Insufficient information submitted to CDC related to maternal prenatal care, testing, or treatment to categorize.

Summary

What is already known about this topic?

Timely identification and treatment of maternal syphilis can prevent congenital syphilis; however, the number of congenital syphilis cases in the United States increased 261% during 2013–2018.

What is added by this report?

Nationally, the most commonly missed opportunities for prevention of congenital syphilis are a lack of adequate maternal treatment despite timely diagnoses of syphilis (31%) and a lack of timely prenatal care (28%), followed by late identification of seroconversions (11%); prevalences of these missed opportunities differ regionally and by race/ethnicity.

What are the implications for public health practice?

Halting continued increases in congenital syphilis requires understanding the missed prevention opportunities and implementing tailored interventions based on local experience.

opportunities while maximizing the impact of finite resources. Interventions are needed for identifying pregnant women with syphilis outside of prenatal care and for reducing barriers to prenatal care for all women. Ensuring timely follow-up of positive syphilis test results for pregnant women and reducing barriers to adequate syphilis treatment for pregnant women and their partners can prevent congenital syphilis cases. Syphilis screening for all pregnant women at the first prenatal visit with repeat screening at 28 weeks and at delivery for women in high prevalence areas or who are at increased risk for acquisition can further reduce congenital syphilis and its associated morbidity. These interventions require collaboration among public health authorities, health care organizations and providers, and policymakers. Jurisdictions can establish congenital syphilis case review boards that can identify local prevention failures and explore solutions. The differences in missed opportunities noted among regions and among racial/ethnic groups within regions demonstrate that tailored prevention efforts are needed.

The findings in this report are subject to at least three limitations. First, U.S. jurisdictions have different processes for congenital syphilis case investigation and reporting, and congenital syphilis investigations can be time-consuming and complicated. Inaccurate or incomplete data can lead to misclassification of missed prevention opportunity categories and might have magnified observed regional differences. Second, case report data provide limited information regarding each infant with congenital syphilis and each mother of an infant with congenital syphilis; this can lead to underascertainment of such factors as seroconversion. Finally, national congenital syphilis case report data do not contain information regarding social determinants of health such as maternal substance use; thus, this analysis cannot address the multifactorial barriers to accessing prenatal care and receiving adequate treatment.

Congenital syphilis prevention requires syphilis prevention for women and their sex partners and timely identification and treatment of pregnant women with syphilis. Improving access to prenatal care and family planning for all women can improve rates of congenital syphilis as well as many other maternal and child health outcomes. Regional differences in the missed prevention opportunities indicate a need for different priorities for interventions that address root causes of congenital syphilis. Halting the continued increases and eventually eliminating congenital syphilis in the United States will require collaboration between public health and health care sectors, understanding missed prevention opportunities, and implementing tailored interventions accordingly.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Multistate Mumps Outbreak Originating from Asymptomatic Transmission at a Nebraska Wedding — Six States, August–October 2019

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In August 2019, 30 attendees at a Nebraska wedding developed mumps after being exposed to one asymptomatic index patient who was fully vaccinated according to Advisory Committee on Immunization Practices (ACIP) recommendations (*1*), resulting in a multistate outbreak. A public health investigation and response revealed epidemiologic links that extended from the index patient through secondary, tertiary, and quaternary patients and culminated in a measles-mumps-rubella (MMR) booster vaccination campaign in the local community where approximately half of the patients resided.

Investigation and Results

On August 26, 2019, the Nebraska Department of Health and Human Services (NDHHS) was notified by a South Dakota hospital of three suspected mumps cases (awaiting laboratory confirmation) in patients who had attended a wedding in Nebraska on August 3. On August 28, an attendee list including 176 families (approximately 325 attendees) was obtained from the bride. She identified 25 wedding attendees that she believed to be ill, including an attendee who developed symptoms <24 hours after the wedding and 15 days before symptom onset in the next earliest ill person identified. Attendees on the list resided in 14 states: Arizona, Arkansas, Colorado, Georgia, Idaho, Iowa, Kansas, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, and Wyoming. That same day, NDHHS issued an alert and call for cases using Epi-X to public health partners nationwide that emphasized the potential for the outbreak to reach to multiple states. The following day, statewide Health Alert Network advisories were sent to providers in Nebraska and South Dakota, and a media statement was released in Nebraska.

To identify additional cases, NDHHS developed a web-based questionnaire using Research Electronic Data Capture,* and the link was provided to all 176 attending families by e-mail and letters to ascertain illness status, symptom onset date among ill persons, and symptoms. In addition, reports of potential mumps cases were solicited from health care providers, local health departments, the South Dakota Department of Health, and clinical, commercial, and public health laboratories. Mumps case status was assigned as probable or confirmed using the 2012 Council of State and Territorial Epidemiologists case definition (*2*). Patients, including those identified through the questionnaire, were interviewed by telephone and advised to observe standard mumps isolation precautions (*3*). Self-reported MMR vaccination history was collected from patients during the investigation, and persons with unknown vaccination histories were cross-referenced with state vaccination registries. CDC's Vaccine Preventable Diseases Reference Center at the Minnesota Public Health Laboratory genotyped four isolates collected from Nebraska patients.

The index patient, a Nebraska resident aged 25 years who worked as a child caretaker, had close contact over a 6-day period beginning July 25 with an ill child aged 1 year who had recently returned from a family vacation in Florida and Antigua.† The child had received the first on-schedule dose of MMR vaccine in June and on return from vacation on July 24, developed a high fever, and exhibited frequent ear-pulling. The child received medical attention on July 24, 26, and 27 and was given a diagnosis of a viral illness. The index patient attended the wedding on August 3 (day 9 after her initial exposure to the child) and reported extensive social interactions, including sharing drinks and dancing. She developed left ear and jaw tenderness the next day (August 4) and parotitis on August 5 (11 days after exposure); she sought medical care on August 9 (day 15). She received treatment with corticosteroids,§ but because no diagnostic testing was performed, she was classified as having a probable case of mumps.

The index patient verified that neither the child nor the child's family attended the wedding and reported she had no contact with any wedding attendees in the weeks preceding the wedding. This index patient was fully vaccinated according to ACIP guidelines (*1*), which was verified in the state vaccination registry. Drinking wine from a shared vessel, a potential vehicle for transmission of respiratory illnesses at weddings, was not a part of the wedding ceremony.

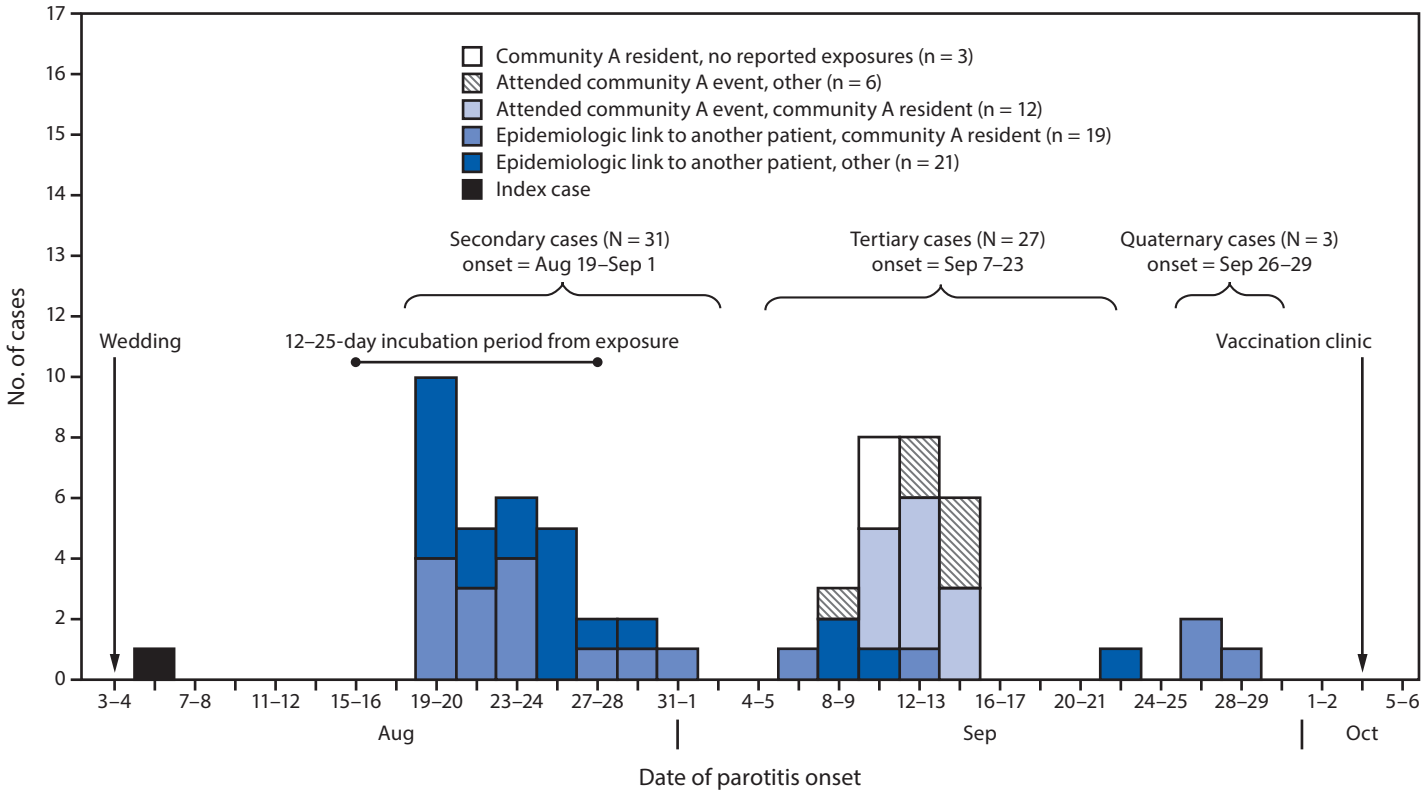
Among approximately 325 persons who attended the wedding, 148 (46%) completed the online questionnaire. Overall, 31 secondary cases (including 13 confirmed and 18 probable) were identified (Figure). Patients with secondary cases reported parotitis onset from August 19 to September 1 (16–29 days after the wedding). Thirty of these patients attended the

* https://www.project-redcap.org/.

† Antigua is one of the Leeward Islands in the Caribbean region and the main island of the country of Antigua and Barbuda.

§ https://www.cdc.gov/mumps/hcp.html.

FIGURE. Onset of parotitis among persons with confirmed and probable mumps cases (N = 62) — six states,* August–October 2019



* Community A events included street dance (N = 7), football game (N = 6), school (N = 3), and unspecified (N = 2).

wedding (attack rate = 30 of 325 [minimum = 9%]); one patient did not attend the wedding but was exposed to the index patient elsewhere. Fourteen patients (45%) resided in community A, a town in northeastern Nebraska with a population of approximately 1,400 persons. Among the 30 patients who attended the wedding, 15 (50%) had received 2 doses of MMR vaccine. Three patients (two who had received 2 doses of MMR vaccine and one with an unknown vaccination history) who had no likely exposures except the wedding developed parotitis 26–29 days after the wedding, which is longer than the typical mumps incubation period of 12–25 days (*3*).

Twenty-seven tertiary cases (23 confirmed and four probable) were subsequently identified. Patients' reported parotitis onset dates ranged from September 7 to September 23 (35–51 days after the wedding). Seventeen (63%) patients resided in community A. Six cases were epidemiologically linked to secondary cases. Eighteen were linked to different events in community A. Three were community A residents with no other known epidemiologic links.

Three quaternary cases, all confirmed, were identified. Patients' reported parotitis onset dates ranged from September 26 to September 29 (54–57 days after the wedding). All three resided in community A and were epidemiologically linked to a tertiary case.

In total, 62 cases were identified (39 confirmed and 23 probable); 54 (87%) were Nebraska residents, including 34 (55%) from community A and eight (13%) from other states (three secondary cases among wedding attendees from South Dakota, one tertiary case from South Dakota, and four secondary cases, one each from Idaho, Minnesota, North Dakota, and Wyoming). Median patient age was 35 years (range = 6–59 years, old enough to have received 2 doses of MMR vaccine); 41 (66%) had received ≥2 doses of MMR vaccine (Table), and 37 (60%) were male. No serious mumps complications or hospitalizations were identified. Genotype

TABLE. Measles-mumps-rubella (MMR) vaccination histories of mumps patients* (N = 62) — six states, August–October 2019

No. of MMR doses received	No. (%) of patients
0	2 (3)
1	5 (8)
2	38 (61)
3	3 (5)
≥1	51 (82)
Unknown	9 (15)

* Mumps vaccination histories were first self-reported during investigations, and vaccine registries were then queried for persons with unknown vaccination status.

testing identified isolates of one secondary patient as indeterminate, one tertiary patient as genotype G, and two quaternary patients as genotype G. No additional cases linked to this outbreak have been identified in Nebraska or elsewhere.

Public Health Response

With 45% of secondary cases occurring among community A residents, state and local public health officials considered an MMR booster vaccine campaign in that community. Because predicting ongoing transmission was difficult given the point-source nature of the wedding exposure and wide geographic distribution of ill attendees, a communitywide vaccination campaign was not initiated at that time. However, after 63% of tertiary cases were identified among community A residents, the increased perception of ongoing risk for the community and potential benefit of a communitywide MMR booster vaccine campaign warranted an escalated response (*4*).

To inform Community A residents of the vaccination campaign, a flyer was distributed to the Chamber of Commerce, local schools, city and county offices, local radio and television stations, a local cable access television channel, and through the local health department's Facebook page and websites. The target population was estimated at 700 persons using the American Community Survey (*5*). Thirty public health officials and volunteers participated in the vaccination campaign, and the National Incident Management System for clinic operations was used to structure the event. Residents were screened to determine whether they met criteria to receive the MMR vaccine, including adults aged 19–62 years living or working in community A with no medical contraindications and who had not received a mumps diagnosis or a mumps-containing vaccine within the past 6 months. On October 3, a total of 327 (47%) persons from the target population received an MMR vaccine dose at the community's fire station.

Summary

What is already known about this topic?

Since 2006, most U.S. mumps cases have been reported among persons who have received 2 doses of measles-mumps-rubella (MMR) vaccine. Mumps is most infectious just before and during the onset of parotitis.

What is added by this report?

A multistate outbreak followed contact with an asymptomatic, fully vaccinated index patient who reported extensive social interactions at a wedding, resulting in 31 secondary cases, 27 tertiary cases, and three quaternary cases. Isolation and a communitywide third-dose MMR vaccination campaign helped end the outbreak.

What are the implications for public health practice?

Asymptomatic transmission of mumps in a conducive environment is capable of producing a widespread outbreak. An MMR vaccine campaign can be considered in community settings.

Discussion

A mumps outbreak involving six states occurred following exposure to an asymptomatic, fully vaccinated (*1*) index patient who reported extensive social interaction during the peak period of infectivity, in an environment where potentially susceptible persons were densely clustered. Mumps immunity after childhood vaccination can wane by early adulthood (*6*). It is likely that waning of vaccine-induced immunity contributed to this outbreak, because approximately two thirds of patients had received ≥2 doses of MMR vaccine, and the median patient age was 35 years. Specific viral factors (e.g., mutations increasing pathogenicity and shedding) were not a likely contributor because mumps genotype G is commonly implicated in both sporadic cases and outbreaks in the United States (*7*). However, mumps is most infectious just before and during onset of parotitis (*3*), and the timing of the event likely contributed to transmission among exposed attendees because the index patient developed parotitis the day after the wedding. The wedding served as a setting conducive to droplet transmission, facilitated by close social contact.

Isolation of ill persons and a communitywide MMR vaccination campaign helped end the outbreak. As of December 1, 2019, no additional cases had been identified in community A, nor had any additional cases been identified in any other state as linked to this outbreak. A decline in case count before the campaign was observed, which complicated assessment of the campaign's relative contribution in controlling the outbreak. Collaborative efforts, including early and regular communication between local, state, and national public health authorities, local health care providers, and community officials proved crucial for efficient resource mobilization, strengthened preparedness, and resulted in effective disease containment.

Acknowledgments

Nebraska: Douglas County Health Department, East Central District Health Department, Elkhorn Logan Valley Public Health Department, Lincoln-Lancaster County Health Department, Northeast Nebraska Community Action Partnership, Public Health Solutions, Sarpy/Cass Health Department, South Heartland District Health Department; State partners in Idaho, Minnesota, North Dakota, South Dakota, Wyoming; Jessica Leung, Mariel Marlow, National Center for Immunizations and Respiratory Disease, CDC; Stacey Bosch, Epidemiology Workforce Branch, CDC; South Dakota Health Department; South Dakota Public Health Laboratory.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Mortality Among Persons with Both Asthma and Chronic Obstructive Pulmonary Disease Aged ≥25 Years, by Industry and Occupation — United States, 1999–2016

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Patients with asthma typically have chronic airway inflammation, variable airflow limitation, and intermittent respiratory symptoms; patients with chronic obstructive pulmonary disease (COPD) often have fixed airflow limitation and persistent respiratory symptoms. Some patients exhibit features suggesting that they have both conditions, which is termed asthma-COPD overlap. These patients have been reported to have worse health outcomes than do those with asthma or COPD alone (*1*). To describe mortality among persons aged ≥25 years with asthma-COPD overlap, CDC analyzed 1999–2016 National Vital Statistics multiple-cause-of-death mortality data* extracted from the National Occupational Mortality System (NOMS), which included industry and occupation† information collected from 26 states§ for the years 1999, 2003, 2004, and 2007–2014. Age-adjusted death rates per one million persons¶ and proportionate mortality ratios (PMRs)** were calculated. During 1999–2016, 6,738 male decedents (age-adjusted rate per million = 4.30) and 12,028 female decedents (5.59) had both asthma and COPD assigned on their death certificate as the underlying or contributing cause of death. The annual age-adjusted death rate per million among decedents with asthma-COPD overlap declined from 6.70 in 1999 to 3.01 in 2016 ($p<0.05$) for men and from 7.71 in 1999 to 4.01 in 2016 ($p<0.05$) for women. Among adults aged 25–64 years, asthma-COPD overlap PMRs, by industry, were significantly elevated among nonpaid workers, nonworkers, and persons working at home for both men (1.72) and women (1.40) and among male food, beverage, and tobacco products workers (2.64). By occupation, asthma-COPD overlap PMRs were significantly elevated among both men (1.98) and women (1.79) who were unemployed, had never worked, or were disabled workers and among women bartenders (3.28) and homemakers (1.34). The association between asthma-COPD overlap mortality and nonworking status among adults aged 25–64 years suggests that asthma-COPD overlap might be associated with substantial morbidity. Increased risk for asthma-COPD overlap mortality among adults in certain industries and occupations suggests targets for public health interventions (e.g., elimination of or removal from exposures, engineering controls, and workplace smoke-free policies) to prevent asthma and COPD in and out of the workplace.

For this report, 1999–2016 National Vital Statistics System's multiple-cause-of-death data extracted from NOMS were analyzed. Decedents with asthma-COPD overlap were identified using the *International Classification of Diseases, Tenth Revision* codes from death certificates for which both asthma and COPD†† were listed as the underlying or contributing cause of death. Death rates per million persons aged ≥25 years were assessed by sex and year and were age-adjusted using the 2000 U.S. Census standard population. Time trends in log-transformed age-adjusted mortality rates were assessed in Joinpoint software§§ by performing a sequence of permutation tests using Monte Carlo sampling and the Bonferroni correction for multiple testing. Information on industry and

* https://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm.

† Guidelines for reporting industry and occupation on death certificates instruct recorders to report decedent's "kind of business/industry" and "usual occupation" (i.e., "the type of job the individual was engaged in for most of his or her working life").

§ Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin. States represent the state where the death took place, not necessarily where the decedent had resided.

¶ Age-adjusted death rates were calculated by applying age-specific death rates to the 2000 U.S. Census standard population age distribution. https://wonder.cdc.gov/wonder/help/mcd.html#Age-AdjustedRates.

** PMR was defined as the observed number of deaths from asthma-COPD overlap in a specified industry or occupation, divided by the expected number of deaths from asthma-COPD overlap. The expected number of deaths was the total number of deaths in industry or occupation of interest multiplied by a proportion defined as the number of asthma-COPD overlap deaths in all industries or occupations, divided by the total number of deaths in all industries or occupations. The asthma-COPD overlap PMRs were internally adjusted by 5-year age groups, sex, and race. CIs were calculated assuming Poisson distribution of the data. A PMR >1.0 indicates that there were more deaths associated with the condition in a specified occupation or industry than expected; a PMR <1.0 indicates that there were fewer deaths associated with the condition in a specified occupation or industry than expected.

†† *International Classification of Diseases, Tenth Revision* codes for asthma: J45.0 (predominantly allergic asthma), J45.1 (nonallergic asthma), J45.8 (mixed asthma), J45.9 (asthma, unspecified), J46 (status asthmaticus); and COPD: J40 (bronchitis, not specified as acute or chronic), J41.0 (simple chronic bronchitis), J41.1 (mucopurulent chronic bronchitis), J41.8 (mixed simple and mucopurulent chronic bronchitis), J42 (unspecified chronic bronchitis), J43.0 (MacLeod's syndrome), J43.1 (panlobular emphysema), J43.2 (centrilobular emphysema), J43.8 (other emphysema), J43.9 (emphysema, unspecified), J44.0 (chronic obstructive pulmonary disease with acute lower respiratory infection), J44.1 (chronic obstructive pulmonary disease with acute exacerbation, unspecified), J44.8 (other specified chronic obstructive pulmonary disease), J44.9 (chronic obstructive pulmonary disease, unspecified).

§§ https://surveillance.cancer.gov/joinpoint/.

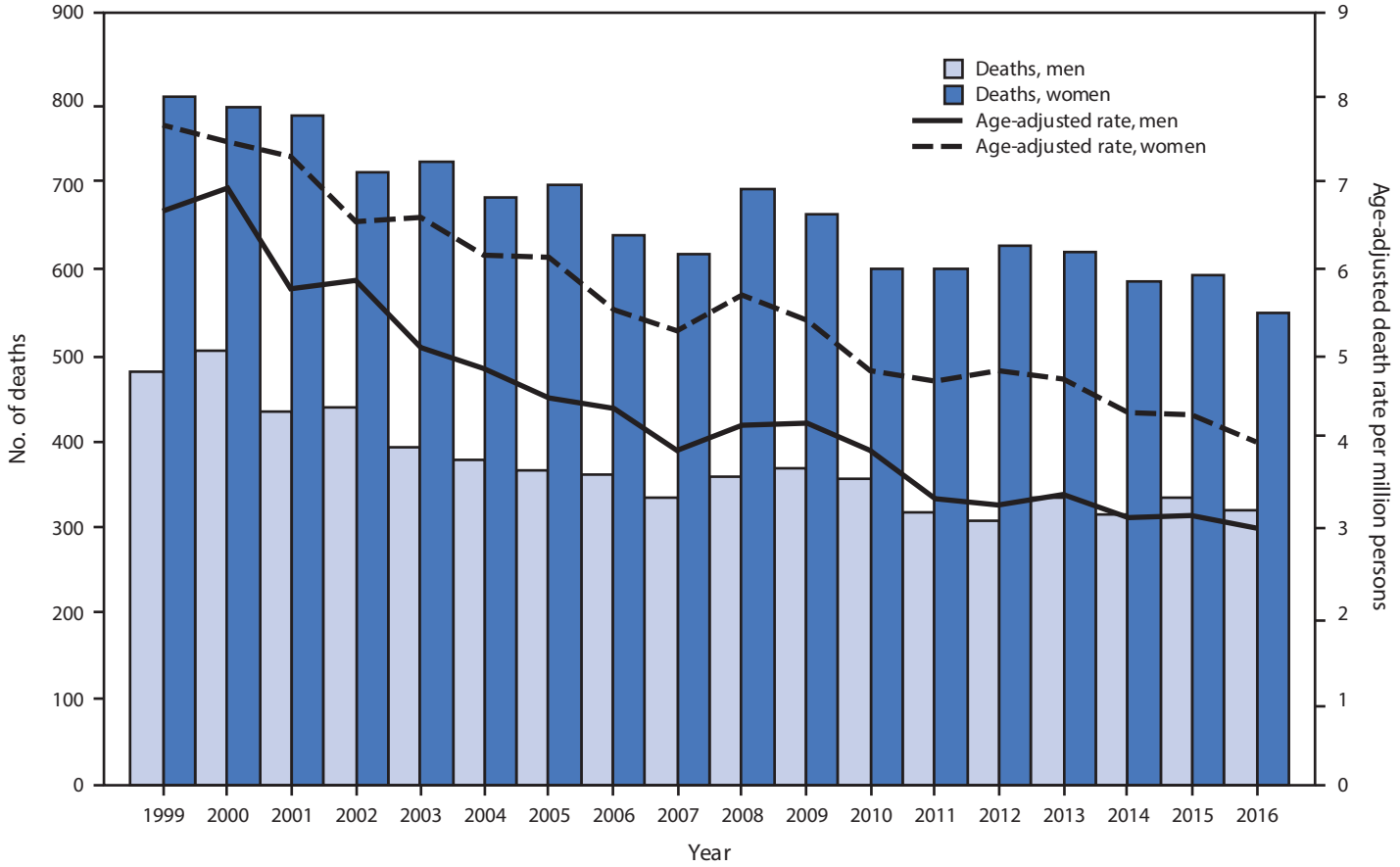
occupation, coded by the National Institute for Occupational Safety and Health using the U.S. Census 2000 Industry and Occupation Classification System, was available from 26 states for the years 1999, 2003, 2004, and 2007–2014.¶¶ PMRs, relative to the expected number of decedents with asthma-COPD overlap, and 95% confidence intervals (CIs) were generated by industry and occupation for men and women and adjusted for 5-year age groups and race. Joinpoint (version 4.7.0.0; National Cancer Institute) and SAS software (version 9.4; SAS Institute) were used to conduct all statistical analyses.

During 1999–2016, among U.S. decedents aged ≥25 years, a total of 4,689,828 had COPD and 164,731 had asthma assigned on their death certificate as the underlying or contributing cause of death. Among these decedents, 18,766 had both asthma and COPD assigned as the underlying or contributing cause of death (6,738 among men and 12,028 among women). The overall death rate among those with asthma-COPD overlap was 5.03 per million persons (4.30 among men and 5.59 among women). The annual age-adjusted death rate per million for men declined from 6.70 in 1999 to 3.01 in 2016 (annual percent change [APC] = –4.82%; p<0.05) and for women declined from 7.71 in 1999 to 4.01 in 2016 (APC = –3.63%; p<0.05) (Figure).

Among persons aged 25–64 years in 26 states during 1999, 2003, 2004, and 2007–2014, industry and occupation data were available for 784 (99.1%) of 791 decedents with

¶¶ https://www.cdc.gov/niosh/topics/noms/default.html.

FIGURE. Number of asthma and chronic obstructive pulmonary disease (COPD) overlap deaths* and age-adjusted asthma-COPD overlap death rates† among decedents aged ≥25 years, by sex — United States, 1999–2016



* Decedents with *International Classification of Diseases, Tenth Revision* codes for asthma: J45.0 (predominantly allergic asthma), J45.1 (nonallergic asthma), J45.8 (mixed asthma), J45.9 (asthma, unspecified), J46 (status asthmaticus); and COPD: J40 (bronchitis, not specified as acute or chronic), J41.0 (simple chronic bronchitis), J41.1 (mucopurulent chronic bronchitis), J41.8 (mixed simple and mucopurulent chronic bronchitis), J42 (unspecified chronic bronchitis), J43.0 (MacLeod's syndrome), J43.1 (panlobular emphysema), J43.2 (centrilobular emphysema), J43.8 (other emphysema), J43.9 (emphysema, unspecified), J44.0 (chronic obstructive pulmonary disease with acute lower respiratory infection), J44.1 (chronic obstructive pulmonary disease with acute exacerbation, unspecified), J44.8 (other specified chronic obstructive pulmonary disease), and J44.9 (chronic obstructive pulmonary disease, unspecified) assigned as the underlying cause of death (i.e., the disease or injury which initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury) or as a contributing cause of death.

† Age-adjusted death rates per million persons were calculated by applying age-specific death rates to the 2000 U.S. Census standard population age distribution. https://wonder.cdc.gov/wonder/help/mcd.html#Age-AdjustedRates.

asthma-COPD overlap (314 [99.4%] of 316 men and 470 [98.9%] of 475 women). By industry, asthma-COPD overlap PMRs were significantly elevated among nonpaid workers, nonworkers, and persons working at home for both men (1.72) and women (1.40) and among male food, beverage, and tobacco products workers (2.64) (Table 1). By occupation, asthma-COPD overlap PMRs were significantly elevated among men (1.98) and women (1.79) who were unemployed, never worked, or were disabled workers and among women bartenders (3.28) and homemakers (1.34) (Table 2).

Among persons aged ≥65 years, industry and occupation data were available for 1,908 (98.3%) of 1,941 decedents with asthma-COPD overlap (624 [99.5%] of 627 men and 1,284 [97.7%] of 1,314 women). Asthma-COPD overlap PMRs were significantly elevated among men in certain industries (e.g., computer and electronic products [2.58]; lumber, wood products, and furniture [2.53]; agriculture, forestry, fishing and hunting [1.82]; beverage manufacturing [3.15]; and miscellaneous manufacturing [1.39]) and among women in private households (1.69), furniture and home furnishings stores (2.99), and unspecified food industries (3.72) (Table 1). By occupation, asthma-COPD overlap PMRs were significantly elevated among men in fishing, hunting, and forestry (3.78); farmers and farm managers (1.62); laborers and material movers (1.54); carpenters (1.68); and industrial production managers (2.23) and among women production workers (1.66) and waitresses (1.70) (Table 2).

Discussion

Among persons aged ≥25 years, more women than men died from asthma-COPD overlap. A study using 2012 Behavioral Risk Factor Surveillance System data from South Carolina found that asthma-COPD overlap was more prevalent among women than among men (*2*). The annual age-adjusted death rate per million for both men and women decreased from 1999 through 2016. When analyzed separately, the age-adjusted death rate for asthma similarly declined among men and women from 1999 to 2016 (*3*). The age-adjusted death rate for COPD among men declined from 1999 to 2011; however, among women, it increased from 2000 to 2011 (*4*). A 2016 Danish study of the long-term prognosis of persons with chronic airway disease found that the number of deaths from chronic respiratory disease were higher among persons with asthma-COPD overlap with late-onset asthma than among those with COPD only (*5*).

The American Thoracic Society estimates that approximately 16% of asthma and 14% of COPD among adults is attributable to workplace exposures (*6*). Several workplace exposures, (e.g., dusts, secondhand smoke, welding fumes, and isocyanates) are causative agents for both asthma and COPD (*7*). An analysis of workplace exposures among U.S. adults using 2010 National Health Interview Survey data found that workers in industries and occupations similar to those identified in the current study had exposure to vapors, gas, dust, or fumes at work (*8*). In that study, an estimated 52.9% of workers in agriculture, forestry, fishing, and hunting and 42.8% of workers in manufacturing industries, as well as 61.5% of production workers, 50.8% of farming, fishing, and forestry workers, and 16.5% of adults in food preparation and serving occupations had frequent exposure to vapors, gas, dust, or fumes at work (*8*). Although cigarette smoking is the primary cause of COPD, 25% of U.S. adults with COPD have never smoked.*** Among nonsmoking adults in food preparation and serving occupations, an estimated 15.4% had frequent exposure to secondhand smoke at work (*8*). Exposure to these agents might explain the increased prevalence of asthma-COPD overlap mortality among workers in certain industries and occupations and should be considered for targets for public health interventions.

Nonpaid workers, nonworkers, and persons working at home had significantly elevated asthma-COPD overlap PMRs among both men and women aged 25–64 years, suggesting that asthma-COPD overlap might be associated with substantial morbidity resulting in loss of employment. Previous reports have similarly found that patients with asthma-COPD overlap were observed to have worse health outcomes than those with asthma or COPD alone (*1*,*5*). Moreover, persons with asthma caused or made worse by workplace exposures were similarly more likely to be unemployed and retire at a significantly younger mean age than were those with asthma that is not work-related (*9*). Retired and unemployed persons might have left the workforce because of severe asthma or COPD; however, complete decedent work histories were unavailable to assess such changes in employment.

The findings in this report are subject to at least five limitations. First, a discrete diagnosis code for asthma-COPD overlap does not currently exist, and no information was available to validate asthma and COPD diagnoses, which might be subject to misdiagnosis. A 1991 study from the United States found that 37% of subjects with a history of physician-diagnosed airways obstructive disease had airways obstructive disease reported on their death certificate, suggesting the potential for underreporting (*10*). In addition, it is possible that differences in patterns of asthma and COPD diagnosis regionally and over time might have affected how these diagnoses were recorded on death certificates. Second, discrete diagnosis codes for occupational asthma or COPD do not currently exist; therefore, determining whether the asthma or COPD diagnoses listed as underlying or contributing to death were

*** https://www.cdc.gov/tobacco/campaign/tips/diseases/copd.html.

TABLE 1. Industries with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, and 2007–2014

Industry	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Male				
Computer and electronic products¶	N/A	N/A	10	2.58 (1.24–4.74)**
Lumber, wood products, and furniture¶	N/A	N/A	12	2.53 (1.30–4.41)**
Sawmills and wood preservation††	N/A	N/A	5	3.57 (1.16–8.34)**
Agriculture, forestry, fishing and hunting¶	N/A	N/A	66	1.82 (1.42–2.33)**
Logging††	N/A	N/A	11	4.82 (2.41–8.62)**
Animal production††	N/A	N/A	16	1.63 (0.93–2.65)
Crop production††	N/A	N/A	35	1.59 (1.10–2.21)**
Broadcasting and telecommunications¶	N/A	N/A	11	1.40 (0.70–2.50)
Wired telecommunications carriers††	N/A	N/A	8	1.51 (0.65–2.97)
Personal and laundry services¶	N/A	N/A	7	1.37 (0.55–2.82)
Nonmetallic mineral products¶	N/A	N/A	5	1.30 (0.42–3.04)
Wholesale trade¶	N/A	N/A	16	1.24 (0.71–2.01)
Groceries and related product wholesalers††	N/A	N/A	5	1.99 (0.64–4.65)
Paper and printing¶	N/A	N/A	9	1.20 (0.55–2.29)
Printing and related support activities††	N/A	N/A	6	1.56 (0.57–3.39)
Publishing, and motion picture and sound recording industries¶	N/A	N/A	5	1.16 (0.37–2.70)
Primary metal industries¶	N/A	N/A	14	1.09 (0.60–1.83)
Iron and steel mills and steel product manufacturing††	N/A	N/A	10	1.07 (0.52–1.97)
Utilities¶	N/A	N/A	11	1.03 (0.52–1.84)
Food, beverage, and tobacco products¶	10	2.64 (1.27–4.86)**	12	1.11 (0.57–1.93)
Beverage manufacturing††	N/A	N/A	5	3.15 (1.02–7.37)**
Arts, entertainment and recreation¶	N/A	N/A	6	0.98 (0.36–2.12)
Retired, unemployed, or nonpaid worker¶	38	1.71 (1.21–2.35)**	11	0.94 (0.47–1.68)
Nonpaid worker or nonworker or own home/at home††	38	1.72 (1.22–2.36)**	11	0.98 (0.49–1.75)
Unknown or not reported¶	24	1.50 (0.96–2.24)	18	1.18 (0.70–1.86)
Mining¶	N/A	N/A	11	0.90 (0.45–1.61)
Oil and gas extraction††	N/A	N/A	6	1.91 (0.70–4.16)
Finance and Insurance¶	N/A	N/A	13	0.86 (0.46–1.46)
Banking and related activities††	N/A	N/A	5	1.28 (0.42–3.00)
Insurance carriers and related activities††	N/A	N/A	6	0.77 (0.28–1.67)
Home furnishings, appliances, building materials, hardware, lawn and garden¶	5	1.49 (0.48–3.48)	5	0.60 (0.19–1.40)
Motor vehicle and parts dealers¶	6	1.44 (0.53–3.14)	5	0.58 (0.19–1.36)
Automobile dealers††	5	1.94 (0.63–4.53)	N/A	N/A
Repair and maintenance¶	16	1.35 (0.77–2.19)	15	0.94 (0.53–1.55)
Automotive repair and maintenance††	12	1.36 (0.70–2.37)	9	0.80 (0.37–1.51)
Military¶	5	1.29 (0.42–3.02)	10	0.68 (0.32–1.24)
Other retail trade¶	12	1.24 (0.64–2.17)	21	1.04 (0.64–1.59)
Gasoline stations††	N/A	N/A	5	2.50 (0.81–5.83)
Not specified retail trade††	6	1.32 (0.48–2.87)	5	0.67 (0.22–1.56)
Chemical¶	N/A	N/A	7	0.79 (0.32–1.63)
Industrial and miscellaneous chemicals††	N/A	N/A	5	0.85 (0.27–1.97)
Food and beverage stores¶	N/A	N/A	6	0.75 (0.28–1.64)
Construction¶	58	1.16 (0.89–1.51)	73	1.08 (0.85–1.37)
Public administration¶	15	1.07 (0.60–1.76)	41	1.00 (0.72–1.36)
Other general government and support††	5	0.95 (0.31–2.23)	16	0.97 (0.56–1.58)
Justice, public order, and safety activities††	5	0.94 (0.30–2.19)	9	0.73 (0.33–1.38)
Health care¶	10	1.05 (0.51–1.94)	11	0.74 (0.37–1.32)
Hospitals††	5	1.17 (0.38–2.72)	7	1.19 (0.48–2.46)
Miscellaneous manufacturing¶	11	0.90 (0.45–1.61)	41	1.39 (1.00–1.89)**
Not specified manufacturing industries††	11	0.99 (0.50–1.77)	38	1.38 (0.98–1.90)
Educational services¶	7	0.83 (0.33–1.71)	22	0.85 (0.53–1.28)
Elementary and secondary schools††	N/A	N/A	17	0.91 (0.53–1.45)
Colleges and universities, including junior colleges††	N/A	N/A	5	0.78 (0.25–1.81)
Transportation and warehousing¶	19	0.76 (0.46–1.18)	53	1.01 (0.77–1.34)
Truck transportation††	15	1.17 (0.65–1.92)	22	1.14 (0.71–1.72)
Water transportation††	N/A	N/A	5	2.73 (0.88–6.38)
Postal service††	N/A	N/A	8	0.92 (0.40–1.81)
Professional, scientific, technical and management services¶	6	0.62 (0.23–1.35)	15	0.72 (0.40–1.18)
Machinery¶	N/A	N/A	6	0.72 (0.26–1.56)
Accommodation and food services¶	8	0.62 (0.27–1.22)	7	0.56 (0.23–1.16)
Restaurants and other food services††	7	0.69 (0.28–1.42)	5	0.56 (0.18–1.32)
Administrative and support, and waste management services¶	7	0.58 (0.23–1.20)	10	0.87 (0.42–1.60)

See table footnotes on page 675.

TABLE 1. (*Continued*) Industries with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, and 2007–2014

Industry	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Transportation equipment¶	6	0.54 (0.20–1.18)	17	0.48 (0.28–0.76)
Motor vehicles and motor vehicle equipment manufacturing††	5	0.62 (0.20–1.45)	14	0.57 (0.31–0.95)
All other industries¶	51	N/A	22	N/A
Female				
Retired, unemployed, or nonpaid worker¶	192	1.40 (1.21–1.62)**	532	1.06 (0.97–1.15)
Nonpaid worker or nonworker or own home/at home††	192	1.40 (1.22–1.62)**	529	1.05 (0.96–1.15)
Private households¶	8	1.34 (0.58–2.63)	24	1.69 (1.08–2.51)**
Home furnishings, appliances, building materials, hardware, lawn and garden¶	N/A	N/A	10	1.69 (0.81–3.11)
Furniture and home furnishings stores††	N/A	N/A	6	2.99 (1.10–6.52)**
Machinery¶	N/A	N/A	5	1.53 (0.49–3.57)
Food, beverage, and tobacco products¶	N/A	N/A	14	1.25 (0.68–2.09)
Not specified food industries††	N/A	N/A	5	3.72 (1.20–8.68)**
Paper and printing¶	N/A	N/A	7	1.21 (0.49–2.50)
Utilities¶	N/A	N/A	5	1.14 (0.37–2.66)
Agriculture, forestry, fishing and hunting¶	N/A	N/A	11	1.13 (0.57–2.02)
Crop production††	N/A	N/A	7	1.14 (0.46–2.36)
Textile mill, apparel and other finished textile products¶	N/A	N/A	26	1.13 (0.74–1.65)
Cut and sew apparel manufacturing††	N/A	N/A	16	1.14 (0.65–1.84)
Fabric mills, except knitting††	N/A	N/A	6	0.91 (0.33–1.99)
Electrical equipment, appliances, and components¶	N/A	N/A	5	1.08 (0.35–2.51)
Publishing, and motion picture and sound recording industries¶	N/A	N/A	6	1.01 (0.37–2.19)
Administrative and support, and waste management services¶	13	1.25 (0.66–2.13)	12	0.72 (0.37–1.26)
Business support services††	5	1.88 (0.61–4.39)	5	0.86 (0.28–2.01)
Arts, entertainment and recreation¶	6	1.10 (0.40–2.40)	6	0.65 (0.24–1.41)
Independent artists, performing arts, spectator sports, and related industries††	5	2.24 (0.73–5.24)	N/A	N/A
Unknown or not reported¶	16	1.09 (0.63–1.78)	19	0.90 (0.54–1.41)
Broadcasting and telecommunications¶	5	1.09 (0.35–2.54)	13	0.92 (0.49–1.57)
Wired telecommunications carriers††	N/A	N/A	10	0.92 (0.44–1.68)
Transportation equipment¶	N/A	N/A	15	0.87 (0.49–1.44)
Motor vehicles and motor vehicle equipment manufacturing††	N/A	N/A	10	0.86 (0.42–1.59)
Chemical¶	N/A	N/A	5	0.82 (0.26–1.91)
Food and beverage stores¶	6	1.00 (0.37–2.18)	19	1.34 (0.81–2.10)
Grocery stores††	6	1.09 (0.40–2.36)	15	1.19 (0.67–1.97)
Other retail trade¶	22	0.97 (0.61–1.47)	50	0.77 (0.57–1.01)
Clothing and accessories, except shoe, stores††	N/A	N/A	5	0.87 (0.28–2.04)
Department stores††	N/A	N/A	8	0.85 (0.37–1.68)
Not specified retail trade††	12	0.99 (0.51–1.73)	19	0.60 (0.36–0.94)
Health care¶	62	0.97 (0.75–1.26)	114	0.99 (0.82–1.20)
Outpatient care centers††	11	0.91 (0.45–1.63)	22	1.06 (0.66–1.60)
Other health care services††	9	1.40 (0.64–2.66)	10	1.04 (0.50–1.92)
Hospitals††	26	0.96 (0.63–1.41)	59	1.00 (0.77–1.30)
Nursing care facilities††	9	1.15 (0.53–2.19)	10	0.92 (0.44–1.69)
Miscellaneous manufacturing¶	10	0.95 (0.46–1.75)	41	1.25 (0.90–1.70)
Not specified manufacturing industries††	9	0.98 (0.45–1.86)	37	1.26 (0.89–1.73)
Real estate and rental leasing¶	5	0.93 (0.30–2.18)	13	0.97 (0.52–1.67)
Real estate††	5	0.98 (0.32–2.28)	13	0.99 (0.53–1.70)
Transportation and warehousing¶	9	0.87 (0.40–1.64)	14	0.81 (0.44–1.36)
Truck transportation††	N/A	N/A	6	1.91 (0.70–4.16)
Postal service††	N/A	N/A	5	1.06 (0.34–2.47)
Social assistance¶	7	0.83 (0.33–1.70)	8	0.78 (0.33–1.53)
Accommodation and food services¶	22	0.82 (0.51–1.24)	58	1.17 (0.90–1.52)
Restaurants and other food services††	15	0.72 (0.40–1.18)	51	1.27 (0.96–1.69)
Traveler accommodation††	N/A	N/A	5	0.69 (0.22–1.61)
Personal and laundry services¶	7	0.81 (0.33–1.67)	23	1.12 (0.71–1.68)
Beauty salons††	7	1.24 (0.50–2.55)	14	1.04 (0.57–1.74)
Drycleaning and laundry services††	N/A	N/A	7	1.47 (0.59–3.03)
Professional, scientific, technical and management services¶	12	0.80 (0.41–1.39)	24	0.88 (0.56–1.30)
Legal services††	N/A	N/A	8	1.19 (0.51–2.33)
Accounting, tax preparation, bookkeeping and payroll services††	5	1.31 (0.42–3.05)	7	0.75 (0.30–1.54)
Public administration¶	13	0.74 (0.39–1.27)	49	1.09 (0.81–1.45)
National security and international affairs††	N/A	N/A	5	1.44 (0.47–3.36)
Administration of human resource programs††	N/A	N/A	5	1.38 (0.45–3.22)
Justice, public order, and safety activities††	N/A	N/A	6	0.87 (0.32–1.89)
Other general government and support††	8	1.04 (0.45–2.05)	26	1.09 (0.71–1.60)

See table footnotes on page 675.

TABLE 1. (*Continued*) Industries with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, and 2007–2014

Industry	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Finance and insurance¶	9	0.62 (0.29–1.18)	28	0.79 (0.53–1.15)
Insurance carriers and related activities††	5	0.85 (0.28–2.00)	8	0.60 (0.26–1.19)
Banking and related activities††	N/A	N/A	14	0.87 (0.47–1.46)
Educational services¶	19	0.61 (0.37–0.96)	86	0.87 (0.70–1.08)
Elementary and secondary schools††	18	0.68 (0.40–1.07)	69	0.80 (0.62–1.01)
Colleges and universities, including junior colleges††	N/A	N/A	16	1.71 (0.98–2.78)
Wholesale trade¶	N/A	N/A	5	0.75 (0.24–1.75)
All other industries¶	27	N/A	37	N/A

Abbreviations: CI = confidence interval; N/A = not applicable; PMR = proportionate mortality ratio.

* Decedents with *International Classification of Diseases, Tenth Revision* codes for asthma: J45.0 (predominantly allergic asthma), J45.1 (nonallergic asthma), J45.8 (mixed asthma), J45.9 (asthma, unspecified), J46 (status asthmaticus); and COPD: J40 (bronchitis, not specified as acute or chronic), J41.0 (simple chronic bronchitis), J41.1 (mucopurulent chronic bronchitis), J41.8 (mixed simple and mucopurulent chronic bronchitis), J42 (unspecified chronic bronchitis), J43.0 (MacLeod's syndrome), J43.1 (panlobular emphysema), J43.2 (centrilobular emphysema), J43.8 (other emphysema), J43.9 (emphysema, unspecified), J44.0 (chronic obstructive pulmonary disease with acute lower respiratory infection), J44.1 (chronic obstructive pulmonary disease with acute exacerbation, unspecified), J44.8 (other specified chronic obstructive pulmonary disease), J44.9 (chronic obstructive pulmonary disease, unspecified) assigned as the underlying cause of death (i.e., the disease or injury which initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury) or as a contributing cause of death.

† Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin.

§ PMR was defined as the observed number of deaths from asthma-COPD overlap in a specified industry or occupation, divided by the expected number of deaths from asthma-COPD overlap. The expected number of deaths was the total number of deaths in industry or occupation of interest multiplied by a proportion defined as the number of asthma-COPD overlap deaths in all industries or occupations, divided by the total number of deaths in all industries or occupations. The asthma-COPD overlap PMRs were internally adjusted by 5-year age groups, sex, and race. CIs were calculated assuming Poisson distribution of the data. A PMR >1.0 indicates that there were more deaths associated with the condition in a specified occupation or industry than expected; a PMR <1.0 indicates that there were fewer deaths associated with the condition in a specified occupation or industry than expected.

¶ U.S. Census 2000 Industry Classification System two-digit industries with five or more deaths.

** Statistically significantly elevated PMR.

†† U.S. Census 2000 Industry Classification System three-digit industry groups with five or more deaths.

TABLE 2. Occupations with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, 2007–2014

Occupation	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Male				
Fishing, hunting, and forestry occupations¶	N/A	N/A	10	3.78 (1.82–6.95)**
Logging workers††	N/A	N/A	10	5.64 (2.71–10.37)**
Farmers and farm managers¶	N/A	N/A	43	1.62 (1.17–2.18)**
Farmers and ranchers††	N/A	N/A	43	1.67 (1.21–2.25)**
Food processing workers¶	N/A	N/A	6	1.59 (0.58–3.47)
Textile, apparel, and furnishings workers¶	N/A	N/A	6	1.56 (0.57–3.39)
Retired, students, volunteers, homemakers and unemployed¶	40	1.77 (1.26–2.41)**	11	0.89 (0.44–1.59)
Unemployed, never worked, disabled††	36	1.98 (1.39–2.75)**	8	1.38 (0.59–2.71)
Vehicle and mobile equipment mechanics, installers, and repairers¶	15	1.41 (0.79–2.33)	17	1.06 (0.62–1.69)
Automotive service technicians and mechanics††	7	1.03 (0.41–2.13)	6	0.71 (0.26–1.54)
Unknown or not reported¶	18	1.30 (0.77–2.05)	15	0.97 (0.54–1.60)
Metal workers and plastic workers¶	13	1.27 (0.67–2.17)	25	0.93 (0.60–1.37)
Welding, soldering, and brazing workers††	5	1.31 (0.42–3.06)	N/A	N/A
Tool and die makers††	N/A	N/A	5	1.32 (0.43–3.09)
Metalworkers and plastic workers, all other††	N/A	N/A	6	2.45 (0.90–5.34)
Machinists††	N/A	N/A	10	0.99 (0.48–1.83)
Laborers and material movers, hand¶	21	1.26 (0.78–1.92)	35	1.54 (1.07–2.14)**
Laborers and freight, stock, and material movers, hand††	21	1.34 (0.82–2.04)	32	1.47 (1.01–2.08)**
Agricultural workers, including supervisors¶	N/A	N/A	7	1.53 (0.62–3.16)
Miscellaneous agricultural workers††	N/A	N/A	6	1.58 (0.58–3.43)
Rail and water transportation workers¶	N/A	N/A	7	1.48 (0.59–3.04)
Motor vehicle operators¶	23	1.19 (0.75–1.78)	38	1.22 (0.86–1.67)
Bus drivers††	N/A	N/A	5	1.77 (0.57–4.12)
Driver-sales workers and truck drivers††	21	1.24 (0.76–1.89)	32	1.19 (0.81–1.68)
Other material moving workers, except laborers¶	N/A	N/A	7	1.21 (0.49–2.50)
Other production occupations, including supervisors¶	13	1.17 (0.62–2.00)	23	0.73 (0.46–1.10)
First-line supervisors or managers of production and operating workers††	N/A	N/A	9	0.83 (0.38–1.58)
Production workers, all other††	6	1.27 (0.47–2.77)	7	0.70 (0.28–1.44)

See table footnotes on page 677.

TABLE 2. (*Continued*) Occupations with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, 2007–2014

Occupation	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Construction trades workers¶	45	1.11 (0.81–1.48)	66	1.20 (0.94–1.54)
Carpenters††	10	1.23 (0.59–2.27)	20	1.68 (1.02–2.59)**
Operating engineers and other construction equipment operators††	N/A	N/A	8	1.59 (0.69–3.13)
Construction laborers††	17	1.29 (0.75–2.07)	16	1.49 (0.85–2.41)
Electricians††	7	1.93 (0.78–3.98)	N/A	N/A
Financial specialists¶	N/A	N/A	12	1.18 (0.61–2.06)
Accountants and auditors††	N/A	N/A	9	1.23 (0.57–2.34)
Business operations specialists¶	N/A	N/A	8	1.14 (0.49–2.24)
Drafters, engineering, and mapping technicians¶	N/A	N/A	5	1.07 (0.35–2.51)
Other protective service workers, including supervisors¶	N/A	N/A	5	1.03 (0.33–2.40)
Assemblers and fabricators¶	N/A	N/A	8	1.03 (0.44–2.02)
Miscellaneous assemblers and fabricators††	N/A	N/A	5	1.03 (0.33–2.40)
Law enforcement workers, including supervisors¶	N/A	N/A	8	1.02 (0.44–2.01)
Police and sheriff's patrol officers††	N/A	N/A	5	1.00 (0.33–2.35)
Extraction workers¶	N/A	N/A	6	1.01 (0.37–2.19)
Health diagnosing and treating practitioners and technical occupations¶	N/A	N/A	5	1.00 (0.32–2.34)
Engineers¶	N/A	N/A	22	0.95 (0.59–1.44)
Civil engineers††	N/A	N/A	6	1.43 (0.52–3.11)
Office and administrative support occupations¶	12	1.04 (0.54–1.82)	23	0.87 (0.55–1.30)
Building and grounds cleaning and maintenance occupations¶	15	1.03 (0.58–1.70)	18	0.92 (0.55–1.46)
Janitors and building cleaners††	12	1.38 (0.71–2.40)	12	0.85 (0.44–1.48)
Education, training, and library occupations¶	N/A	N/A	13	0.86 (0.46–1.48)
Postsecondary teachers††	N/A	N/A	5	1.20 (0.39–2.81)
Elementary and middle school teachers††	N/A	N/A	8	1.01 (0.43–1.98)
Supervisors, construction and extraction workers¶	N/A	N/A	6	0.78 (0.29–1.70)
First-line supervisors or managers of construction trades and extraction workers††	N/A	N/A	6	0.78 (0.29–1.70)
Electrical equipment mechanics and other installation, maintenance, and repair workers¶	9	1.01 (0.46–1.91)	16	0.75 (0.43–1.22)
First-line supervisors or managers of mechanics, installers, and repairers††	N/A	N/A	7	1.63 (0.65–3.35)
Food preparation and serving related occupations¶	7	0.77 (0.31–1.60)	N/A	N/A
Sales and related occupations¶	14	0.70 (0.38–1.17)	48	0.88 (0.65–1.17)
First-line supervisors or managers of nonretail sales workers††	N/A	N/A	6	1.20 (0.44–2.61)
Retail salespersons††	5	0.85 (0.27–1.98)	9	0.77 (0.35–1.46)
Sales representatives, wholesale and manufacturing††	N/A	N/A	5	0.77 (0.25–1.80)
First-line supervisors or managers of retail sales workers††	N/A	N/A	13	0.72 (0.38–1.23)
Management occupations, except agricultural¶	11	0.53 (0.26–0.94)	54	0.91 (0.69–1.19)
Managers, all other††	6	1.19 (0.44–2.60)	17	1.10 (0.64–1.77)
Industrial production managers††	N/A	N/A	10	2.23 (1.07–4.10)**
Transportation, storage, and distribution managers††	N/A	N/A	5	1.87 (0.60–4.36)
Chief executives††	N/A	N/A	8	1.55 (0.67–3.05)
Military occupations¶	N/A	N/A	9	0.66 (0.30–1.26)
Military, rank not specified††	N/A	N/A	6	1.06 (0.39–2.30)
All other occupations¶	58	N/A	42	N/A
Female				
Agricultural workers, including supervisors¶	N/A	N/A	5	2.00 (0.65–4.68)
Media and communications workers¶	N/A	N/A	5	1.41 (0.46–3.29)
Other protective service workers, including supervisors¶	5	2.34 (0.76–5.47)	N/A	N/A
Other production occupations, including supervisors¶	N/A	N/A	39	1.29 (0.92–1.77)
Inspectors, testers, sorters, samplers, and weighers††	N/A	N/A	8	1.19 (0.51–2.35)
Production workers, all other††	N/A	N/A	22	1.66 (1.04–2.52)**
Textile, apparel, and furnishings workers¶	N/A	N/A	34	1.20 (0.83–1.68)
Sewing machine operators††	N/A	N/A	21	1.32 (0.82–2.02)
Tailors, dressmakers, and sewers††	N/A	N/A	5	1.15 (0.37–2.68)
Retired, students, volunteers, homemakers and unemployed¶	193	1.41 (1.22–1.63)**	535	1.06 (0.97–1.15)
Unemployed, never worked, disabled††	41	1.79 (1.29–2.42)**	11	1.27 (0.64–2.27)
Homemakers††	151	1.34 (1.14–1.58)**	521	1.05 (0.97–1.15)
Farmers and farm managers¶	N/A	N/A	5	1.02 (0.33–2.38)
Farmers and ranchers††	N/A	N/A	5	1.07 (0.35–2.49)
Financial specialists¶	N/A	N/A	14	1.00 (0.54–1.67)
Accountants and auditors††	N/A	N/A	8	0.87 (0.38–1.72)
Health technologists and technicians¶	11	1.33 (0.66–2.38)	9	0.66 (0.30–1.26)
Licensed practical and licensed vocational nurses††	8	2.24 (0.96–4.40)	N/A	N/A

See table footnotes on page 677.

TABLE 2. (*Continued*) Occupations with five or more asthma-COPD overlap deaths* among decedents aged ≥25 years, by sex and age group — 26 states,† 1999, 2003, 2004, 2007–2014

Occupation	Decedents aged 25–64 yrs		Decedents aged ≥65 yrs	
	Deaths	PMR§ (95% CI)	Deaths	PMR§ (95% CI)
Healthcare support occupations¶	27	1.27 (0.83–1.84)	38	1.38 (0.98–1.89)
Nursing, psychiatric, and home health aides††	25	1.52 (0.98–2.25)	31	1.42 (0.97–2.02)
Motor vehicle operators¶	6	1.25 (0.46–2.73)	N/A	N/A
Sales and related occupations¶	31	1.00 (0.68–1.42)	66	0.83 (0.65–1.06)
Cashiers††	9	1.61 (0.74–3.06)	N/A	N/A
Retail salespersons††	11	1.12 (0.56–2.00)	35	1.08 (0.75–1.50)
First-line supervisors or managers of retail sales workers††	N/A	N/A	17	0.85 (0.49–1.35)
Building and grounds cleaning and maintenance occupations¶	14	0.96 (0.53–1.62)	34	1.13 (0.79–1.58)
Janitors and building cleaners††	6	1.41 (0.52–3.07)	9	1.16 (0.53–2.20)
Maids and housekeeping cleaners††	8	0.90 (0.39–1.76)	25	1.23 (0.79–1.81)
Personal care and service occupations¶	16	0.94 (0.54–1.53)	24	0.87 (0.56–1.29)
Personal and home care aides††	5	1.27 (0.41–2.97)	5	1.07 (0.34–2.49)
Hairdressers, hairstylists, and cosmetologists††	6	1.16 (0.42–2.52)	13	1.06 (0.56–1.81)
Community and social services occupations¶	6	0.92 (0.34–2.01)	N/A	N/A
Laborers and material movers, hand¶	8	0.92 (0.40–1.82)	25	1.31 (0.85–1.94)
Laborers and freight, stock, and material movers, hand††	8	1.01 (0.43–1.98)	25	1.51 (0.97–2.22)
Unknown or not reported¶	13	0.92 (0.49–1.57)	23	1.15 (0.73–1.73)
Food preparation and serving related occupations¶	18	0.83 (0.49–1.31)	57	1.22 (0.93–1.60)
Cooks††	6	0.91 (0.33–1.98)	23	1.26 (0.80–1.89)
Bartenders††	6	3.28 (1.20–7.15)**	N/A	N/A
Waiters and waitresses††	N/A	N/A	23	1.70 (1.07–2.55)**
Education, training, and library occupations¶	17	0.82 (0.48–1.31)	58	0.87 (0.67–1.14)
Elementary and middle school teachers††	10	0.82 (0.39–1.50)	40	0.86 (0.62–1.18)
Health diagnosing and treating practitioners and technical occupations¶	12	0.72 (0.37–1.25)	43	1.09 (0.79–1.46)
Registered nurses††	11	0.75 (0.38–1.34)	41	1.11 (0.80–1.50)
Office and administrative support occupations¶	36	0.64 (0.45–0.88)	152	0.86 (0.73–1.01)
First-line supervisors or managers of office and administrative support workers††	5	0.96 (0.31–2.24)	10	0.85 (0.41–1.57)
Secretaries and administrative assistants††	10	0.68 (0.33–1.26)	54	0.82 (0.62–1.08)
Office clerks, general††	7	1.04 (0.42–2.15)	18	0.85 (0.50–1.35)
Receptionists and information clerks††	N/A	N/A	6	1.24 (0.45–2.69)
Telephone operators††	N/A	N/A	7	1.18 (0.47–2.43)
Bookkeeping, accounting, and auditing clerks††	N/A	N/A	24	0.89 (0.57–1.32)
Office and administrative support workers, all other††	N/A	N/A	6	1.80 (0.66–3.92)
Management occupations, except agricultural¶	11	0.45 (0.23–0.81)	54	1.06 (0.80–1.39)
Property, real estate, and community association managers††	N/A	N/A	6	2.02 (0.74–4.40)
Food service managers††	N/A	N/A	10	1.14 (0.55–2.10)
Financial managers††	N/A	N/A	5	0.95 (0.31–2.22)
Managers, all other††	N/A	N/A	9	0.74 (0.34–1.41)
Business operations specialists¶	N/A	N/A	8	0.74 (0.32–1.45)
Assemblers and fabricators¶	N/A	N/A	5	0.36 (0.12–0.84)
All other occupations¶	46	N/A	51	N/A

Abbreviations: CI = confidence interval; N/A = not applicable; PMR = proportionate mortality ratio.

* Decedents with *International Classification of Diseases, Tenth Revision* codes for asthma: J45.0 (predominantly allergic asthma), J45.1 (nonallergic asthma), J45.8 (mixed asthma), J45.9 (asthma, unspecified), J46 (status asthmaticus); and COPD: J40 (bronchitis, not specified as acute or chronic), J41.0 (simple chronic bronchitis), J41.1 (mucopurulent chronic bronchitis), J41.8 (mixed simple and mucopurulent chronic bronchitis), J42 (unspecified chronic bronchitis), J43.0 (MacLeod's syndrome), J43.1 (panlobular emphysema), J43.2 (centrilobular emphysema), J43.8 (other emphysema), J43.9 (emphysema, unspecified), J44.0 (chronic obstructive pulmonary disease with acute lower respiratory infection), J44.1 (chronic obstructive pulmonary disease with acute exacerbation, unspecified), J44.8 (other specified chronic obstructive pulmonary disease), J44.9 (chronic obstructive pulmonary disease, unspecified) assigned as the underlying cause of death (i.e., the disease or injury which initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury) or as a contributing cause of death.

† Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin.

§ PMR was defined as the observed number of deaths from asthma-COPD overlap in a specified industry or occupation, divided by the expected number of deaths from asthma-COPD overlap. The expected number of deaths was the total number of deaths in industry or occupation of interest multiplied by a proportion defined as the number of asthma-COPD overlap deaths in all industries or occupations, divided by the total number of deaths in all industries or occupations. The asthma-COPD overlap PMRs were internally adjusted by 5-year age groups, sex, and race. CIs were calculated assuming Poisson distribution of the data. A PMR >1.0 indicates that there were more deaths associated with the condition in a specified occupation or industry than expected; a PMR <1.0 indicates that there were fewer deaths associated with the condition in a specified occupation or industry than expected.

¶ U.S. Census 2000 Occupation Classification System two-digit occupations with five or more deaths.

** Statistically significantly elevated PMR.

†† U.S. Census 2000 Occupation Classification System three-digit occupation groups with five or more deaths.

Summary

What is already known about this topic?

Patients with features of both asthma and chronic obstructive pulmonary disease (COPD), termed asthma-COPD overlap, have been reported to have worse health outcomes than those with asthma or COPD alone.

What is added by this report?

During 1999–2016, 18,766 U.S. decedents aged ≥25 years had asthma and COPD assigned on their death certificates as the underlying or contributing cause of death. Among adults aged 25–64 years, asthma-COPD overlap mortality was associated with nonworking status among men and women and bartending among women.

What are the implications for public health practice?

Excess risk for asthma-COPD overlap mortality among adults in certain industries and occupations suggests targets for public health interventions to prevent asthma and COPD in and out of the workplace.

caused by workplace exposures is not possible. Third, guidelines for reporting industry and occupation on death certificates[†††] instruct recorders to report decedent's "kind of business/industry" and "usual occupation" (i.e., "the type of job the individual was engaged in for most of his or her working life"). Therefore, if asthma and COPD were caused by workplace exposures, the industry and occupation reported on death certificates might not reflect those in which potential workplace exposures occurred. Workers might have changed jobs or held more than one job; however, information is not available to assess changes in employment. Fourth, no information was available to evaluate the smoking status of decedents, which might have caused or worsened the consequences of asthma or COPD. Finally, only selected states provided information on industry and occupation, and only for certain years; therefore, information by industry and occupation might not be nationally representative.

Among persons aged ≥25 years, deaths associated with asthma-COPD overlap were more frequent among women than among men. The association between asthma-COPD overlap mortality and nonworking status among adults of working age (25–64 years) suggests that asthma-COPD overlap might be associated with substantial morbidity resulting in loss of employment. Increased risk for asthma-COPD overlap mortality among adults in certain industries and occupations suggests targets for public health interventions (e.g., elimination or substitution of exposures, removing workers from exposures, engineering controls such as ventilation or enclosure of exposure generating processes, and workplace smoke-free policies) to prevent asthma and COPD in and out of the workplace. Continued surveillance for asthma-COPD overlap morbidity and mortality is essential to inform policy and intervention activities.

[†††] https://www.cdc.gov/nchs/data/misc/hb_occup.pdf.

Acknowledgments

Colorado Department of Public Health and Environment; Florida Department of Health; Georgia Department of Public Health; Hawaii State Department of Health; Idaho Department of Health and Welfare; Indiana State Department of Health; Kansas Department of Health and Environment; Kentucky Department for Public Health; Louisiana Department of Health; Michigan Department of Health & Human Services; Nebraska Department of Health and Human Services; Nevada Department of Health and Human Services; New Hampshire Department of Health and Human Services; New Jersey Department of Health; New Mexico Department of Health; North Carolina Department of Health and Human Services; North Dakota Department of Health; Ohio Department of Health; Rhode Island Department of Health; South Carolina Department of Health and Environmental Control; Texas Department of State Health Services; Utah Department of Health; Vermont Department of Health; Washington State Department of Health; West Virginia Department of Health and Human Resources; Wisconsin Department of Health Services; Janet Croft, PhD, National Center for Chronic Disease Prevention and Health Promotion, CDC; David Weissman, MD, National Institute for Occupational Safety and Health, CDC.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Evidence for Limited Early Spread of COVID-19 Within the United States, January–February 2020

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On May 29, 2019, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

From January 21 through February 23, 2020, public health agencies detected 14 U.S. cases of coronavirus disease 2019 (COVID-19), all related to travel from China (*1*,*2*). The first nontravel–related U.S. case was confirmed on February 26 in a California resident who had become ill on February 13 (*3*). Two days later, on February 28, a second nontravel–related case was confirmed in the state of Washington (*4*,*5*). Examination of four lines of evidence provides insight into the timing of introduction and early transmission of SARS-CoV-2, the virus that causes COVID-19, into the United States before the detection of these two cases. First, syndromic surveillance based on emergency department records from counties affected early by the pandemic did not show an increase in visits for COVID-19–like illness before February 28. Second, retrospective SARS-CoV-2 testing of approximately 11,000 respiratory specimens from several U.S. locations beginning January 1 identified no positive results before February 20. Third, analysis of viral RNA sequences from early cases suggested that a single lineage of virus imported directly or indirectly from China began circulating in the United States between January 18 and February 9, followed by several SARS-CoV-2 importations from Europe. Finally, the occurrence of three cases, one in a California resident who died on February 6, a second in another resident of the same county who died February 17, and a third in an unidentified passenger or crew member aboard a Pacific cruise ship that left San Francisco on February 11, confirms cryptic circulation of the virus by early February. These data indicate that sustained, community transmission had begun before detection of the first two nontravel–related U.S. cases, likely resulting from the importation of a single lineage of virus from China in late January or early February, followed by several importations from Europe. The widespread emergence of COVID-19 throughout the United States after February highlights the importance of robust public health systems to respond rapidly to emerging infectious threats.

Syndromic Surveillance

Through the National Syndromic Surveillance Program, U.S. public health agencies receive real-time data from emergency departments in approximately 4,000 health care facilities in 47 U.S. states and the District of Columbia. In 14 counties with early community-acquired cases of COVID-19, no substantial increase was observed in the proportion of COVID-19–like illness (fever and cough or shortness of breath or difficulty breathing, or the listing of a coronavirus diagnostic code) before February 28 (Figure).

Surveillance for Acute SARS-CoV-2 Infection

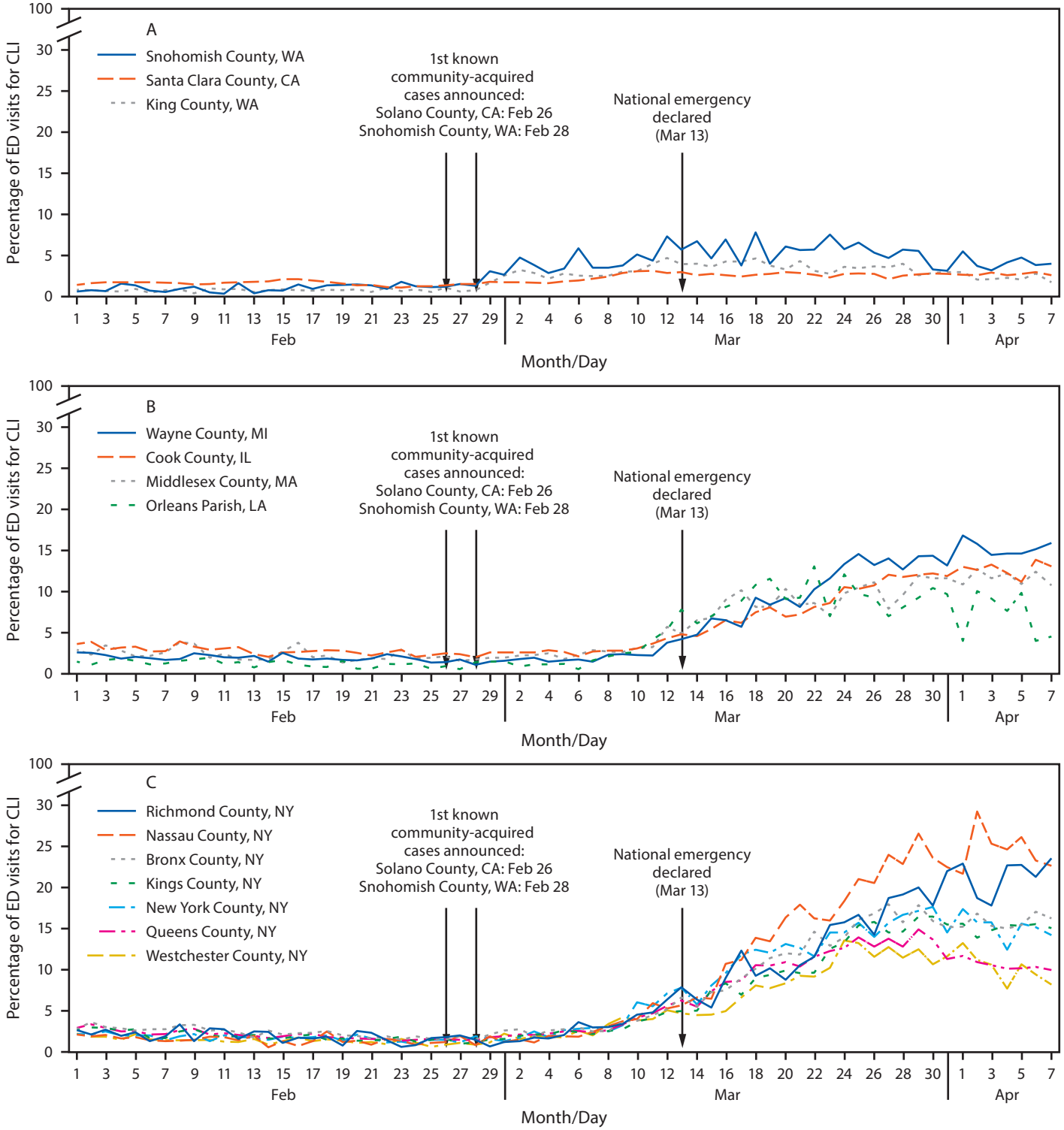
The Seattle Flu Study (*5*) began monitoring acute respiratory disease in the Seattle metropolitan area in November 2018. In late February 2020, the study began testing specimens using reverse transcription–polymerase chain reaction (RT-PCR) testing for SARS-CoV-2. The first positive laboratory result for SARS-CoV-2 was detected on February 28 from a specimen collected February 24. After this detection, deidentified specimens collected earlier were retrospectively tested for the virus. There were no positive results among 5,270 respiratory specimens collected during January 1–February 20 (*5*) (T. Bedford, Fred Hutchinson Cancer Research Center, Seattle, Washington, personal communication, May 6, 2020).

The first specimen that tested positive among these retrospectively tested specimens had been collected February 21. During the week beginning February 21, eight of 1,255 specimens (0.6%) tested positive, and during the following week, 29 of 1,862 (1.6%) specimens tested positive.

Two influenza vaccine effectiveness study networks with sites in six states (Michigan, Pennsylvania, Tennessee, Texas, Washington, and Wisconsin)* retrospectively tested respiratory specimens from patients with acute respiratory disease for SARS-CoV-2 by RT-PCR. At the Washington site, none of the 497 specimens collected during January 19–February 24 tested positive; the first specimen that tested positive was collected on February 25. At the five other sites (Ann Arbor and Detroit, Michigan; Pittsburgh, Pennsylvania; Temple, Texas; Marshfield, Wisconsin; and Nashville, Tennessee), none of 2,620 samples collected during January 19–February 29 tested positive for SARS-CoV-2.

* The U.S. Influenza Vaccine Effectiveness Network (five study sites, including sites in Michigan, Pennsylvania, Texas, Washington, and Wisconsin) and Hospitalized Adult Influenza Vaccine Effectiveness Network (includes sites in Michigan, Pennsylvania, Tennessee, and Texas).

FIGURE. Percentage of emergency department (ED) visits for COVID-19-like illness (CLI),* in 14 counties†,§ (three in California and Washington [A]; four in Illinois, Louisiana, Massachusetts, and Michigan [B]; and seven in New York [C]) — National Syndromic Surveillance Program,¶ February 1–April 7, 2020



Abbreviation: COVID-19 = coronavirus disease 2019.

* Fever and cough or shortness of breath or difficulty breathing or presence of a coronavirus diagnostic code.

† *California:* Santa Clara County; *Washington:* King County, Snohomish County; *Illinois:* Cook County; *Louisiana:* Orleans Parish; *Massachusetts:* Middlesex County; *Michigan:* Wayne County; *New York:* Bronx County, Kings County, Nassau County, New York County, Richmond County, Queens County, Westchester County.

§ King County, Washington includes Seattle; Cook County, Illinois includes Chicago and many of its suburbs; Wayne County, Michigan includes Detroit and many of its suburbs; Orleans Parish includes New Orleans; Kings County (Brooklyn), Queens County (Queens), Bronx County (Bronx), Richmond County (Staten Island), and New York County (Manhattan) are all within New York City.

¶ From the subset of emergency departments in each county that participate in the National Syndromic Surveillance Program.

As of May 22, 2020, four (<0.2%) of approximately 3,000 specimens collected from children and adolescents aged <18 years enrolled in the New Vaccine Surveillance Network† during January 1–March 31 have tested positive for SARS-CoV-2. The earliest positive result was from a specimen collected March 20 in Seattle.

Phylogenetic Analysis

Analysis of the genomic diversity of SARS-CoV-2 from early cases of COVID-19 from the Seattle area found that most viruses belonged to a single clade (the Washington State clade), whose most recent common ancestor was estimated to have existed between approximately January 18 and February 9 (point estimate = February 1).§ The predicted genomic sequence of that progenitor virus was consistent with that from the first U.S. case of imported COVID-19, which occurred in a man who arrived in Seattle from Wuhan, China, on January 15 and became ill 4 days later. However, it is also possible that the Washington State clade arose from a virus with a similar or identical sequence from another person with SARS-CoV-2 infection. Analysis of viruses in California and the northeastern United States from February through mid-March suggested that there had been several importations of virus, primarily from Europe, followed by transmission of virus within the United States¶,** (*6*).

Known Cases in Persons with No Relevant Travel History Before February 26

Two notable cases of COVID-19 occurred in Santa Clara County, California: one in a woman who became ill on January 31 and died on February 6 and another in an unrelated man who died at home between February 13 and 17. Neither had traveled internationally in the weeks preceding their deaths. SARS-CoV-2 RNA was detected by RT-PCR testing at CDC from postmortem tissue specimens from these patients. These deaths were certified by a medical examiner as COVID-19–associated deaths. Investigation of these cases is ongoing.

Outbreaks of COVID-19 occurred during two consecutive voyages of a Grand Princess cruise ship (*7*). The genomic sequence of viruses from these outbreaks was within the Washington State clade, suggesting that a passenger or crew member infected with that virus was aboard the ship when it left the Port of San Francisco on February 11 for a round-trip cruise. The identity of that person is unknown.

† Rochester, New York; Pittsburgh, Pennsylvania; Cincinnati, Ohio; Nashville, Tennessee; Kansas City, Missouri; Houston, Texas; and Seattle, Washington.
§ https://www.medrxiv.org/content/10.1101/2020.04.02.20051417v2.
¶ https://www.medrxiv.org/content/10.1101/2020.04.08.20056929v2.
** https://www.medrxiv.org/content/10.1101/2020.03.27.20044925v1.

Discussion

Information from these diverse data sources suggests that limited community transmission of SARS-CoV-2 in the United States occurred between the latter half of January and the beginning of February, following an importation of SARS-CoV-2 from China. This importation initiated a lineage, the Washington State clade, which subsequently spread throughout the Seattle metropolitan area and possibly elsewhere. Several importations of SARS-CoV-2 from Europe followed in February and March. It is not known how many U.S. infections occurred during February and March, but overall disease incidence before February 28 was too low to be detected through emergency department syndromic surveillance data.

Also unknown are the dates of entry of the imported viruses into the United States and the identities of the persons who carried them. One possible early source is the first reported U.S. case of COVID-19, which occurred in a Washington man who became ill on January 19 after returning from Wuhan, China, on January 15; the genomic sequence of the virus isolated from that man is consistent with his being the possible source of the Washington State clade, although the thoroughness of the contact investigation of this case and the absence of identified secondary cases argue against this (*8*). However, subsequent published reports have indicated that infection with SARS-CoV-2 is frequently asymptomatic and that transmission can occur before the onset of symptoms (*9*). The possibility of presymptomatic transmission raises at least three other potential scenarios involving this case: 1) that one or more secondary asymptomatic infections might have occurred among the patient's contacts and that these led to further, undetected spread of the virus; 2) that the man might have infected contacts before his symptom onset (such contacts would not have been identified through the standard recommended contact investigation at that time); or 3) that he and at least one other person were infected by another passenger on the same flight from Wuhan, and undetected spread from the other infected persons gave rise to the Washington State clade. Which, if any, of these scenarios occurred likely will never be known. It is also possible, given the limited global phylogenetic diversity of SARS-CoV-2 at the time, that the Washington State clade was imported into the United States by another, unknown person around the same time.

Results of serologic testing are not presented here, because serology (i.e., testing for antibody to SARS-CoV-2) is likely to be a relatively insensitive means of detecting a newly emergent virus, particularly when the specimens were collected at random rather than from persons most likely to be infected (in contrast, for example, to viral testing of outpatients or hospitalized patients with acute respiratory disease) and because

serologic assays generally do not approach 100% specificity unless some form of confirmatory testing is available. For example, a hypothetical serologic survey in the Seattle metropolitan area (population of 3.5 million) conducted after the first 3,500 infections would find a true seroprevalence of 0.1%, whereas the use of an assay with 99% specificity would be expected to produce false positives in 10 times as many samples. Serologic surveys, nonetheless, are useful in tracking the progress of the pandemic once established and have the potential advantage of detecting all infections, regardless of the symptom profile.

The findings in this report are subject to at least three limitations. First, the data presented here are retrospective. Although they are geographically diverse, they cannot provide as definitive a picture of transmission as would be available had widespread testing been immediately available after discovery of the virus. Second, some of the studies cited and possibly others are continuing to test samples retrospectively and might find earlier cases than those presented in this report. Finally, the relative phylogenetic homogeneity of SARS-CoV-2 globally in January and early February limited what could be inferred from genomic analysis.

Few countries have avoided the importation and sustained spread of COVID-19. In the United States, SARS-CoV-2 is now circulating widely after several importations from China, Europe, and elsewhere. Steps are underway throughout the U.S. public health system to improve indicators of SARS-CoV-2 activity, including expanding syndromic surveillance among emergency departments and increasing the availability of testing for SARS-CoV-2. Given the probability that most of the U.S. population is still susceptible, sustained efforts to slow the spread of the virus are crucial, including effective contact tracing and nonpharmaceutical interventions, such as physical distancing and source control (i.e., wearing cloth face coverings).

Acknowledgments

New Vaccine Surveillance Network; Influenza Vaccine Effectiveness Network; Hospitalized Adult Influenza Vaccine Effectiveness Network.

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Summary

What is already known about this topic?

The first U.S. cases of nontravel–related COVID-19 were confirmed on February 26 and 28, 2020, suggesting that community transmission was occurring by late February.

What is added by the report?

Four separate lines of evidence (syndromic surveillance, virus surveillance, phylogenetic analysis, and retrospectively identified cases) suggest that limited U.S. community transmission likely began in late January or early February 2020, after a single importation from China, followed by multiple importations from Europe. Until late February, COVID-19 incidence was too low to be detected by emergency department syndromic surveillance for COVID-19–like illness.

What are the implications for public health practice?

Enhanced syndromic and virus surveillance will be needed to monitor COVID-19 trends for the duration of the pandemic.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Michael Boeckh reports grants or personal fees for consulting and research support from Ansun Biopharma, Gilead, GlaxoSmithKline, Janssen Pharmaceutical, Merck, VirBio, Amazon, Allovir, Pulmotect, EvrysBio, Moderna, Bavarian Nordic, Ablynx, ADMA Biologics, Kyorin and Oxford Immunotec. Janet A. Englund reports personal fees for consulting on RSV vaccines from Sanofi Pasteur and Meissa Vaccines. Helen Chu reports consultant fees from Merck and GlaxoSmithKline, a research grant from Sanofi Pasteur, and research supplies from Cepheid, Ellume, and Roche-Genentech. Deborah A. Nickerson reports a grant from Gates Ventures. Trevor Bedford reports grants from Gates Ventures, the National Institutes of Health, and Pew Charitable Trusts. No other potential conflicts of interest were disclosed.

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COVID-19 Monitoring and Response Among U.S. Air Force Basic Military Trainees — Texas, March–April 2020

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On June 2, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The coronavirus disease 2019 (COVID-19) pandemic has resulted in substantial morbidity and mortality since it was first described in December 2019 (*1*). Based on epidemiologic data showing spread in congregate settings (*2–4*), national, state, and local governments instituted significant restrictions on large gatherings to prevent transmission of disease in early March 2020. This and other nonpharmaceutical interventions (NPIs) have shown initial success in slowing the pandemic across the country (*5*). This report examines the first 7 weeks (March 1–April 18) of implementation of NPIs in Basic Military Training (BMT) at a U.S. Air Force base. In a population of 10,579 trainees, COVID-19 incidence was limited to five cases (47 per 100,000 persons), three of which were in persons who were contacts of the first patient. Transmission of symptomatic COVID-19 was successfully limited using strategies of quarantine, social distancing, early screening of trainees, rapid isolation of persons with suspected cases, and monitored reentry into training for trainees with positive test results after resolution of symptoms.

BMT is the first step in the accession of airmen into the USAF. Approximately 40,000 new airmen are trained each year at Joint Base San Antonio-Lackland (JBSA) in Texas with an average of approximately 800 trainees arriving per week. Approximately 75% of incoming trainees are male, and most are in their late teens or early 20s. These trainees are prescreened for underlying medical conditions and are generally in good overall health. Training involves classroom lectures, small group activities, and field exercises. Each training cohort (flight) consists of 50 persons who live in communal, open-bay quarters and perform all daily and training activities as a group. For accountability and safety purposes, trainees are never alone, performing every activity with at least one fellow trainee. In recent decades, outbreaks of respiratory illnesses caused by pathogens such as adenovirus serotype B14 in 2007 have occurred during BMT, resulting in head-to-toe bunk arrangements, regular cleaning of shared equipment, and active syndromic surveillance for respiratory illness (*6*).

Diagnostic Testing Strategy

The initial testing approach for COVID-19 at the Air Force base was based on CDC guidelines (*7*). Initially, trainees who reported as ill to the medical officer on duty (sick call) were evaluated. Trainees were eligible for testing for SARS-CoV-2, the virus that causes COVID-19, only if they reported both symptoms (including cough, fever, or shortness of breath) and either exposure to a person known to have COVID-19 or travel from a high-transmission area. Using these criteria, from March 1 to March 15, two patients were tested for COVID-19. On March 16, the testing criteria became entirely symptom-based with no exposure prerequisite. All trainees underwent an entry screen provided by training instructors. Trainees who had a positive screen were interviewed by medical providers to determine whether further testing was needed.

All laboratory testing (Biofire Respiratory Panel, rapid influenza, and SARS-CoV-2) was conducted on the base. A nasopharyngeal swab was collected for polymerase chain reaction (PCR) testing, and the trainee was isolated in a single-occupancy room and received daily visits from a health care provider or technician to monitor signs and symptoms and determine whether additional care was needed. Isolation rooms were already in place, having been established for previous quarantine of travelers from cruise ships. Symptomatic recruits could return to training at least 7 days after symptom onset and after at least 3 afebrile days.*

Nonpharmaceutical Interventions

To reduce exposure risk, beginning on March 11, access to the base was limited to essential personnel (Figure). BMT graduation ceremonies, which typically draw family members from around the world, were closed to all visitors. On March 13, training instructors were placed under local area travel restriction to prevent travel-related infection and potential spread to trainees.

Beginning March 17, all new recruits were segregated upon arrival for a 2-week arrival quarantine on an area of the base separated from the main cohort of trainees. In addition, all trainees were instructed to maintain a distance of at least 6 feet between one another to ensure social distancing. After the first positive result in a trainee on March 23, the training schedule was shortened from 8.5 to 7 weeks to maximize efficiency while limiting time of possible exposure. On April 6, universal use of cloth face coverings was introduced.

* https://www.cdc.gov/coronavirus/2019-ncov/hcp/return-to-work.html.

Summary

What is already known about this topic?

Substantial COVID-19 transmission has been documented in some congregate living settings.

What is added by this report?

Nonpharmaceutical interventions (NPI) introduced among 10,579 basic trainees at Joint Base San Antonio-Lackland limited COVID-19 incidence to five cases (47 per 100,000 persons), three of which were in persons who were contacts of the first patient.

What are the implications for public health practice?

Despite documented outbreaks of COVID-19 in congregate settings, implementation of NPIs, including screening, testing, administrative measures, quarantine, isolation, and source control, can limit transmission of symptomatic COVID-19 and ensure continuity of critical activities.

Although BMT had the usual number of incoming trainees through March, BMT stopped taking recruits from areas of the United States with higher community transmission of SARS-CoV-2 in April, reducing the number of incoming trainees by approximately 40%.[†]

COVID-19 Cases

A total of 10,579 trainees were present at JBSA for BMT during the study period, including 4,073 (39%) who had begun training during March 1–April 18. During that period, 345 (3%) trainees met criteria for testing and further investigation. Among these, 86 (25%) were tested during arrival quarantine, and five (1%) tested PCR-positive for SARS-CoV-2. Testing also identified five cases of rhinovirus or enterovirus, three cases of parainfluenza, two cases of metapneumovirus, and two cases of influenza B. All patients who had positive test results for SARS-CoV-2 or influenza were in arrival quarantine when tested. Public health officials conducted contact tracing for all PCR-confirmed COVID-19 cases.

Patient A arrived at BMT on March 17 and developed symptoms 5 days later, on March 22. The patient was evaluated and found positive with the SARS-CoV-2 PCR test at sick call on March 23 and was immediately isolated. Patients B, C, and D were contacts of patient A during training; they became symptomatic and were evaluated on March 25, March 27, and March 30, respectively. All three had positive test results for SARS-CoV-2. Investigators could not identify the source of infection for patient A; they speculated that he might have been infected during transit because he arrived from a state not reporting community spread of COVID-19.

Another trainee, patient E, arrived at BMT on March 25 and developed symptoms the same day. The patient was evaluated at sick call 2 days later and had a positive test result for SARS-CoV-2. Public health investigations revealed that during the weekend preceding BMT, the patient had visited a large city experiencing community COVID-19 transmission.

All five cases occurred in men. None of the patients required hospitalization or received antimicrobials. Each was placed in isolation until he met the criteria for returning to training. No additional cases were detected during March 1–April 18.

Discussion

During March 1–April 18, a total of 4,073 incoming trainees joined 6,506 trainees who had already started BMT. Five cases of COVID-19 were diagnosed among incoming recruits, including three cases of transmission within JBSA (cumulative incidence = 47 per 100,000 persons). A combination of administrative controls, increased testing, and quarantine and isolation allowed military training to continue, albeit with 40% reduced numbers, during the first months of the COVID-19 pandemic.

Despite the high risk for transmission in congregate settings (*2*–*4*) such as BMT, as of April 18, the cumulative incidence of symptomatic COVID-19 at the base was lower than the overall rate in the United States (220 per 100,000).[§] Reports of outbreaks in other congregate settings have been substantially higher. For example, the rates at the base during BMT were significantly lower than the incidence of COVID-19 in homeless shelter residents of 17,000–66,000/100,000 persons over the same time period (*8*).

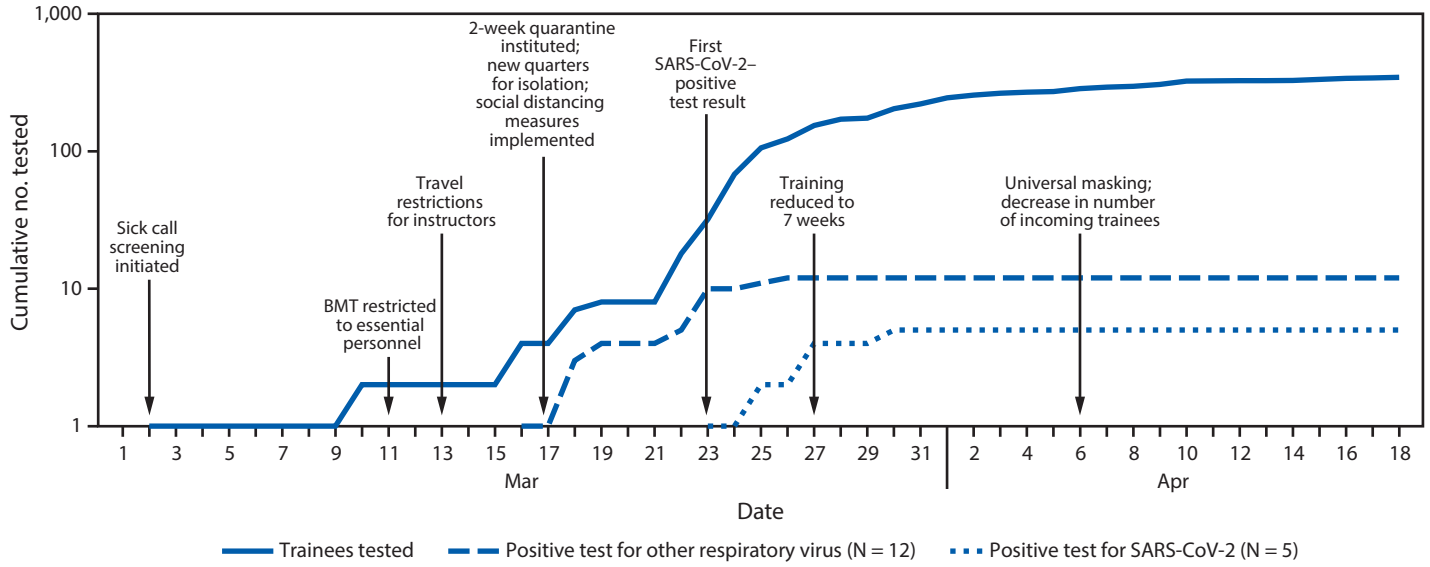
Despite the communal nature of BMT, which has historically been conducive to outbreaks of respiratory pathogens (*9*), the spread of COVID-19 among trainees in BMT appears to have been low: all cases detected occurred during an initial 14-day arrival quarantine, with no cases identified in the larger training population. Factors contributing to lack of transmission likely included early implementation of mitigation strategies before the first case occurred, mobilization of nonmedical personnel to assist in symptom screening, and flexibility of the military training staff to adjustments in programs and schedules. JBSA had recently accommodated cruise ship passengers during their quarantine, and the infrastructure that was developed to host these passengers was repurposed for BMT quarantine and isolation.

The findings in this report are subject to at least two limitations. First, the interventions were implemented in a highly structured and sufficiently resourced military base. Therefore, the success of these interventions in preventing transmission

[†] https://www.defense.gov/Explore/News/Article/Article/2145502/precautions-protect-air-force-trainees-from-covid-19/.

[§] https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html.

FIGURE. Cumulative number of tested trainees with respiratory symptoms and positive test results for SARS-CoV-2 or other respiratory viruses* and interventions implemented — Joint Base San Antonio-Lackland, Texas, March 1–April 18, 2020



Abbreviation: BMT = basic military training.
* Rhinovirus or enterovirus (five cases), parainfluenza (three cases), metapneumovirus (two cases), and influenza B virus (two cases).

of SARS-CoV-2 at JBSA might not be transferrable to other settings. Second, cases in asymptomatic or presymptomatic persons cannot be detected by symptom screening, and the prevalence of asymptomatic SARS-CoV-2 infection in this young population with few underlying medical conditions is unknown. However, because no COVID-19 cases were identified during training after quarantine, asymptomatic transmission within this cohort is unlikely. Studies to assess potential asymptomatic spread in military facilities setting are needed.

Transmission of symptomatic COVID-19 was successfully limited at a single military base with adequate resources to screen personnel and the ability to track the movement of all trainees. Despite the presence of 10,579 persons from across the country in communal residence and training, early interventions focusing on NPIs including quarantine, physical distancing, and source control (universal use of cloth face coverings), along with rapid identification and isolation of potential cases, permitted continuation of operations at JBSA during the COVID-19 pandemic. The disciplined and highly structured environment and the population structure (young healthy adults) likely contributed to the success of the implemented interventions. These findings demonstrate the success of widespread implementation of NPIs focused on social distancing, quarantine, and source control in preventing transmission of SARS-CoV-2.

Acknowledgments

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Erratum:

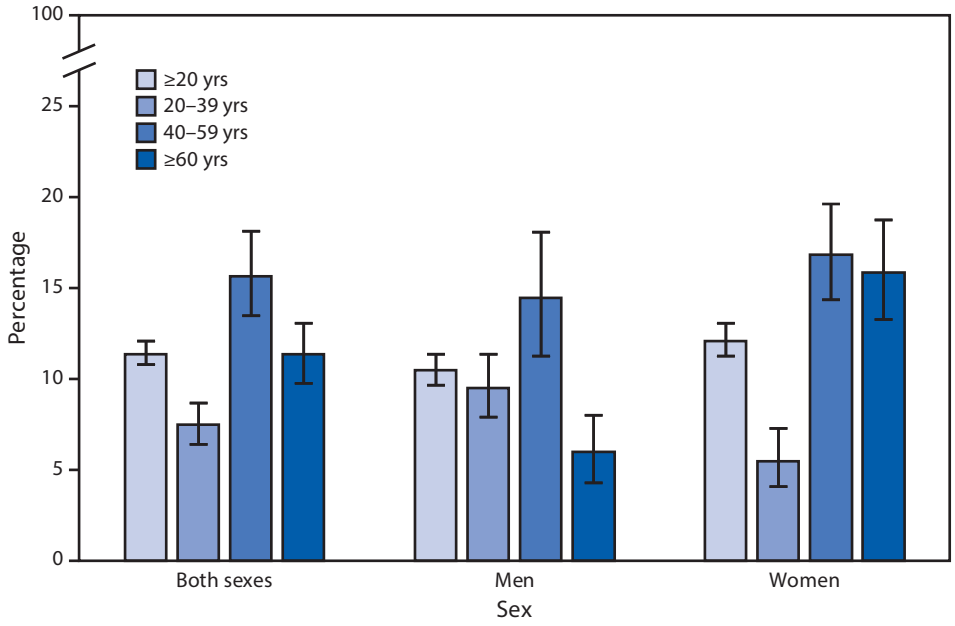
Vol. 69, No. 12

In the report "Tuberculosis Preventive Treatment Scale-Up Among Antiretroviral Therapy Patients — 16 Countries Supported by the U.S. President's Emergency Plan for AIDS Relief, 2017–2019," on page 329, an author's academic degree was listed incorrectly. The correct degree is Sevim Ahmedov, **MD**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Prevalence of High Total Cholesterol* Among Adults Aged ≥20 Years,† by Age Group and Sex — National Health and Nutrition Examination Survey, 2015–2018



* Defined as serum total cholesterol ≥240 mg/dL.
† Estimates for the category of persons aged ≥20 years were age-adjusted by the direct method to the year 2000 U.S. Census population using the age groups 20–39, 40–59 and ≥60 years. Estimates are presented with 95% confidence intervals indicated by error bars.

During 2015–2018, the prevalence of high total cholesterol among adults aged ≥20 years was 11.4%, with no significant difference between men (10.5%) and women (12.1%). Prevalence was highest among adults aged 40–59 years (15.7%), followed by those aged ≥60 years (11.4%), and lowest among those aged 20–39 years (7.5%). Among men, the prevalence was highest among those aged 40–59 years (14.5%), followed by those aged 20–39 years (9.5%), and lowest among those aged ≥60 years (6.0%). Among women, the pattern was different, with women aged 20–39 years (5.5%) having a lower prevalence than either women aged 40–59 years (16.9%) or women aged ≥60 years (15.9%). Prevalence among women aged 20–39 years was lower than that among men in this age group, but prevalence was higher among women aged ≥60 years than it was among men of that age group. There was no significant difference between men and women for adults aged 40–59 years.

Sources: Carroll MD, Fryar CD. Total and high-density lipoprotein cholesterol in adults: United States, 2015–2018. NCHS Data Brief, no 363. https://www.cdc.gov/nchs/products/databriefs/db363.htm. National Center for Health Statistics, National Health and Nutrition Examination Survey, 2015–2018. https://www.cdc.gov/nchs/nhanes.htm.

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ISSN: 0149-2195 (Print)