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Prevalence of Self-Reported Hypertension and Antihypertensive Medication Use Among Adults — United States, 2017

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Hypertension, or high blood pressure, is a major risk factor for heart disease and stroke (*1*). The prevalence of hypertension is higher among men than among women, increases with age, is highest among non-Hispanic blacks (blacks) (*2*), and has been consistently highest in the Southeastern region of the United States (*1*). To update prevalence estimates for self-reported hypertension and use of antihypertensive medication, CDC analyzed data from the 2017 Behavioral Risk Factor Surveillance System (BRFSS). The overall (unadjusted) prevalence of self-reported hypertension was 32.4% (95% confidence interval [CI] = 32.1%–32.7%). The age-standardized, median state-specific prevalence of self-reported hypertension was 29.7% (range = 24.3%–38.6%). Overall age-standardized hypertension prevalence was higher among men (32.9%) than among women (27.0%), highest among blacks (40.0%), decreased with increasing levels of education and household income, and was generally highest in the Southeastern and Appalachian states.* Among persons reporting hypertension, the overall unadjusted prevalence of self-reported antihypertensive medication use was 76.0% (95% CI = 75.5%–76.4%). The age-standardized, median state-specific prevalence of antihypertensive medication use among persons with reported hypertension was 59.4% (range = 50.2%–71.2%). Prevalence was higher among women than men, highest among blacks compared with other racial/ethnic groups, and highest among states in the Southeast, Appalachia, and the Dakotas. These findings can help inform CDC's initiatives to enhance hypertension awareness, treatment, and control across all states.

BRFSS† is an annual, random-digit–dialed telephone survey (both landline and mobile phone), representative of the noninstitutionalized adult population aged ≥18 years of the 50 states, the District of Columbia (DC), and U.S. territories. In 2017, a total of 450,016 adults were interviewed. The present study includes data from the 50 states and DC; the median response rate was 45.9% (range = 30.6%–64.1%).§ Respondents were classified as having hypertension if they answered "yes" to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high

* https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp.
† https://www.cdc.gov/brfss/index.html.
§ https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-sdqr-508.pdf.

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

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blood pressure?" Those with borderline and pregnancy-related hypertension were categorized as "no." Respondents reporting hypertension were classified as currently taking antihypertensive medication if they answered "yes" to the question "Are you currently taking medicine for your high blood pressure?" All analyses incorporated methods to account for the complex survey design. Application of sampling weights accounted for nonresponse, noncoverage, and mobile telephone–only households, and were derived from an iterative proportional weighting (raking) procedure.¶

The unadjusted, age-specific, and age-standardized prevalence of self-reported hypertension and antihypertensive medication use were estimated overall, for each of the 50 states and DC, and by sociodemographic characteristics. Prevalence estimates were age-standardized to the 2000 U.S. standard population (*3*). Differences in prevalence across sociodemographic subgroups were tested using chi-squared tests, and differences reported were considered statistically significant for p-values <0.05. All analyses were conducted using SAS-callable SUDAAN (version 11.0.3; RTI International).

During 2017, the overall unadjusted prevalence of hypertension for the 50 states and DC was 32.4% (95% CI = 32.1%–32.7%), representing an estimated 81.7 million adults (Table 1). The age-standardized median state-specific prevalence of hypertension was 29.7% (range = 24.3% [Minnesota] to 38.6% [Alabama and West Virginia]). Age-standardized hypertension prevalences were generally highest in Southeastern and Appalachian states (Figure). Age-specific hypertension prevalence increased with increasing age group (Table 2). The age-standardized prevalence of hypertension was higher among men (32.9%) than among women (27.0%), highest among blacks (40.0%), and decreased with increasing levels of education and household income.

Among those reporting hypertension, the overall, unadjusted prevalence of antihypertensive medication use was 76.0% (95% CI = 75.5%–76.4%), representing an estimated 61.9 million adults (Table 1). The age-standardized, median, state-specific prevalence of antihypertensive medication use was 59.4% (range = 50.2% [Idaho] to 71.2% [Mississippi]). Age-standardized prevalence of antihypertensive medication use was highest in the Southeastern and Appalachian states, as well as the Dakotas (Figure). The age-specific prevalence of antihypertensive medication use also increased with increasing age (Table 2), was highest among blacks (68.1%), was higher among women (64.0%) than among men (56.7%), and did not vary by education or household income level.

Discussion

During 2017, approximately one third (82 million) of U.S. adults reported having hypertension, and an estimated three quarters of those with hypertension (62 million) reported using antihypertensive medication. Age-standardized prevalence of hypertension varied widely by state, remaining highest in the Southeast and among men and blacks. Age-standardized prevalence of antihypertensive medication use also increased

¶ https://www.cdc.gov/brfss/annual_data/2017/pdf/weighting-2017-508.pdf.

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TABLE 1. Unadjusted and age-standardized* prevalence of self-reported hypertension (HTN)† and current antihypertensive medication use§ among adults aged ≥18 years — Behavioral Risk Factor Surveillance System, 50 U.S. states and the District of Columbia, 2017

Area	Hypertension				Current antihypertensive medication use among adults with hypertension			
	Sample with HTN	Population with HTN (x 1,000)¶	% (95% CI)		Sample using antihypertensive medication	Population using antihypertensive medication (x 1,000)¶	% (95% CI)	
			Unadjusted	Age-standardized*			Unadjusted	Age-standardized*
Overall	**178,312**	**81,674**	**32.4 (32.1–32.7)**	**29.9 (29.6–30.2)**	**146,754**	**61,927**	**76.0 (75.5–76.4)**	**59.6 (58.8–60.3)**
State								
Alabama	3,435	1,582	41.9 (40.3–43.4)	38.6 (37.1–40.1)	2,954	1,281	81.1 (79.1–83.1)	70.5 (67.1–73.9)
Alaska	1,245	176	31.8 (29.2–34.5)	31.8 (29.4–34.2)	875	113	64.4 (59.8–69.0)	53.0 (46.7–59.2)
Arizona	6,005	1,655	30.7 (29.8–31.5)	28.0 (27.1–28.8)	4,891	1,236	74.8 (73.2–76.3)	56.0 (53.6–58.4)
Arkansas	2,892	949	41.4 (39.0–43.7)	38.5 (36.1–40.8)	2,547	754	79.6 (76.5–82.8)	69.3 (64.2–74.4)
California	2,854	8,647	28.4 (27.1–29.6)	27.0 (25.9–28.1)	2,060	6,141	71.1 (68.8–73.4)	53.0 (50.0–56.0)
Colorado	3,189	1,130	26.0 (24.9–26.9)	24.8 (23.8–25.7)	2,395	764	69.9 (67.8–72.0)	52.7 (49.6–55.8)
Connecticut	3,991	859	30.5 (29.3–31.6)	27.2 (26.1–28.3)	3,313	658	76.8 (74.8–78.9)	57.3 (54.0–60.6)
Delaware	1,683	263	34.9 (32.9–36.9)	31.1 (29.2–33.0)	1,367	203	77.3 (74.2–80.4)	58.8 (53.5–64.1)
District of Columbia	1,505	149	26.4 (24.8–28.1)	28.2 (26.7–29.6)	1,241	111	74.5 (71.3–77.8)	61.7 (57.3–66.0)
Florida	9,360	5,810	34.6 (33.2–36.0)	29.7 (28.5–31.0)	7,568	4,496	77.5 (75.5–79.5)	58.3 (54.8–61.7)
Georgia	2,520	2,624	33.1 (31.6–34.6)	31.6 (30.2–33.0)	2,153	2,042	77.9 (75.4–80.3)	62.7 (59.0–66.4)
Hawaii	2,657	343	30.6 (29.2–32.0)	28.1 (26.9–29.4)	2,067	257	75.0 (72.5–77.4)	57.9 (54.3–61.5)
Idaho	1,806	379	29.8 (28.1–31.5)	27.5 (26.0–29.0)	1,378	260	69.0 (65.8–72.0)	50.2 (46.2–54.2)
Illinois	2,190	3,187	32.2 (30.8–33.7)	29.9 (28.5–31.3)	1,788	2,410	75.7 (73.3–78.2)	59.8 (55.4–64.1)
Indiana	6,226	1,796	35.2 (34.2–36.3)	32.6 (31.7–33.6)	5,262	1,372	76.5 (74.8–78.2)	60.4 (57.8–63.0)
Iowa	2,906	762	31.5 (30.3–32.6)	28.3 (27.3–29.4)	2,384	589	77.5 (75.5–79.4)	60.7 (57.4–64.0)
Kansas	8,757	718	32.8 (32.0–33.5)	30.5 (29.8–31.2)	7,187	544	75.8 (74.6–77.1)	59.2 (57.3–61.2)
Kentucky	4,214	1,356	39.4 (37.7–41.0)	36.1 (34.6–37.6)	3,600	1,094	80.8 (78.7–82.9)	67.5 (64.1–70.9)
Louisiana	2,208	1,400	39.0 (37.3–40.7)	36.8 (35.2–38.4)	1,849	1,123	80.3 (78.0–82.5)	69.0 (65.3–72.6)
Maine	3,909	376	34.8 (33.4–36.2)	29.9 (28.5–31.3)	3,117	279	74.5 (72(2–76.9)	56.5 (52.7–60.8)
Maryland	5,982	1,522	32.4 (31.2–33.5)	29.8 (28.7–30.9)	5,179	1,211	79.7 (77.8–81.5)	62.6 (59.1–66.1)
Massachusetts	2,475	1,564	28.6 (26.8–30.3)	25.7 (24.3–27.2)	2,053	1,220	78.1 (75.2–81.0)	59.7 (54.4–65.0)
Michigan	4,397	2,697	34.7 (33.6–35.8)	31.3 (30.3–32.3)	3,625	2,067	76.7 (75.0–78.4)	59.4 (56.5–62.2)
Minnesota	5,533	1,134	26.6 (25.8–27.4)	24.3 (23.5–25.0)	4,492	861	76.0 (74.3–77.6)	58.0 (55.3–60.5)
Mississippi	2,621	926	40.8 (38.8–42.7)	38.2 (36.4–40.0)	2,314	750	81.0 (78.3–83.8)	71.2 (66.8–75.5)
Missouri	3,133	1,513	32.0 (30.6–33.4)	29.0 (27.7–30.3)	2,671	1,204	79.7 (77.4–82.0)	64.0 (59.8–68.0)
Montana	2,211	238	29.0 (27.5–30.5)	25.7 (24.2–27.1)	1,750	170	71.8 (68.8–74.7)	51.7 (47.5–56.0)
Nebraska	5,895	443	30.6 (29.5–31.7)	28.2 (27.3–29.2)	4,957	348	78.6 (76.8–80.4)	61.5 (58.3–64.7)
Nevada	1,471	757	32.6 (30.5–34.8)	30.0 (28.1–32.0)	1,149	548	72.5 (68.9–76.2)	55.1 (49.2–61.1)
New Hampshire	2,284	324	30.0 (28.4–31.6)	25.9 (24.4–27.4)	1,915	257	79.7 (77.0–82.3)	62.2 (56.0–68.3)
New Jersey	4,897	2,305	33.0 (31.6–34.4)	30.1 (28.8–31.4)	4,096	1,750	76.0 (73.7–78.4)	58.3 (54.7–62.0)
New Mexico	2,496	484	30.5 (29.0–32.0)	28.0 (26.6–29.4)	1,952	353	73.2 (70.5–75.8)	57.1 (52.9–61.3)
New York	4,329	4,574	29.4 (28.3–30.5)	27.1 (26.2–28.1)	3,485	3,449	75.6 (73.7–77.5)	57.4 (54.6–60.2)
North Carolina	2,002	2,775	34.7 (33.0–36.5)	31.8 (30.2–33.3)	1,662	2,217	80.0 (77.6–82.5)	64.1 (59.9–68.4)
North Dakota	2,813	173	29.5 (28.2–30.8)	28.2 (27.0–29.4)	2,401	135	78.2 (75.9–80.6)	63.2 (59.2–67.3)

See table footnotes on the next page

with increasing age, was highest among blacks, and was higher among women than among men.

The overall age-standardized self-reported hypertension prevalence of 29.9% was similar to that reported based on 2011–2015 BRFSS data (29.8%) (*1*) and measured hypertension prevalence of 29% based on data from the 2015–2016 National Health and Nutrition Examination Survey (*2*). Also consistent with other reports, hypertension prevalence decreased with increasing income (*4*) and education level (*1*) and was highest in Southeastern and Appalachian states (*1*,*2*). The overall, age-standardized prevalence of antihypertensive medication use (59.6%) was also similar to estimates from the 2011–2015 BRFSS, ranging from 63.0% in 2011 to 61.8% in 2015 (*1*). Like hypertension prevalence, medication use prevalence was highest in Southeastern and Appalachian states. In the present study, prevalence of medication use was also highest in the Dakotas, despite a midrange prevalence of hypertension in these states. Prevalence of antihypertensive medication use was higher in older age groups, highest among blacks, and higher among women than men. This overall gender difference has been reported previously (*1*), but the reasons are unclear. Data from Medicare Part D beneficiaries aged ≥65 years suggest that antihypertensive medication nonadherence is similar for men (25.8%) and women (26.7%) (*5*). More information is needed to examine the relationship between the prevalence

TABLE 1. (*Continued*) Unadjusted and age-standardized* prevalence of self-reported hypertension (HTN)† and current antihypertensive medication use§ among adults aged ≥18 years — Behavioral Risk Factor Surveillance System, 50 U.S. states and the District of Columbia, 2017

	Hypertension				Current antihypertensive medication use among adults with hypertension			
			% (95% CI)				% (95% CI)	
Area	Sample with HTN	Population with HTN (x 1,000)¶	Unadjusted	Age-standardized*	Sample using antihypertensive medication	Population using antihypertensive medication (x 1,000)¶	Unadjusted	Age-standardized*
Ohio	5,394	3,130	34.7 (33.5–35.9)	31.4 (30.2–32.6)	4,618	2,433	77.9 (75.9–79.9)	61.5 (58.3–64.6)
Oklahoma	3,176	1,124	37.7 (36.2–39.2)	35.4 (34.0–36.7)	2,719	874	77.8 (75.6–80.0)	64.0 (60.6–67.5)
Oregon	1,835	987	30.1 (28.7–31.5)	27.2 (25.9–28.5)	1,374	699	71.0 (68.4–73.5)	53.3 (49.5–57.0)
Pennsylvania	2,337	3,295	32.6 (31.1–34.1)	28.9 (27.6–30.2)	1,896	2,586	78.6 (76.4–80.9)	60.9 (56.9–64.8)
Rhode Island	2,303	280	33.1 (31.4–34.8)	29.9 (28.3–31.5)	1,969	226	81.0 (78.4–83.7)	65.5 (60.3–70.6)
South Carolina	5,632	1,498	38.1 (36.9–39.3)	34.4 (33.3–35.6)	4,916	1,206	80.6 (78.9–82.4)	68.5 (65.2–71.8)
South Dakota	2,862	203	30.8 (28.9–32.7)	28.0 (26.2–29.7)	2,420	161	79.4 (76.3–82.5)	64.8 (59.0–70.5)
Tennessee	2,638	2,012	38.7 (36.9–40.4)	35.5 (33.9–37.2)	2,210	1,580	78.6 (76.0–81.1)	65.0 (60.9–69.1)
Texas	5,299	6,853	32.5 (30.8–34.2)	31.9 (30.3–33.5)	4,446	4,958	72.4 (69.4–75.3)	57.5 (53.5–61.6)
Utah	3,044	534	24.5 (23.4–25.5)	25.4 (24.5–26.4)	2,224	359	67.4 (65.1–69.7)	52.3 (49.6–55.1)
Vermont	2,313	153	30.4 (28.9–31.9)	26.4 (25.1–27.8)	1,804	112	73.5 (71.0–76.1)	51.7 (47.8–55.6)
Virginia	3,895	2,136	32.4 (31.1–33.6)	30.3 (29.1–31.5)	3,245	1,613	75.7 (73.5–77.9)	58.3 (55.1–61.5)
Washington	4,840	1,700	29.5 (28.6–30.5)	27.6 (26.6–28.5)	3,696	1,184	69.9 (68.0–71.7)	54.5 (51.9–57.2)
West Virginia	2,769	631	43.5 (28.6–30.5)	38.6 (37.0–40.2)	2,380	502	79.6 (77.5–81.7)	61.7 (58.4–65.1)
Wisconsin	2,143	1,387	30.8 (29.2–32.4)	27.9 (26.4–29.4)	1,743	1,041	75.4 (72.6–78.2)	57.0 (52.4–61.5)
Wyoming	1,741	138	30.8 (29.2–32.4)	28.5 (27.0–30.0)	1,397	98	71.7 (68.8–74.7)	53.5 (49.4–57.6)
Median	—	—	**32.2**	**29.7**	—	—	**76.7**	**59.4**
Range	—	—	**24.5–43.5**	**24.3–38.6**	—	—	**64.4–81.1**	**50.2–71.2**

Abbreviation: CI = confidence interval.

* Age standardized to the 2000 U.S. projected population using three age groups: 18–44, 45–64, and ≥65 years.

† Hypertension was defined as an affirmative response to "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" Preeclampsia or borderline high or prehypertensive was categorized as "no."

§ Current antihypertensive medication use was defined as affirmative response to "Are you currently taking medicine prescribed by a doctor or other health professional for your high blood pressure?"

¶ Weighted number of adults in the population with hypertension or currently using antihypertensive medication.

of self-reported hypertension and that of antihypertensive medication use.

The findings in this report are subject to at least three limitations. First, data were self-reported. The lack of documented diagnosis of hypertension based on historic blood pressure measurements does not allow for precise assessment of hypertension; however, the results were similar to data from previous reports based on both self-report (*1*) and measured hypertension (*2*). Second, low median response rates across states might limit the representativeness of the 2017 BRFSS sample and potentially result in either under- or overestimates of prevalence, although application of sampling weights is likely to reduce some nonresponse bias. Finally, findings are representative of noninstitutionalized civilian persons only and would exclude those living in nursing homes, prisons, and other institutions.

This report provides the most recent state-level surveillance data on prevalence of self-reported hypertension and antihypertensive medication use among persons reporting hypertension. Hypertension prevention and control is a priority of CDC's state and local funding for heart disease and

Summary

What is already known about this topic?

Prevalence of hypertension increases with increasing age and is higher among men than women and among non-Hispanic blacks than among other racial/ethnic groups; prevalence has been consistently higher in the Southeastern and Appalachian regions of the United States.

What is added by this report?

Analysis of 2017 Behavioral Risk Factor Surveillance System data found that approximately one third of U.S. adults reported having hypertension, and an estimated 75% of those reporting having hypertension reported using antihypertensive medication. The prevalence of these factors varied widely by state and was generally highest in the Southeastern and Appalachian states.

What are the implications for public health practice?

A multidisciplinary team-based strategy working to educate patients, maintain dialogue over time, and identify risk factors can provide intervention opportunities for better blood pressure control and could reduce disparities in hypertension awareness, treatment, and control across the United States.

TABLE 2. Unadjusted and age-standardized* prevalence of self-reported hypertension (HTN)† and antihypertensive medication use§ among adults aged ≥18 years, by selected characteristics — Behavioral Risk Factor Surveillance System, United States, 2017

Characteristic	Hypertension				Antihypertensive medication use among adults with hypertension			
	Sample with HTN	Population with HTN (x 1000)¶	% (95% CI)		Sample using antihypertensive medication	Population using antihypertensive medication (x 1,000)¶	% (95% CI)	
			Unadjusted	Age-standardized*			Unadjusted	Age-standardized*
Overall	**178,312**	**81,674**	**32.4 (32.1–32.7)**	**29.9 (29.6–30.2)**	**146,754**	**61,927**	**76.0 (75.5–76.4)**	**59.6 (58.8–60.3)**
Age group (yrs)								
18–44	18,432	16,429	14.1 (13.7–14.5)	14.1 (13.8–14.5)	7,512	6,195	37.9 (36.5–39.2)	37.9 (36.5–39.2)
45–64	66,699	34,048	40.5 (40.0–41.0)	40.5 (40.0–41.0)	53,783	27,085	79.6 (78.9–80.3)	79.6 (78.9–80.3)
≥65	93,181	31,198	60.5 (60.0–61.1)	60.5 (60.0–61.1)	85,459	28,647	92.0 (91.5–92.4)	92.0 (91.5–92.4)
Sex*								
Men	81,648	42,260	34.5 (34.0–34.9)	32.9 (32.5–33.3)	64,010	30,136	71.5 (70.7–72.2)	56.7 (55.8–57.6)
Women	96,569	39,363	30.4 (30.0–30.8)	27.0 (26.6–27.3)	82,669	31,747	80.8 (80.1–81.4)	64.0 (62.7–65.2)
Race/Ethnicity*								
White, non-Hispanic	136,668	53,179	34.0 (33.7–34.3)	29.0 (28.7–29.3)	113,525	41,278	77.7 (77.2–78.2)	59.0 (58.1–59.9)
Black, non-Hispanic	18,628	12,127	41.1 (40.1–42.1)	40.0 (39.2–40.9)	16,116	9,649	79.6 (78.3–80.9)	68.1 (66.2–70.0)
Hispanic	9,081	9,510	23.9 (23.0–24.7)	28.2 (27.3–29.1)	6,359	6,133	64.8 (62.8–66.8)	54.0 (51.9–56.0)
American Indian/ Alaska Native, non-Hispanic	3,624	976	38.8 (36.4–41.3)	37.1 (34.7–39.5)	2,784	690	70.7 (66.7–74.7)	58.6 (53.6–63.5)
Asian, non-Hispanic	2,290	2,659	19.6 (17.8–21.4)	23.8 (21.9–25.8)	1,786	1,835	69.2 (64.5–73.9)	58.0 (52.8–63.0)
Native Hawaiian/ Pacific Islander, non-Hispanic	316	127	26.4 (21.2–31.7)	33.0 (28.3–38.0)	200	87	68.4 (59.1–77.6)	54.9 (45.8–63.6)
Multiracial, non-Hispanic	3,373	1,060	30.1 (28.3–32.0)	31.6 (29.9–33.4)	2,504	731	69.1 (65.9–72.3)	56.7 (52.8–60.6)
Other, non-Hispanic	880	368	33.1 (28.8–37.3)	28.9 (25.3–32.8)	703	276	75.2 (67.9–82.5)	54.9 (45.4–64.0)
Education level*								
Less than high school	15,316	13,232	39.1 (38.1–40.2)	35.4 (34.4–36.3)	12,605	10,020	75.9 (74.4–77.4)	58.6 (56.4–60.8)
High school or equivalent	54,498	24,742	35.2 (34.6–35.7)	32.3 (31.8–32.8)	45,423	18,944	76.7 (75.9–77.6)	59.6 (58.4–60.9)
More than high school	107,886	43,411	29.5 (29.2–29.9)	27.5 (27.2–27.8)	88,234	32,756	75.6 (74.9–76.2)	59.8 (58.8–60.8)
Household income*								
<$15,000	17,836	9,145	40.7 (39.6–41.8)	37.9 (36.9–39.0)	14,384	6,889	75.5 (73.9–77.1)	61.5 (59.3–63.7)
$15,000 to <$25,000	28,614	13,017	36.9 (36.1–37.7)	34.3 (33.6–35.1)	23,605	9,895	76.1 (74.9–77.4)	59.7 (57.9–61.5)
$25,000 to <$35,000	17,502	7,731	35.5 (34.5–36.6)	31.9 (30.9–32.9)	14,589	5,928	76.8 (75.3–78.4)	60.4 (57.5–63.2)
$35,000 to <$50,000	22,129	9,213	33.1 (32.3–34.0)	29.9 (29.1–30.7)	18,451	7,029	76.4 (75.0–77.8)	56.9 (54.9–58.8)
≥$50,000	61,667	29,012	28.2 (27.8–28.7)	26.9 (26.5–27.3)	49,890	21,529	74.3 (73.5–75.1)	59.7 (58.5–60.9)

Abbreviation: CI = confidence interval.

* Age standardized to the 2000 U.S. projected population using three age groups: 18–44, 45–64, and ≥65 years.

† Hypertension was defined as an affirmative response to "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" Preeclampsia or borderline high or pre-hypertensive was categorized as "no."

§ Current antihypertensive medication use was defined as affirmative response to "Are you currently taking medicine prescribed by a doctor or other health professional for your high blood pressure?"

¶ Weighted number of adults in the population with hypertension or currently using antihypertensive medication.

stroke prevention** and one of the important elements of the Million Hearts initiative (*6*). CDC has been working closely with states to enhance hypertension management through a strategy of team-based care in which two or more health care providers work collaboratively with each patient. These teams may include doctors, nurses, pharmacists, dietitians, community health workers, and other health care providers. This approach is often multidisciplinary with a team working to educate patients, identify risk factors, provide treatments, and sustain ongoing conversations with patients. This strategy can result in multiple opportunities for intervention for better blood pressure control (*7*),†† with the ultimate goal of reducing disparities in hypertension awareness, treatment, and control across the United States.

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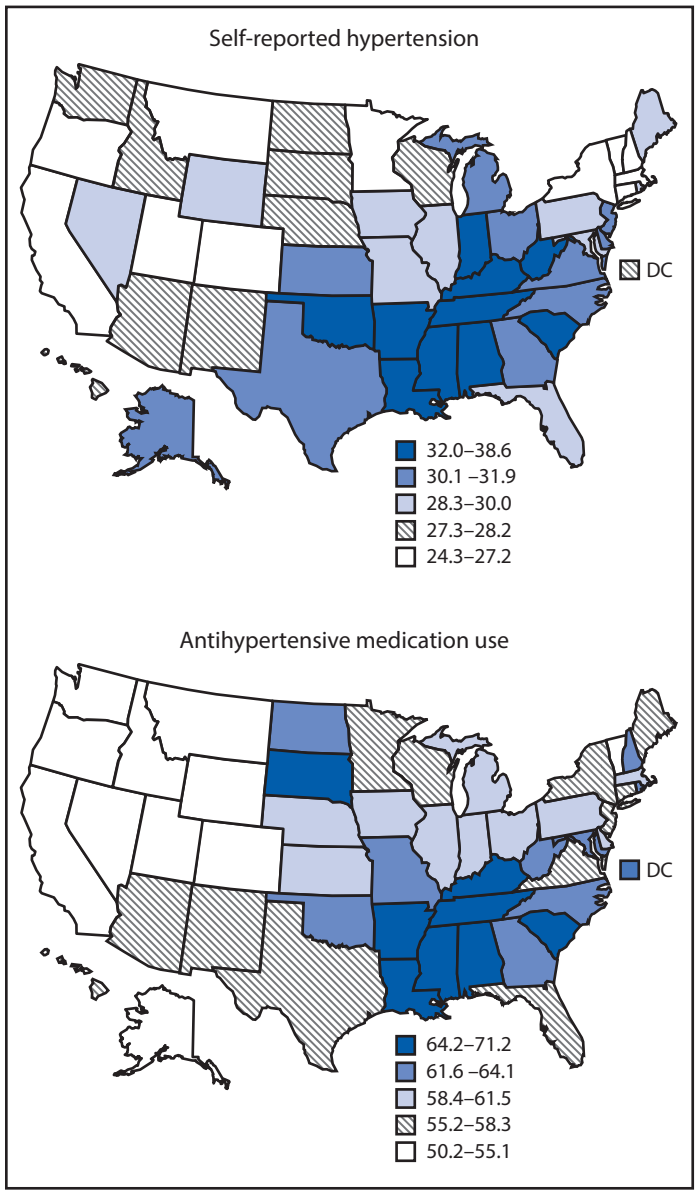
** https://www.cdc.gov/dhdsp/programs/index.htm.

†† https://www.cdc.gov/dhdsp/pubs/guides/best-practices/team-based-care.htm.

FIGURE. Age-standardized percentage of self-reported hypertension and antihypertensive medication use among adults aged ≥18 years, by state — Behavioral Risk Factor Surveillance System, United States, 2017



Abbreviation: DC = District of Columbia.

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Vital Signs: Newly Reported Acute and Chronic Hepatitis C Cases — United States, 2009–2018

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Abstract

Introduction: Hepatitis C is a leading cause of death from liver disease in the United States. Acute hepatitis C infection is often asymptomatic, and >50% of cases will progress to chronic infection, which can be life-threatening. Hepatitis C can be diagnosed with a blood test and is curable, yet new cases of this preventable disease are increasing.

Methods: National Notifiable Diseases Surveillance System data were analyzed to determine the rate of acute hepatitis C cases reported to CDC by age group and year during 2009–2018 and the number and rate of newly reported chronic cases in 2018 by sex and age. The proportion of adults aged ≥20 years with hepatitis C who reported having ever been told that they had hepatitis C was estimated with 2015–2018 National Health and Nutrition Examination Survey data.

Results: During 2018, a total of 3,621 cases of acute hepatitis C were reported, representing an estimated 50,300 cases (95% confidence interval [CI] = 39,800–171,600). The annual rate of reported acute hepatitis C cases per 100,000 population increased threefold, from 0.3 in 2009 to 1.2 in 2018, and was highest among persons aged 20–29 (3.1) and 30–39 years (2.6) in 2018. A bimodal distribution of newly reported chronic hepatitis C cases in 2018 was observed, with the highest proportions among persons aged 20–39 years and 50–69 years. Only 60.6% (95% CI = 46.1%–73.9%) of adults with hepatitis C reported having been told that they were infected.

Conclusions and Implications for Public Health Practice: Increasing rates of acute hepatitis C among young adults, including reproductive-aged persons, have put multiple generations at risk for chronic hepatitis C. The number of newly reported chronic infections was approximately equal among younger and older adults in 2018. The new CDC hepatitis C testing recommendations advise screening all adults and pregnant women, not just persons born during 1945–1965, and those with risk factors.

Introduction

Hepatitis C is a leading cause of morbidity and mortality from liver disease, costing the U.S. health care system billions of dollars annually (*1*,*2*). Hepatitis C virus (HCV) is primarily transmitted through direct percutaneous exposure to blood through injection drug use, but can also be transmitted sexually or from an infected mother to her infant during pregnancy or childbirth. HCV can cause an acute infection (acute hepatitis C), followed in some cases by chronic infection (chronic hepatitis C). Persons with acute hepatitis C are typically asymptomatic or have only a mild clinical illness. Acute hepatitis C infection might clear completely without any treatment, but >50% of infections will progress to chronic hepatitis C, which is also typically asymptomatic until liver damage is severe enough to cause symptoms (*3*,*4*). Left untreated, chronic hepatitis C can be life-threatening.

Despite availability of accurate diagnostic tests and highly effective curative treatment, approximately 2.4 million adults in the United States (i.e., approximately 1.0% of all U.S. adults) were living with hepatitis C during 2013–2016 (*5*). Because HCV infection is most often asymptomatic, only 55.6% of these adults reported having ever been told that they had hepatitis C during 2013–2016 (*6*). Being unaware of an HCV infection can have serious health consequences and increase risk for transmission to others. In 2018, ≥15,713 death certificates listed hepatitis C as the underlying or contributing cause of death (*7*).

Historically, the highest prevalence of chronic hepatitis C in the United States has been among persons born during 1945–1965 (baby boomers) (*8*). Concurrent with the nation's opioid crisis, in more recent years, new HCV infections have occurred primarily among young adults, including persons of reproductive age. Compared with 2005 when reported acute hepatitis C cases were at a low point this century (0.2 per 100,000 population), by 2017 the rate had increased approximately fourfold, to 1.0 per 100,000, mostly among persons aged 20–39 years* (*9*). Further, a recent study of the Healthcare

* Historical CDC viral hepatitis surveillance data are available at https://www.cdc.gov/hepatitis/statistics/SurveillanceRpts.htm.

Cost and Utilization Project showed that U.S. rates of maternal HCV infection at delivery increased from 0.8 per 1,000 live births in 2000 to 4.1 in 2015, with the highest increases among women with opioid use disorder (*10*).

Because hepatitis C testing and curative treatment substantially reduces long-term risk for disease and death, in 2012 CDC augmented the risk-based testing guidelines to recommend screening all persons born during 1945–1965 (*8*). Because of the changing epidemiology of hepatitis C in the United States, CDC is now recommending screening of all adults at least once in their lifetime and screening of all pregnant women during every pregnancy (*11*). The purpose of this report is to highlight the epidemic of hepatitis C among all adults in support of this new CDC screening recommendation.

Methods

National Notifiable Diseases Surveillance System (NNDSS) data for 2009–2018 were analyzed by age group to quantify the annual number of confirmed acute hepatitis C cases per 100,000 population (rate) reported to CDC. During 2016–2019, the Council of State and Territorial Epidemiologists (CSTE) defined a confirmed acute hepatitis C case as one that met both clinical and laboratory criteria, or test conversion criteria.† To meet clinical criteria, a person must have been evaluated for discrete onset of any sign or symptom consistent with acute viral hepatitis and have had either jaundice or elevated serum alanine aminotransferase levels. To meet laboratory criteria, the person must have had a positive nucleic amplification test (NAT) for HCV RNA or HCV antigen test. Test conversion is defined as having received a positive anti-HCV test, HCV antigen test, or NAT within 12 months after a negative result for any of these tests. To account for underascertainment and underreporting in acute hepatitis C surveillance data, the total estimated number of cases of acute hepatitis C for 2018 was calculated using standard methodology as described in the CDC viral hepatitis annual surveillance reports (*9*,*12*).

To quantify the number and rate of confirmed chronic hepatitis C cases newly reported to CDC by sex, age, and social generation (i.e., birth cohort), NNDSS data for 2018 were analyzed. In 2018, CSTE defined a confirmed chronic hepatitis C case as one that did not meet the definition of an acute case and had a positive NAT for HCV RNA or HCV antigen test. A newly reported chronic case is a chronic hepatitis C case that meets the CSTE case definition and has not been reported previously.§ All acute and chronic hepatitis C rates were calculated using yearly U.S. population estimates from 2009–2018.¶ The p-values for all chi-squared tests were <0.001 and are not presented.

National Health and Nutrition Examination Survey (NHANES) data were analyzed to estimate the proportion of adults with confirmed current hepatitis C who reported having ever been told that they had hepatitis C. NHANES is an ongoing, nationally representative interview and examination survey of the U.S. noninstitutionalized population.** As part of the 2015–2016 and 2017–2018 surveys, participants were asked whether they had ever been told that they had hepatitis C and were then tested for hepatitis C during an examination (anti-HCV testing followed by reflex NAT testing for HCV RNA). Participants who answered "No" and had positive test results for HCV RNA were considered to be unaware of their infection. Those who refused to answer were classified as missing. Because the number of HCV RNA-positive NHANES participants during any given survey is small (e.g., 50 during 2015–2016 and 51 during 2017–2018), the two survey cycles were combined to improve stability of the estimates. The proportion of HCV RNA-positive persons aged ≥20 years aware of their infection during 2015–2018 was weighted to account for unequal probability of selection and nonresponse, and 95% Clopper-Pearson exact CIs accounted for the complex survey design. SUDAAN (version 11.0.1; RTI International) was used for the analyses. Stratifying the estimate by selected demographic and socioeconomic characteristics was attempted; however, no stratifications of interest met National Center for Health Statistics data presentation standards because of small cell counts (*13*).

Results

During 2018, a total of 3,621 cases of acute hepatitis C were reported, representing an estimated 50,300 cases (95% CI = 39,800–171,600), after adjusting for underascertainment and underreporting. During 2009–2018, the number of reported acute hepatitis C cases per 100,000 population increased threefold, from 0.3 in 2009 to 1.2 in 2018. During 2018, the highest rate of reported acute hepatitis C cases was in persons aged 20–29 years (3.1 per 100,000), followed by

† Complete CSTE case definitions for confirmed acute hepatitis C for 2011, 2012, and 2016 are available at https://wwwn.cdc.gov/nndss/conditions/hepatitis-c-acute.

§ The 2016 CSTE definition for confirmed chronic hepatitis C is available at https://wwwn.cdc.gov/nndss/conditions/hepatitis-c-chronic/case-definition/2016.

¶ U.S. population estimates were calculated using the Vintage 2018 Bridge-Race Postcensal Population Estimates available at https://www.cdc.gov/nchs/nvss/bridged_race.htm with states excluded as determined by case reporting status of acute hepatitis C.

** https://www.cdc.gov/nchs/nhanes/index.htm.

persons aged 30–39 years (2.6), 40–49 years (1.3), 50–59 years (0.9) and ≥60 years (0.4); the lowest rate (0.1) was in persons aged <20 years (Figure 1). This age pattern was consistent throughout 2009–2018, but the absolute increase in the annual case counts per 100,000 was highest for persons aged 20–39 years; among those aged 20–29 years, rates increased approximately 300%, from 0.7 in 2009 to 3.1 in 2018, and among those aged 30–39 years, rates increased approximately 400%, from 0.5 in 2009 to 2.6 in 2018.

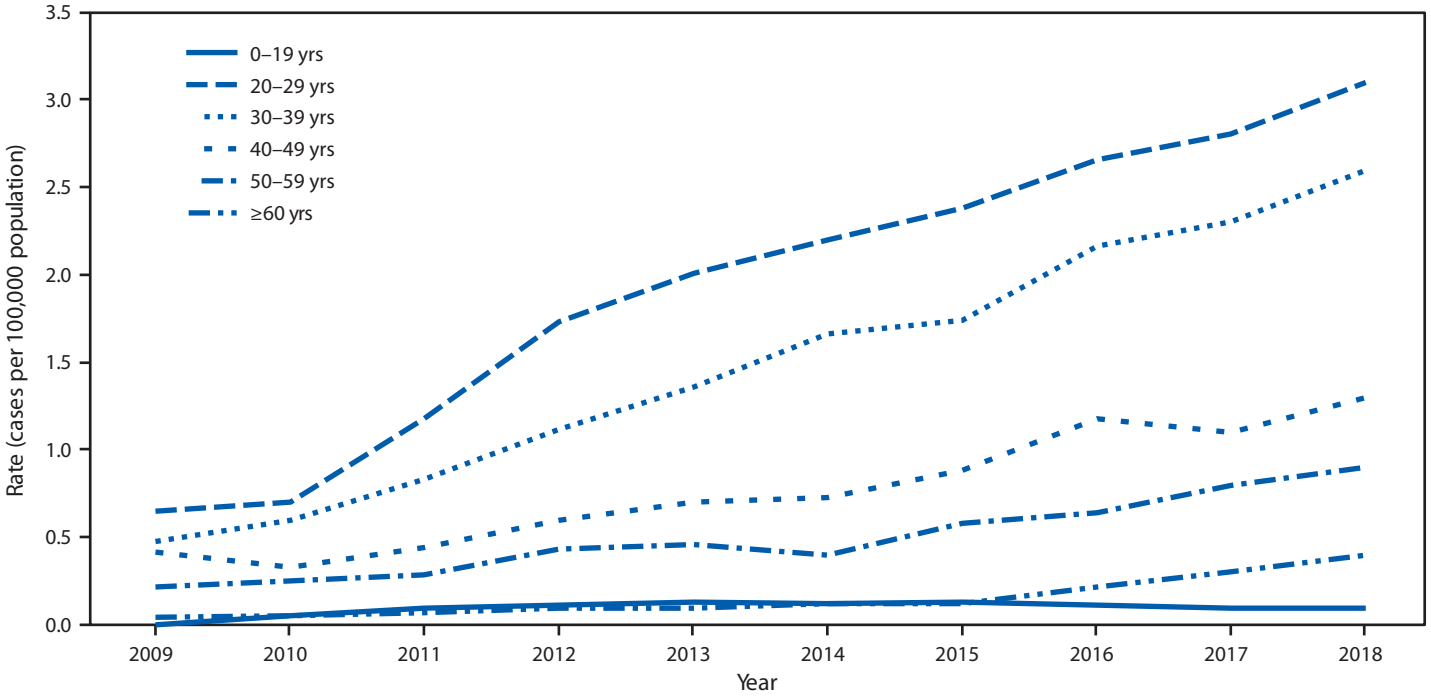
A total of 137,713 new chronic hepatitis C cases were reported during 2018. A larger percentage of these cases were among males (63.1%) than among females (36.9%) (Table). Among both males and females, a bimodal age distribution was observed, with the largest proportion of all newly reported chronic cases among persons aged 20–39 and 50–69 years (Figure 2). Baby boomers accounted for 36.3% of newly reported chronic hepatitis C cases in 2018, persons born during 1966–1980 (Generation X) accounted for 23.1%, and those born during 1981–1996 (millennials) accounted for 36.5%. (Table). Among 2015–2018 NHANES participants aged ≥20 years who were HCV RNA-positive, 60.6% (95% CI = 46.1%–73.9%) reported having been told that they had hepatitis C.

Discussion

Historically, CDC has focused hepatitis C screening efforts among persons born during 1945–1965 and testing among those with identified risk factors regardless of age (*8*,*14*,*15*). Concurrent with the nation's opioid crisis, however, rapid increases in acute HCV infections among young adults, including reproductive-aged persons, have put multiple U.S. generations at risk for chronic HCV infection. In today's issue of *MMWR Recommendations and Reports*, CDC recommends a universal testing strategy for hepatitis C among adults, including pregnant women (*11*).

CDC first began publishing recommendations for hepatitis C screening in 1991, when the U.S. Public Health Service (USPHS) issued guidelines recommending hepatitis C testing of all blood and organ donations intended for human use (*16*). In 1998, CDC expanded the hepatitis C interagency testing guidelines to include a recommendation for testing persons at high risk. These persons were defined as those who had ever injected drugs and shared needles, syringes, or other drug preparation equipment; received clotting factor concentrates produced before 1987; had ever been on

FIGURE 1. Rate* of reported† acute hepatitis C cases,§ by year and age group — National Notifiable Diseases Surveillance System, United States, 2009–2018



* Cases per 100,000 U.S. population.

† The states and jurisdictions reporting cases to CDC through the National Notifiable Diseases Surveillance System might vary by year (https://www.cdc.gov/hepatitis/statistics/2017surveillance/index.htm). During 2018, cases of acute hepatitis C were either not reportable by law, statute, or regulation; not reported; or otherwise unavailable to CDC from Alaska, Arizona, Delaware, District of Columbia, Hawaii, Iowa, Mississippi, and Rhode Island.

§ Only confirmed, acute hepatitis C cases are included. Complete case definitions by year are available at https://wwwn.cdc.gov/nndss/conditions/hepatitis-c-acute/.

TABLE. Newly reported* chronic hepatitis C cases,† by characteristic — National Notifiable Diseases Surveillance System, United States, 2018

Characteristic	No. (%)	Rate§
Total	**137,713 (100.0)**	**54.1**
Sex		
Male	86,670 (63.1)	69.1
Female	50,730 (36.9)	39.2
Age group (yrs)		
0–19	1,302 (0.9)	2.1
20–29	25,353 (18.4)	72.0
30–39	32,223 (23.4)	95.0
40–49	19,707 (14.3)	62.8
50–59	28,385 (20.7)	84.1
60–69	25,360 (18.5)	85.8
≥70	5,104 (3.7)	18.2
Social generation (birth cohort)¶		
Alpha (born after 2012)	176 (0.1)	1.0
Generation Z (born 1997–2012)	3,120 (2.3)	6.1
Millennial (born 1981–1996)	50,160 (36.5)	89.7
Generation X (born 1966–1980)	31,688 (23.1)	66.7
Baby boomers (born 1945–1965)	49,940 (36.3)	79.8
Silent (born 1928–1944)	2,246 (1.6)	—**
Greatest (born 1901–1927)	104 (0.1)	—**

* During 2018, cases of chronic hepatitis C were either not reportable by law, statute, or regulation; not reported; or otherwise unavailable to CDC from Alabama, Arizona, Arkansas, California, Delaware, District of Columbia, Hawaii, Indiana, Kentucky, Mississippi, Nevada, North Carolina, Rhode Island, and Texas.

† Only confirmed, newly diagnosed, chronic hepatitis C cases are included. Complete case definition is available at https://wwwn.cdc.gov/nndss/conditions/hepatitis-c-chronic/case-definition/2016/.

§ Cases per 100,000 population.

¶ In 2018, persons categorized in the Alpha Generation (born since 2012) were aged 0–5 years, Generation Z (born 1997–2012) were aged 6–21 years, millennials (born 1981–1996) were aged 22–37 years, Generation X (born 1966–1980) were aged 38–52 years, baby boomers (born 1945–1965) were aged 53–73 years, the Silent Generation (born 1928–1944) were aged 74–90 years, and the Greatest Generation (born 1901–1927) were aged ≥91 years.

** Rates cannot be calculated because single-year population size for persons aged ≥85 years are not available.

maintenance hemodialysis; had persistently abnormal alanine aminotransferase levels; received blood transfusions or organ transplants before July 1992; had a recognized exposure (e.g., a needlestick or other sharps injury); or were born to a mother infected with HCV (*14*). In 1999, USPHS added persons with human immunodeficiency virus to the groups recommended for testing (*15*). In 2012, because of concern regarding limited effectiveness of risk-based hepatitis C testing and a high prevalence of disease among persons born during 1945–1965, CDC augmented the risk-based testing guidelines with a recommendation for a one-time testing of all baby boomers, even in the absence of a known risk factor (*8*).

Ecologic evidence reveals that CDC's 2012 recommendation to screen all baby boomers for HCV infection resulted in increased testing among that birth cohort (*17*). However, existing testing strategies have had limited success because >39% of all adults with HCV infection still report being unaware that they are infected. Further, the increase in new

Summary

What is already known about this topic?

Acute hepatitis C infection is often asymptomatic, but >50% of cases will progress to chronic infection, which can be life-threatening. Hepatitis C can be diagnosed with a blood test and is curable.

What is added by this report?

The annual rate of reported acute hepatitis C tripled from 2009 to 2018 and was highest among persons aged 20–39 years. In 2018, the largest proportion of chronic hepatitis C cases occurred among persons aged 20–39 years and 50–69 years. Only 61% of adults with hepatitis C knew that they were infected.

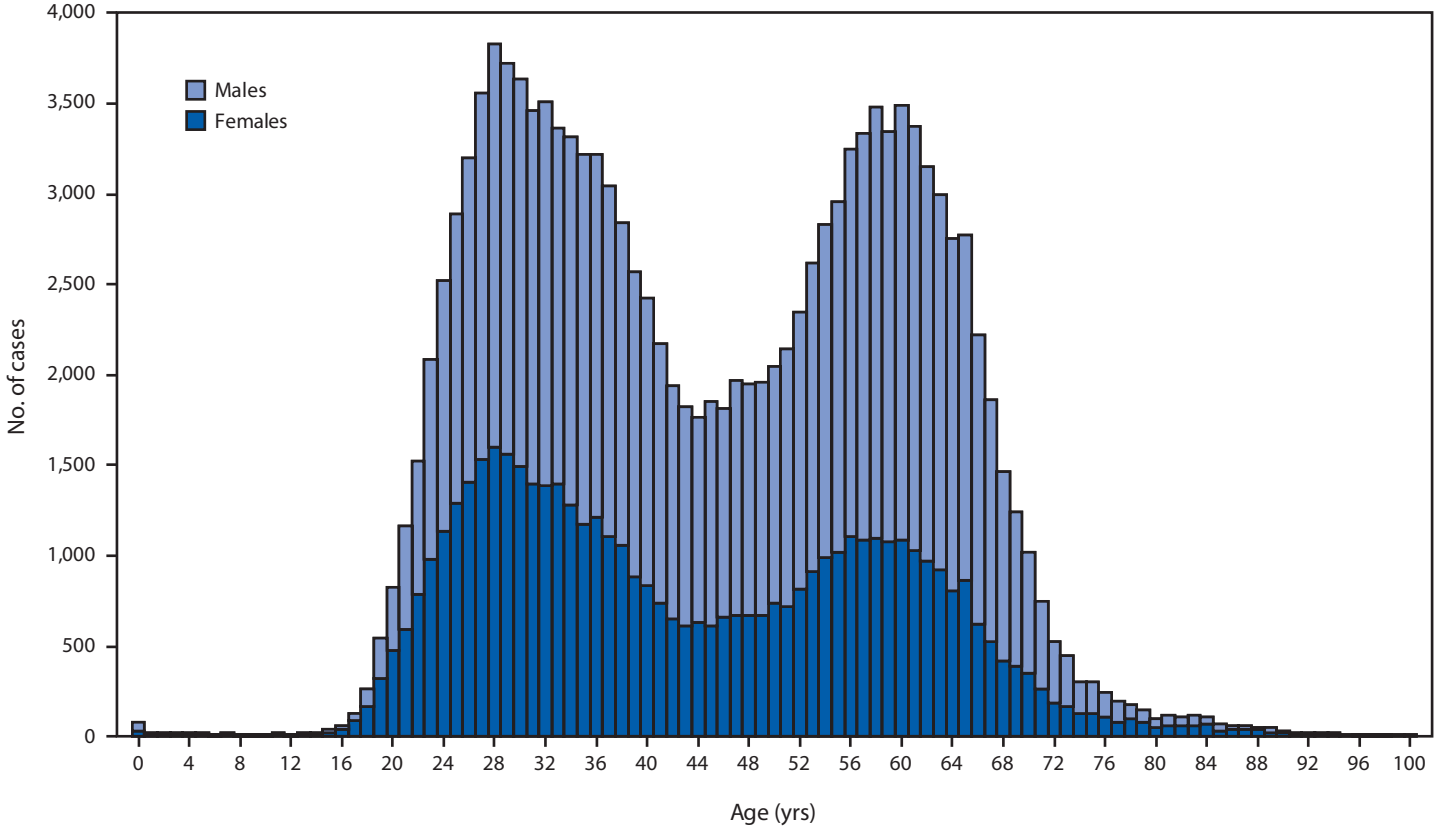
What are the implications for public health practice?

All adults and pregnant women should be screened for hepatitis C according to CDC's new screening recommendations.

acute and newly reported chronic infections among young adults further supports the need for expanded and easier-to-implement hepatitis C testing recommendations. The new CDC recommendations released today include screening of all adults aged ≥18 years once in their lifetime and screening of all pregnant women during each pregnancy (*11*). They also include an exception for settings where the prevalence of HCV infection is <0.1%; however, there are few known settings with a hepatitis C prevalence below that threshold (*18*,*19*). The recommendation for testing of persons with risk factors remains in effect, regardless of age or setting prevalence, including continued periodic testing of persons with ongoing risk. The U.S. Preventive Services Task Force (USPSTF) recently published a recommendation statement on screening for hepatitis C virus infection in all adults aged 18–79 years (B recommendation) (*20*). The USPSTF recommendation differs from CDC's recommendation in that 1) an upper age limit is defined, 2) there is no recommendation for screening during every pregnancy, 3) and a prevalence threshold at which universal screening would remain cost-effective is not identified.

The findings in this report are subject to at least three limitations. First, the number of cases of acute and chronic hepatitis C reported to CDC underestimate the actual incidence of disease, and not all states reported chronic infections to CDC in 2018. For every reported case of acute hepatitis C, CDC estimates that there are 13.9 actual cases (*9*,*12*); however, this estimation methodology is imprecise and might be influenced by testing rates. Second, minor changes to the CSTE case definition, changes to the reporting practices across jurisdictions, and changes to hepatitis C testing practices among providers during 2009–2018 should be considered when examining acute hepatitis C cases temporally. Finally, because NHANES sampling is limited to the noninstitutionalized, civilian population, survey results related to hepatitis C might not be

FIGURE 2. Number of newly reported* chronic hepatitis C cases,† by sex and age — National Notifiable Diseases Surveillance System, United States, 2018



* During 2018, cases of chronic hepatitis C were either not reportable by law, statute, or regulation; not reported; or otherwise unavailable to CDC from Alabama, Arizona, Arkansas, California, Delaware, District of Columbia, Hawaii, Indiana, Kentucky, Mississippi, Nevada, North Carolina, Rhode Island, and Texas.
† Only confirmed, newly diagnosed, chronic hepatitis C cases with information regarding both sex and age are included. Complete case definition is available at https://wwwn.cdc.gov/nndss/conditions/hepatitis-c-chronic/case-definition/2016/.

nationally representative because they do not include some populations at highest risk for hepatitis C (e.g., incarcerated persons).

These findings highlight the need for immediate implementation of the new CDC universal hepatitis C screening recommendations for all adults and pregnant women (*11*). Following a decade of sharp increases in acute hepatitis C infections, particularly among young adults, the rates of newly reported chronic infections among baby boomers and millennials are now equal, demonstrating that even younger generations are at risk. Diagnosing HCV infection is a necessary first step to linking persons to cure to prevent life-threatening consequences of long-term chronic infections and transmission to others.

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Update to U.S. Medical Eligibility Criteria for Contraceptive Use, 2016: Updated Recommendations for the Use of Contraception Among Women at High Risk for HIV Infection

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"U.S. Medical Eligibility Criteria for Contraceptive Use" (U.S. MEC) 2016 provides evidence-based guidance for the safe use of contraceptive methods among U.S. women with certain characteristics or medical conditions (*1*). The U.S. MEC is adapted from global guidance from the World Health Organization (WHO) and kept up to date through continual review of published literature (*1*). CDC recently evaluated the evidence and the updated WHO guidance on the risk for human immunodeficiency virus (HIV) acquisition among women using hormonal contraception and intrauterine devices (IUDs) (*2*). After careful review, CDC adopted WHO's 2019 updated guidance for inclusion in the U.S. MEC guidance; CDC's updated guidance states that progestin-only injectable contraception (including depot medroxyprogesterone acetate [DMPA]) and IUDs (including levonorgestrel-releasing and copper-bearing) are safe for use without restriction among women at high risk for HIV infection (U.S. MEC category 1 [previously U.S. MEC category 2, advantages outweigh risks]) (Box). CDC's guidance also adds an accompanying clarification for women who wish to use IUDs, which states "Many women at a high risk for HIV infection are also at risk for other sexually transmitted diseases (STDs). For these women, refer to the recommendations in the 'U.S. Medical Eligibility Criteria for Contraceptive Use' for women with other factors related to STDs, and the 'U.S. Selected Practice Recommendations for Contraceptive Use' on STD screening before IUD insertion" (*1*,*3*). Recommendations for other hormonal contraceptive methods (including combined hormonal methods, implants, and progestin-only pills) remain the same; there is also no restriction for their use among women at high risk for HIV infection (U.S. MEC category 1). Finally, CDC clarified that the U.S. MEC recommendations for concurrent use of hormonal contraceptives or IUDs and antiretroviral use for treatment of HIV infection also apply to use of antiretrovirals for prevention of HIV acquisition (preexposure prophylaxis [PrEP]).

BOX. Categories for classifying contraceptives

1 = A condition for which there is no restriction for the use of the contraceptive method.
2 = A condition for which the advantages of using the method generally outweigh the theoretical or proven risks.
3 = A condition for which the theoretical or proven risks usually outweigh the advantages of using the method.
4 = A condition that represents an unacceptable health risk if the contraceptive method is used.

Background

Although the rate of unintended pregnancy is decreasing in the United States, it remains high, with nearly half of pregnancies unintended (*4*). Increasing access to and promoting correct and consistent use of contraception is a priority strategy to reduce unintended pregnancies. HIV infection continues to be a major public health issue in the United States, with approximately 80% of new infections among women attributed to heterosexual contact (*5*). HIV infection is associated with adverse pregnancy outcomes for both the mother and child, including increased morbidity during pregnancy and perinatal HIV transmission (*6*). Therefore, prevention of both unintended pregnancy and HIV acquisition is critical among women at high risk for HIV infection.

Evidence on the potential association between contraceptive use and risk for HIV acquisition among women at high risk for HIV infection has been closely monitored by CDC and WHO. In July 2019, WHO held a consultation with external experts and stakeholders during which new evidence was reviewed. Following this consultation, WHO's Guideline Development Group updated its recommendations to state that use of progestin-only injectable contraception, including DMPA, is MEC category 1 (safe for use without restriction) (*2*). In addition, WHO's updated recommendations state that IUDs (both levonorgestrel-releasing and copper-bearing) are MEC category 1 with an accompanying clarification that women at high risk for HIV infection are also at risk for other STDs, and providers should refer to additional recommendations on IUD use for women at increased risk for STDs. Because of newly published studies and the WHO update, CDC initiated a process to assess whether its guidance should be updated for the U.S. context.

Methods

CDC considered several factors and opinions in determining whether to update its guidance. First, CDC used two systematic reviews that were conducted preceding the 2019 WHO consultation: 1) an updated systematic review on hormonal contraception and risk for HIV infection to include new evidence since the last review (*7*), containing a total of 36 studies, 17 of which met minimum quality criteria defined in the review (*8*), and 2) a systematic review on copper IUD use and risk for HIV acquisition, containing seven studies, three of which met minimum quality criteria (*9*). The systematic reviews included primary reports of longitudinal studies (randomized clinical trials or observational studies) identified in PubMed or Embase databases through June 2019. Studies that met inclusion criteria compared incident HIV infection among women using hormonal contraception (injectables, oral contraceptives, implants, patches, rings, or hormonal intrauterine devices) or IUDs (copper or unspecified type) versus women using either 1) a nonhormonal method or no contraception or 2) a specific hormonal method of contraception. In these reviews, study quality was evaluated using a framework developed for a previous review on this topic (*7*) and updated to include quality criteria for randomized clinical trials.

In addition to the systematic reviews on contraception and risk for HIV acquisition, CDC considered the information on biologic mechanisms for HIV acquisition that was presented at the WHO consultation (*2*). CDC also reviewed existing reports on the epidemiology of unintended pregnancy, contraceptive use, maternal morbidity and mortality, and HIV infection in the United States as compared with the global context.

CDC also invited eight experts from outside the agency and one expert from within the agency to serve as ad hoc reviewers of the evidence and updated WHO recommendations. The reviewers were selected based on their expertise in HIV infection, family planning, or the intersection of these topics. The reviewers joined a teleconference with CDC staff members in September 2019 during which CDC staff members presented 1) the evidence; 2) the process and outcome of the updated WHO recommendations; and 3) the epidemiology of unintended pregnancy, contraceptive use, maternal morbidity and mortality, and HIV infection in the United States. The participants provided their individual input about 1) whether there has been a substantial evolution in the evidence regarding hormonal contraception or IUD use and HIV acquisition, 2) how the updated evidence might influence clinical practice in the United States, and 3) how the updated WHO recommendations might translate to clinical practice in the United States. Participants were not asked to develop recommendations or a consensus opinion. In addition, because PrEP is a key strategy in preventing HIV among women at high risk for HIV infection, CDC also considered whether the current U.S. MEC recommendations for concurrent use of hormonal contraceptives or IUDs and antiretroviral drugs for treatment of HIV also apply to use of antiretrovirals for PrEP.

After the teleconference, CDC developed the recommendations described in this report. CDC took into consideration the evidence, the updated WHO recommendations, and the individual perspectives provided by the expert reviewers.

Rationale and Evidence

The primary source of new evidence was the Evidence for Contraceptive Options and HIV Outcomes (ECHO) trial, a large randomized clinical trial conducted in Eswatini, Kenya, South Africa, and Zambia that compared HIV acquisition among approximately 7,800 women using DMPA, levonorgestrel implants, or copper IUDs (*10*). No statistically significant differences in HIV acquisition were found among the three groups. This was deemed a high-quality study because of its large size, robust randomization and allocation procedures, high follow-up rates, high continuation of allocated contraceptive method, and comprehensive analysis (*2*). The design of the ECHO trial minimized the potential for confounding by sexual behavior and other factors that had limited the interpretation of previous observational studies.

Among the observational evidence examining the association between progestin-only injectables and risk for HIV acquisition, results were inconsistent across studies and limited by methodologic concerns (*8*). Limited evidence on other progestin-only contraceptives, combined hormonal contraceptives, and copper IUDs did not suggest increased risk for HIV acquisition, compared with other hormonal or nonhormonal contraceptives or no method (*8*,*9*).

Animal and laboratory data suggest possible biologic mechanisms for an association between hormonal contraceptive use and increased risk for HIV acquisition, including hormonally mediated changes in the vaginal epithelium and alterations in local and systemic immune responses. However, the relevance of these observations to clinical outcomes in women is unclear (*2*).

Although the rate of unintended pregnancy is declining, 45% of pregnancies in the United States were unintended in 2011, with higher percentages among women aged 15–19 years (75%) and black women (64%) (*4*). Contraceptive use and method distribution in the United States differs by certain characteristics, including age, race/ethnicity, and level of education (*11*). Although low overall, pregnancy-related mortality in the United States also differs significantly by race, with approximately a threefold higher risk among black compared with white women (*12*). In 2018, an estimated 7,100 newly diagnosed HIV infections occurred among U.S. women, with higher rates among racial/ethnic minorities (*5*). Although HIV prevalence is lower

in the United States than in many areas globally (*13*), the risk for infection is higher among subgroups of women who have characteristics associated with nonuse of contraception, unintended pregnancy, and pregnancy-related complications (*5*).

PrEP is an important HIV prevention measure that is underutilized among women (*14*). Currently, daily oral PrEP with the fixed-dose combination of 300 mg of tenofovir disoproxil fumarate (TDF) and 200 mg of emtricitabine (FTC) has been shown to be safe and effective in reducing the risk for sexual HIV acquisition in adults and adolescents weighing at least 77 lbs (35 kg).* PrEP is recommended for HIV prevention for sexually active men and women reporting sexual behaviors that put them at substantial ongoing risk for HIV exposure and acquisition, and for men and women who inject drugs and report injection practices that put them at substantial ongoing risk for HIV exposure and acquisition (*15*). The U.S. MEC includes recommendations for safety and effectiveness of concurrent use of hormonal contraception or IUDs and antiretroviral drugs, based on a systematic review of the evidence on the potential for drug interactions between antiretroviral drugs and hormonal contraception (*1*,*16*). Studies of women who concurrently use PrEP and hormonal contraception have not demonstrated evidence of drug interactions (*16*).

Recommendations for the Use of Hormonal Contraceptives and IUDs in Women at High Risk for HIV

CDC adopted the updated 2019 WHO guidance, which included changes to the recommendations for DMPA and IUDs. CDC's updated recommendations are that all hormonal contraceptives (including implants, DMPA, progestin-only pills, and combined hormonal contraceptives) and IUDs (including levonorgestrel-releasing and copper-bearing) can be used without restriction among women at high risk for HIV infection (U.S. MEC category 1) (Table 1). For women using IUDs, a clarification to CDC's updated recommendation states "Many women at a high risk for HIV are also at risk for STDs. For these women, refer to the recommendations in the 'U.S. Medical Eligibility Criteria for Contraceptive Use' for women with other factors related to STDs, and the 'U.S. Selected Practice Recommendations for Contraceptive Use' on STD screening before IUD insertion."† CDC also clarified that recommendations for use of hormonal contraceptives and IUDs among women using antiretroviral therapy apply to antiretroviral drug use for prevention (PrEP) or treatment of HIV (Table 2). These updated recommendations for the use of contraception among women at high risk for HIV infection assume that no other conditions are present; providers should consult the U.S. MEC to assess eligibility related to other medical conditions or characteristics (*1*).

Discussion

CDC adopted WHO's guidance for inclusion in the U.S. MEC based on new, high-quality evidence that found the risk for HIV acquisition is similar across hormonal contraceptive methods and IUDs. Although the ECHO trial did not assess risk for HIV acquisition among nonusers, the trial addressed the relevant clinical question of differences in risk for HIV infection among contraceptive methods used by women desiring effective contraception. Women at high risk for HIV infection are eligible to use all hormonal contraceptive methods and IUDs without restriction. Although the context in the United States differs from the context globally in a number of ways (e.g., different contraceptive method mix, greater access to a range of contraceptive methods, lower risk for maternal morbidity and mortality, and generally lower HIV incidence), issues related to possible risks and the need for counseling are relevant across settings.

To avoid unintended pregnancy, access to the full range of safe and effective Food and Drug Administration–approved contraceptive methods is essential for all women, including those at high risk for HIV infection. Some additional considerations exist for use of barrier methods (*1*). Correct and consistent use of condoms can reduce the risk for pregnancy and acquisition of STDs, including HIV. No drug interactions between antiretroviral therapy and barrier methods are known. However, for spermicides and diaphragms (with spermicide), high risk for HIV is classified as category 4 (unacceptable health risk) because repeated and high-dose use of the spermicide nonoxynol-9 is associated with increased risk for genital lesions, which might increase the risk for HIV infection.

The rate of HIV acquisition in the ECHO trial was high overall (3.81 per 100 woman-years), despite participants receiving comprehensive HIV prevention services (*10*). HIV infection prevention measures should be strongly encouraged among all women at risk for HIV acquisition, including PrEP and postexposure prophylaxis, limiting numbers of sexual partners, and correct and consistent use of condoms.§ Family planning providers are in a unique position to offer HIV prevention services to women at high risk for HIV infection. Although STD (including HIV) counseling and screening services are not required for safe initiation of contraception

* https://www.cdc.gov/hiv/guidelines/preventing.html.

† For women with other factors related to STDs, the benefits of IUD use outweigh the risks (U.S. MEC Category 2). If a woman has not been screened for STDs according to STD screening guidelines, screening can be performed at the time of insertion and insertion should not be delayed.

§ https://www.cdc.gov/hiv/basics/prevention.html.

TABLE 1. Updated recommendations for contraceptive use by women who are at high risk for human immunodeficiency virus (HIV) infection

Condition	Category								Clarifications/Evidence
	Cu-IUD		LNG-IUD						
	I	C	I	C	Implants	DMPA	POP	CHCs	
High risk for HIV	1	1	1	1	1	1	1	1	**Clarification (IUDs):** Many women at high risk for HIV are also at risk for other STDs. For these women, refer to the recommendations in the "U.S. Medical Eligibility Criteria for Contraceptive Use" for women with other factors related to STDs and the "U.S. Selected Practice Recommendations for Contraceptive Use" on STD screening before IUD insertion.*,†
									Evidence (IUDs): High-quality evidence from one randomized clinical trial, along with low-quality evidence from two observational studies, suggested no increased risk for HIV acquisition with Cu-IUD use.§ No studies were identified for LNG-IUDs.¶
									Evidence (implants, DMPA, POP): High-quality evidence from one randomized clinical trial observed no statistically significant differences in HIV acquisition between DMPA-IM versus Cu-IUD, DMPA-IM versus LNG implant, and Cu-IUD versus LNG implant.¶,** Of the low-to-moderate-quality evidence from 14 observational studies, some studies suggested a possible increased risk for HIV with progestin-only injectable use, which was most likely due to unmeasured confounding.¶ Low-quality evidence from 3 observational studies did not suggest an increased HIV risk for implant users.¶ No studies of sufficient quality were identified for POPs.¶
									Evidence (CHCs): Low-to-moderate-quality evidence from 11 observational studies suggested no association between COC use (it was assumed that studies that did not specify oral contraceptive type examined mostly, if not exclusively, COC use) and HIV acquisition.¶ No studies of patch, ring, or combined injectable contraception were identified.¶

Abbreviations: C = continuation; CHC = combined hormonal contraceptive; COC = combined oral contraceptive; Cu = copper; DMPA = depot medroxyprogesterone acetate; I = initiation; IM = intramuscular; IUD = intrauterine device; LNG = levonorgestrel; POP = progestin-only pill; STD = sexually transmitted disease.

* Curtis KM, Tepper NK, Jatlaoui TC, Berry-Bibee E, Horton LG, Zapata LB, et al. U.S. medical eligibility criteria for contraceptive use, 2016. MMWR Recomm Rep 2016;65(No. RR-3).

† Curtis KM, Jatlaoui TC, Tepper NK, et al. U.S. selected practice recommendations for contraceptive use, 2016. MMWR Recomm Rep 2016;65(No. RR-4).

§ Hannaford PC, Ti A, Chipato T, Curtis KM. Copper intrauterine device use and HIV acquisition in women: a systematic review. BMJ Sex Reprod Health 2020;46:17–25.

¶ Curtis KM, Hannaford PC, Rodriguez MI, Chipato T, Steyn PS, Kiarie JN. Hormonal contraception and HIV acquisition among women: an updated systematic review. BMJ Sex Reprod Health 2020;46:8–16.

** Evidence for Contraceptive Options and HIV Outcomes (ECHO) Trial Consortium. HIV incidence among women using intramuscular depot medroxyprogesterone acetate, a copper intrauterine device, or a levonorgestrel implant for contraception: a randomized, multicentre, open-label trial. Lancet 2019;394:303–13.

(*3*), they are a core component of providing family planning and should be offered in accordance with CDC's guidelines on STD treatment and HIV testing (*17*,*18*). Further integration of HIV prevention services, including PrEP, into family planning services could substantially increase access to these prevention measures for women at risk for HIV acquisition (*19*).

Acknowledgments

Invited Expert Reviewers: Sharon Achilles, MD, University of Pittsburgh, Pittsburgh, Pennsylvania; Jean Anderson, MD, Johns Hopkins University, Baltimore, Maryland; Alison Edelman, MD, Oregon Health & Science University, Portland, Oregon; Diane Foley, MD, U.S. Department of Health and Human Services, Rockville, Maryland; June Gupta, MSN, Planned Parenthood Federation of America, New York, New York; Lisa Haddad, MD, Emory School of Medicine, Atlanta, Georgia; Karen Hoover, MD, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC, Atlanta, GA; Roxanne Jamshidi, MD, American College of Obstetricians and Gynecologists and George Washington University School of Medicine and Health Sciences, Washington, D.C.; Herbert Peterson, MD, University of North Carolina, Chapel Hill, North Carolina.

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Competing Interests for Expert Reviewers and Expert Review Teleconference Attendees: Jean Anderson serves on the CDC/Health Resources and Services Administration (HRSA) Advisory Committee on HIV, hepatitis and STIs, the American College of Obstetricians and Gynecologists HIV Working Group, and the U.S. Preventive Services Task Force Perinatal Guidelines Panel, receives funding from HRSA for HIV programs and the National Cancer Institute, and her spouse owns Gilead stock; Roxanne Jamshidi is a Nexplanon trainer for Merck.

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TABLE 2. Updated recommendations for contraceptive use by women who are using antiretrovirals*

Condition	Category								Clarifications/Evidence/Comments
	Cu-IUD		LNG-IUD		Implants	DMPA	POP	CHCs	
Antiretrovirals used for prevention (PrEP) or treatment of HIV	I	C	I	C					**Clarification (IUDs):** No known interaction exists between ARVs and IUDs. However, for women with HIV infection, IUD insertion is classified as category 2 if the woman is not clinically well or not receiving ARV therapy. Otherwise, both insertion and continuation are classified as category 1 (see HIV Infection section). For women at high risk for HIV, IUDs are category 1 for initiation and continuation (see High risk for HIV section). **Comment:** These recommendations generally are for ARV agents used alone. However, most women receiving ARVs are using multiple drugs in combination. In general, whether interactions between ARVs and hormonal contraceptives differ when ARVs are given alone or in combination is unknown.
a. Nucleoside reverse transcriptase inhibitors (NRTIs)									**Evidence:** NRTIs do not appear to have significant risk for interactions with hormonal contraceptive methods.†
i. Tenofovir (TDF) (Used for prevention [PrEP] or treatment)	1/2	1	1/2	1	1	1	1	1	
ii. Emtricitabine (FTC) (Used for prevention [PrEP] or treatment)	1/2	1	1/2	1	1	1	1	1	
iii. Zidovudine (AZT)	1/2	1	1/2	1	1	1	1	1	
iv. Lamivudine (3TC)	1/2	1	1/2	1	1	1	1	1	
v. Didanosine (DDI)	1/2	1	1/2	1	1	1	1	1	
vi. Abacavir (ABC)	1/2	1	1/2	1	1	1	1	1	
vii. Stavudine (D4T)	1/2	1	1/2	1	1	1	1	1	

Abbreviations: ARV = antiretroviral; C = continuation; CHC = combined hormonal contraceptive; COC = combined oral contraceptive; Cu = copper; DMPA = depot medroxyprogesterone acetate; HIV = human immunodeficiency virus; I = initiation; IUD = intrauterine device; LNG = levonorgestrel; POP = progestin-only pill; PrEP = preexposure prophylaxis.

* See full "U.S. Medical Eligibility Criteria for Contraceptive Use" for complete list of recommendations for all ARVs. No drug interactions between antiretroviral therapy and barrier methods are known. However, for spermicides and diaphragms (with spermicide), high risk for HIV is classified as category 4 because repeated and high-dose use of the spermicide nonoxynol-9 is associated with increased risk for genital lesions, which might increase the risk for HIV infection.

† Nanda K, Stuart GS, Robinson J, Gray AL, Tepper NK, Gaffield ME. Drug interactions between hormonal contraceptives and antiretrovirals. AIDS 2017;31:917–52.

Summary

What is already known about this topic?

Prevention of both unintended pregnancy and human immunodeficiency virus (HIV) acquisition is critical among women at high risk for HIV infection.

What is added by this report?

CDC updated recommendations in the "U.S. Medical Eligibility Criteria for Contraceptive Use" to state that progestin-only injectable contraception (including depot medroxyprogesterone acetate) and intrauterine devices (including levonorgestrel-releasing and copper-bearing) are safe for use without restriction among women at high risk for HIV infection.

What are the implications for public health practice?

Women at high risk for HIV are eligible to use all hormonal contraceptive methods and intrauterine devices. Recommended HIV infection prevention measures, including preexposure and postexposure prophylaxis, limiting number of sexual partners, and correct and consistent use of condoms, should be strongly encouraged among all women at high risk for HIV acquisition and should be integrated into family planning services.

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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Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020

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Presymptomatic transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), might pose challenges for disease control. The first case of COVID-19 in Singapore was detected on January 23, 2020, and by March 16, a total of 243 cases had been confirmed, including 157 locally acquired cases. Clinical and epidemiologic findings of all COVID-19 cases in Singapore through March 16 were reviewed to determine whether presymptomatic transmission might have occurred. Presymptomatic transmission was defined as the transmission of SARS-CoV-2 from an infected person (source patient) to a secondary patient before the source patient developed symptoms, as ascertained by exposure and symptom onset dates, with no evidence that the secondary patient had been exposed to anyone else with COVID-19. Seven COVID-19 epidemiologic clusters in which presymptomatic transmission likely occurred were identified, and 10 such cases within these clusters accounted for 6.4% of the 157 locally acquired cases. In the four clusters for which the date of exposure could be determined, presymptomatic transmission occurred 1–3 days before symptom onset in the presymptomatic source patient. To account for the possibility of presymptomatic transmission, officials developing contact tracing protocols should strongly consider including a period before symptom onset. Evidence of presymptomatic transmission of SARS-CoV-2 underscores the critical role social distancing, including avoidance of congregate settings, plays in controlling the COVID-19 pandemic.

Early detection and isolation of symptomatic COVID-19 patients and tracing of close contacts is an important disease containment strategy; however, the existence of presymptomatic or asymptomatic transmission would present difficult challenges to contact tracing. Such transmission modes have not been definitively documented for COVID-19, although cases of presymptomatic and asymptomatic transmissions have been reported in China (*1*,*2*) and possibly occurred in a nursing facility in King County, Washington (*3*). Examination of serial intervals (i.e., the number of days between symptom onsets in a primary case and a secondary case) in China suggested that 12.6% of transmission was presymptomatic (*2*). COVID-19 cases in Singapore were reviewed to determine whether presymptomatic transmission occurred among COVID-19 clusters.

The surveillance and case detection methods employed in Singapore have been described (*4*). Briefly, all medical practitioners were required by law to notify Singapore's Ministry of Health of suspected and confirmed cases of COVID-19. The definition of a suspected case was based on the presence of respiratory symptoms and an exposure history. Suspected cases were tested, and a confirmed case was defined as a positive test for SARS-CoV-2, using laboratory-based polymerase chain reaction or serologic assays (*5*). All cases in this report were confirmed by polymerase chain reaction only. Asymptomatic persons were not routinely tested, but such testing was performed for persons in groups considered to be at especially high risk for infection, such as evacuees on flights from Wuhan, China (*6*), or families that experienced high attack rates.

Patients with confirmed COVID-19 were interviewed to obtain information about their clinical symptoms and activity history during the 2 weeks preceding symptom onset to ascertain possible sources of infection. Contact tracing examined the time from symptom onset until the time the patient was successfully isolated to identify contacts who had interactions with the patient. All contacts were monitored daily for their health status, and those who developed symptoms were tested as part of active case finding.

Clinical and epidemiologic data for all 243 reported COVID-19 cases in Singapore during January 23–March 16 were reviewed. Clinical histories were examined to identify symptoms before, during, and after the first positive SARS-CoV-2 test.

Records of cases that were epidemiologically linked (clusters) were reviewed to identify instances of likely presymptomatic transmission. Such clusters had clear contact between a source patient and a patient infected by the source (a secondary patient), had no other likely explanations for infection, and had the source patient's date of symptom onset occurring after the date of exposure to the secondary patient who was subsequently infected. Symptoms considered in the review included respiratory, gastrointestinal (e.g., diarrhea), and constitutional symptoms. In addition, the source patient's exposure had to be strongly attributed epidemiologically to transmission from another source. This reduced the likelihood that an unknown source was involved in the cases in the cluster.

Summary

What is already known about this topic?

Preliminary evidence indicates the occurrence of presymptomatic transmission of SARS-CoV-2, based on reports of individual cases in China.

What is added by this report?

Investigation of all 243 cases of COVID-19 reported in Singapore during January 23–March 16 identified seven clusters of cases in which presymptomatic transmission is the most likely explanation for the occurrence of secondary cases.

What are the implications for public health practice?

The possibility of presymptomatic transmission increases the challenges of containment measures. Public health officials conducting contact tracing should strongly consider including a period before symptom onset to account for the possibility of presymptomatic transmission. The potential for presymptomatic transmission underscores the importance of social distancing, including the avoidance of congregate settings, to reduce COVID-19 spread.

Seven Clusters of COVID-19 Cases Suggesting Presymptomatic Transmission

Investigation of COVID-19 cases in Singapore identified seven clusters (clusters A–G) in which presymptomatic transmission likely occurred. These clusters occurred during January 19–March 12, and involved from two to five patients each (Figure). Ten of the cases within these clusters were attributed to presymptomatic transmission and accounted for 6.4% of the 157 locally acquired cases reported as of March 16.

Cluster A. A woman aged 55 years (patient A1) and a man aged 56 years (patient A2) were tourists from Wuhan, China, who arrived in Singapore on January 19. They visited a local church the same day and had symptom onset on January 22 (patient A1) and January 24 (patient A2). Three other persons, a man aged 53 years (patient A3), a woman aged 39 years (patient A4), and a woman aged 52 years (patient A5) attended the same church that day and subsequently developed symptoms on January 23, January 30, and February 3, respectively. Patient A5 occupied the same seat in the church that patients A1 and A2 had occupied earlier that day (captured by closed-circuit camera) (*5*). Investigations of other attendees did not reveal any other symptomatic persons who attended the church that day.

Cluster B. A woman aged 54 years (patient B1) attended a dinner event on February 15 where she was exposed to a patient with confirmed COVID-19. On February 24, patient B1 and a woman aged 63 years (patient B2) attended the same singing class. Two days later (February 26), patient B1 developed symptoms; patient B2 developed symptoms on February 29.

Cluster C. A woman aged 53 years (patient C1) was exposed to a patient with confirmed COVID-19 on February 26 and likely passed the infection to her husband, aged 59 years (patient C2) during her presymptomatic period; both patients developed symptoms on March 5.

Cluster D. A man aged 37 years (patient D1) traveled to the Philippines during February 23–March 2, where he was in contact with a patient with pneumonia who later died. Patient D1 likely transmitted the infection to his wife (patient D2), aged 35 years, during his presymptomatic period. Both patients developed symptoms on March 8.

Cluster E. A man aged 32 years (patient E1) traveled to Japan during February 29–March 8, where he was likely infected, and subsequently transmitted the infection to his housemate, a woman aged 27 years (patient E2), before he developed symptoms. Both developed symptoms on March 11.

Cluster F. A woman aged 58 years (patient F1) attended a singing class on February 27, where she was exposed to a patient with confirmed COVID-19. She attended a church service on March 1, where she likely infected a woman aged 26 years (patient F2) and a man aged 29 years (patient F3), both of whom sat one row behind her. Patient F1 developed symptoms on March 3, and patients F2 and F3 developed symptoms on March 3 and March 5, respectively.

Cluster G. A man aged 63 years (patient G1) traveled to Indonesia during March 3–7. He met a woman aged 36 years (patient G2) on March 8 and likely transmitted SARS-CoV-2 to her; he developed symptoms on March 9, and patient G2 developed symptoms on March 12.

Investigation of these clusters did not identify other patients who could have transmitted COVID-19 to the persons infected. In four clusters (A, B, F, and G), presymptomatic transmission exposure occurred 1–3 days before the source patient developed symptoms. For the remaining three clusters (C, D, and E), the exact timing of transmission exposure could not be ascertained because the persons lived together, and exposure was continual.

Discussion

This investigation identified seven clusters of COVID-19 in Singapore in which presymptomatic transmission likely occurred. Among the 243 cases of COVID-19 reported in Singapore as of March 16, 157 were locally acquired; 10 of the 157 (6.4%) locally acquired cases are included in these clusters and were attributed to presymptomatic transmission. These findings are supported by other studies that suggest that presymptomatic transmission of COVID-19 can occur (*1*–*3*). An examination of transmission events among cases in Chinese patients outside of Hubei province, China, suggested that

FIGURE. Seven COVID-19 clusters with evidence of likely presymptomatic SARS-CoV-2 transmission from source patients to secondary patients — Singapore, January 19–March 12, 2020

Cluster A	Dates of likely transmission, symptom onset, and other exposure																	Symptoms
	Jan													Feb				
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	
Patient A1 ★																		Fever
Patient A2 ★																		Fever
Patient A3																		Fever
Patient A4																		Fever, cough
Patient A5																		Fever, sore throat

Cluster B	Dates of likely transmission, symptom onset, and other exposure															Symptoms
	Feb															
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Patient B1 ★																Cough, headache, myalgia
Patient B2																Fever, cough, headache, myalgia

Cluster C	Dates of likely transmission, symptom onset, and other exposure									Symptoms
	Feb				Mar					
	26	27	28	29	1	2	3	4	5	
Patient C1 ★										Itchy throat, chills
Patient C2										Cough

Cluster D	Dates of likely transmission, symptom onset, and other exposure															Symptoms
	Feb							Mar								
	23	24	25	26	27	28	29	1	2	3	4	5	6	7	8	
Patient D1 ★																Cough, blocked nose
Patient D2																Fever, sore throat, sneezing

★ **Source patient**

Other exposure (clusters B, C and F: known COVID-19 case; cluster A: unknown exposure in Wuhan, China; cluster D: patient in Philippines with pneumonia; cluster E: unknown exposure in Japan; cluster G: unknown exposure in Indonesia)

Likely period of transmission from source patient to secondary patients

Symptom onset date

FIGURE. (*Continued*) Seven COVID-19 clusters with evidence of likely presymptomatic SARS-CoV-2 transmission from source patients to secondary patients — Singapore, January 19–March 12, 2020

Cluster E	Dates of likely transmission, symptom onset, and other exposure												Symptoms
	Feb	Mar											
	29	1	2	3	4	5	6	7	8	9	10	11	
Patient E1 ★													Fever
Patient E2													Cough

Cluster F	Dates of likely transmission, symptom onset, and other exposure								Symptoms
	Feb			Mar					
	27	28	29	1	2	3	4	5	
Patient F1 ★									Sore throat, blocked nose
Patient F2									Cough
Patient F3									Cough, runny nose, sore throat, myalgia

Cluster G	Dates of likely transmission, symptom onset, and other exposure										Symptoms
	Mar										
	3	4	5	6	7	8	9	10	11	12	
Patient G1 ★											Fever
Patient G2											Sore throat

★ **Source patient**

Other exposure (clusters B, C and F: known COVID-19 case; cluster A: unknown exposure in Wuhan, China; cluster D: patient in Philippines with pneumonia; cluster E: unknown exposure in Japan; cluster G: unknown exposure in Indonesia)

Likely period of transmission from source patient to secondary patients

Symptom onset date

12.6% of transmissions could have occurred before symptom onset in the source patient (*3*).

Presymptomatic transmission might occur through generation of respiratory droplets or possibly through indirect transmission. Speech and other vocal activities such as singing have been shown to generate air particles, with the rate of emission corresponding to voice loudness (*7*). News outlets have reported that during a choir practice in Washington on March 10, presymptomatic transmission likely played a role in SARS-CoV-2 transmission to approximately 40 of 60 choir members.*

*https://www.latimes.com/world-nation/story/2020-03-29/coronavirus-choir-outbreak.

Environmental contamination with SARS-CoV-2 has been documented (*8*), and the possibility of indirect transmission through fomites by presymptomatic persons is also a concern. Objects might be contaminated directly by droplets or through contact with an infected person's contaminated hands and transmitted through nonrigorous hygiene practices.

The possibility of presymptomatic transmission of SARS-CoV-2 increases the challenges of COVID-19 containment measures, which are predicated on early detection and isolation of symptomatic persons. The magnitude of this impact is dependent upon the extent and duration of transmissibility while a patient is presymptomatic, which, to date, have

not been clearly established. In four clusters (A, B, F, and G), it was possible to determine that presymptomatic transmission exposure occurred 1–3 days before the source patient developed symptoms. Such transmission has also been observed in other respiratory viruses such as influenza. However, transmissibility by presymptomatic persons requires further study.

The findings in this report are subject to at least three limitations. First, although these cases were carefully investigated, the possibility exists that an unknown source might have initiated the clusters described. Given that there was not widespread community transmission of COVID-19 in Singapore during the period of evaluation and while strong surveillance systems were in place to detect cases, presymptomatic transmission was estimated to be more likely than the occurrence of unidentified sources. Further, contact tracing undertaken during this period was extensive and would likely have detected other symptomatic cases. Second, recall bias could affect the accuracy of symptom onset dates reported by cases, especially if symptoms were mild, resulting in uncertainty about the duration of the presymptomatic period. Finally, because of the nature of detection and surveillance activities that focus on testing symptomatic persons, underdetection of asymptomatic illness is expected. Recall bias and interviewer bias (i.e., the expectation that some symptoms were present, no matter how mild), could have contributed to this.

The evidence of presymptomatic transmission in Singapore, in combination with evidence from other studies (*9*,*10*) supports the likelihood that viral shedding can occur in the absence of symptoms and before symptom onset. This study identified seven clusters of cases in which presymptomatic transmission of COVID-19 likely occurred; 10 (6.4%) of such cases included in these clusters were among the 157 locally acquired cases reported in Singapore as of March 16. Containment measures should account for the possibility of presymptomatic transmission by including the period before symptom onset when conducting contact tracing. These findings also suggest that to control the pandemic it might not be enough for only persons with symptoms to limit their contact with others because persons without symptoms might transmit infection. Finally, these findings underscore the importance of social distancing in the public health response to the COVID-19 pandemic, including the avoidance of congregate settings.

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Detection of SARS-CoV-2 Among Residents and Staff Members of an Independent and Assisted Living Community for Older Adults — Seattle, Washington, 2020

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In the Seattle, Washington metropolitan area, where the first case of novel coronavirus 2019 disease (COVID-19) in the United States was reported (*1*), a community-level outbreak is ongoing with evidence of rapid spread and high morbidity and mortality among older adults in long-term care skilled nursing facilities (SNFs) (*2*,*3*). However, COVID-19 morbidity among residents of senior independent and assisted living communities, in which residents do not live as closely together as do residents in SNFs and do not require skilled nursing services, has not been described. During March 5–9, 2020, two residents of a senior independent and assisted living community in Seattle (facility 1) were hospitalized with confirmed COVID-19 infection; on March 6, social distancing and other preventive measures were implemented in the community. UW Medicine (the health system linked to the University of Washington), Public Health – Seattle & King County, and CDC conducted an investigation at the facility. On March 10, all residents and staff members at facility 1 were tested for SARS-CoV-2, the virus that causes COVID-19, and asked to complete a questionnaire about their symptoms; all residents were tested again 7 days later. Among 142 residents and staff members tested during the initial phase, three of 80 residents (3.8%) and two of 62 staff members (3.2%) had positive test results. The three residents had no symptoms at the time of testing, although one reported an earlier cough that had resolved. A fourth resident, who had negative test results in the initial phase, had positive test results 7 days later. This resident was asymptomatic on both days. Possible explanations for so few cases of COVID-19 in this residential community compared with those in several Seattle SNFs with high morbidity and mortality include more social distancing among residents and less contact with health care providers. In addition, early implementation of stringent isolation and protective measures after identification of two COVID-19 cases might have been effective in minimizing spread of the virus in this type of setting. When investigating a potential outbreak of COVID-19 in senior independent and assisted living communities, symptom screening is unlikely to be sufficient to identify all persons infected with SARS-CoV-2. Adherence to CDC guidance to prevent COVID-19 transmission in senior independent and assisted living communities (*4*) could be instrumental in preventing a facility outbreak.

Facility 1 comprises 83 apartments (45 independent living and 38 assisted living) along multiple hallways; and communal dining, library, and activity areas. Residents are physically able to move about the facility with minimal assistance. Independent-living residents have access to help if needed but are otherwise unaided; assisted-living residents have daily in-home help with medications and activities of daily living.

All residents were able to leave their rooms and move about the facility until March 6, when social distancing and other preventive measures were implemented. Residents were isolated in their rooms with no communal meals or activities, no visitors were allowed in the facility, and staff member screening and exclusion of symptomatic staff members were implemented. Enhanced hygiene practices were put into effect, including cleaning and disinfection of frequently touched surfaces and additional hand hygiene stations in hallways for workers to use.

All residents and staff members participated in this investigation with the exception of the two hospitalized residents with COVID-19 and one resident staying with relatives off-site for an extended period. Two rounds of SARS-CoV-2 testing were conducted, 7 days apart. On the day of the first round of testing, March 10, social distancing and other preventive measures had been in effect for >72 hours. Nasopharyngeal swabs were used to collect specimens from all residents and staff members; SARS-CoV-2 real-time reverse transcription–polymerase chain reaction assay was performed on specimens. Residents and staff members were also asked to complete a questionnaire assessing fever, cough, and other symptoms during the preceding 14 days; some residents received assistance from staff members to complete the questionnaire. Staff members from all shifts came to the facility for the assessment, including two ill staff members who were tested in their cars. In addition, specimens and symptom questionnaires were collected on March 11 from two residents who had been off-site and from

several staff members who had been unable to go to the facility on March 10. All residents were tested again 7 days later; symptom information was not collected at that time, with the exception of symptom ascertainment through follow-up of any resident with a positive test result. Staff members were not retested because they had no new facility exposure to SARS-CoV-2; all residents who had positive test results during the first round were in isolation, and the facility's personal protective equipment protocols* were being followed. Testing procedures for the second round were the same as those used for the first round.

In total, 80 residents and 62 staff members were tested on March 10 and 11. Mean age of residents was 86 years (range = 69–102 years); 77% were female; and 79% had one or more chronic medical conditions including chronic lung disease, diabetes mellitus, cardiovascular disease, cerebrovascular disease, renal disease, cognitive impairment, or obesity. Mean age of staff members was 40 years (range = 16–70 years), and 72% were female.

SARS-CoV-2 was detected in three (3.8%) residents and two (3.2%) staff members (Table). None of the residents with positive tests reported symptoms at the time of testing; however, one (resident C) reported resolved mild cough and loose stool during the preceding 14 days. All three residents with positive test results were living on separate floors in their own apartments; one received assistance with activities of daily living. One resident lived on the same floor as the two hospitalized residents with known COVID-19, and one had known close contact with one of the hospitalized residents; the third resident who had positive test results had no contact with either of the hospitalized residents. One staff member who had positive test results for SARS-CoV-2 worked in dining services, and the other worked as a health aide. Both reported symptoms. One staff member (staff member D) reported headache for 10 days, and the other (staff member E) reported a 5-day history of body aches, headache, and cough; this staff member had not worked while ill. When the second round of testing was conducted 7 days later, one additional positive test result was reported for an asymptomatic resident who had negative test results on the first round.

During the first round of testing and symptom screening, symptoms were reported by 42% of residents and 25% of staff members who had negative test results for SARS-CoV-2. Symptoms reported by residents who had negative test results included sore throat, chills, confusion, body aches, dizziness, malaise, headaches, cough, shortness of breath, and diarrhea. Signs and symptoms reported by staff members who had negative test results included fever, sore throat, chills, confusion, malaise, headache, cough, and diarrhea. All residents remained in the independent and assisted living facility in isolation and were clinically stable (i.e., no change in their usual state of health) as of March 31.

Summary

What is already known about this topic?

Community transmission of COVID-19 has been associated with rapid spread and high morbidity and mortality among older adults in long-term skilled nursing facilities. COVID-19 transmission in other types of senior living communities has not been described.

What is added by this report?

Following identification of two COVID-19 cases in a Seattle independent and assisted living facility, stringent preventive measures were implemented. Testing of all residents and staff members found few cases of COVID-19. Three of four residents who had positive test results were asymptomatic.

What are the implications for public health practice?

Symptom-based screening might not identify SARS-CoV-2 infections in independent and assisted living facility residents, underscoring the importance of adhering to CDC guidance to prevent COVID-19 transmission in senior living communities.

Discussion

In this senior independent and assisted living facility, symptom screening of residents did not identify persons who had positive test results for SARS-CoV-2; three of the four residents who had positive test results were asymptomatic at the time of testing, and one reported a cough that had resolved. Moreover, >40% of residents who had test results (whether positive or negative) reported one or more symptoms potentially compatible with COVID-19 during the preceding 2 weeks.

That only four residents had positive test results differed markedly from reports from two Seattle SNFs that experienced high COVID-19 transmission, morbidity, and mortality (*2*,*3*). Possible explanations for differences in findings in this residential community from those in SNFs include more social distancing among residents and less contact with health care providers in independent and assisted living communities than that in SNFs. In addition, early implementation of stringent isolation and protective measures after identification of two COVID-19 cases might have been effective in minimizing spread of the virus.

The findings in this report are subject to at least one limitation. Symptom reports by residents and staff members might have been subject to recall bias, given the general anxiety about

*Current CDC recommendations on use of personal protective equipment by health care personnel caring for patients with suspected or confirmed COVID-19 are available at https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html.

TABLE. Characteristics of residents and staff members with positive SARS-CoV-2 test results* on day 1 and day 7 — independent and assisted living community for older adults, Seattle, Washington, March 10 and 17, 2020

Test group/Case ID	Sex	Age (yrs)	Symptoms reported in 14 days preceding first test	SARS-CoV-2 test results	
				Day 1	Day 7
Persons with positive test results on day 1					
Resident A	Female	92	None	Positive	Negative
Resident B	Female	82	None	Positive	Positive
Resident C	Male	75	Cough (resolved) and one loose stool on day of test	Positive	Positive
Staff member D	Female	24	Headache x 10 days	Positive	Not retested
Staff member E	Female	51	Body aches, cough, and headache x 5 days	Positive	Not retested
Person with positive test result on day 7					
Resident F	Female	86	None	Negative	Positive

* Defined as a real-time reverse transcription–polymerase chain reaction testing cycle threshold value <40.

COVID-19 in response to the identification of the two initial COVID-19 cases. Nonetheless, the high percentage of both residents and staff members who had negative test results for SARS-CoV-2, yet reported symptoms, illustrates the limitations associated with COVID-19 case identification strategies determined by presence of symptoms alone. The findings from this investigation underscore the importance of SARS-CoV-2 mitigation measures, including social distancing, visitor restriction, resident and staff member testing, exclusion of ill staff members, and enhanced disinfection and hygiene practices, which are consistent with current CDC guidance for preventing transmission of COVID-19 in independent and assisted living communities (*4*).

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Rapid Sentinel Surveillance for COVID-19 — Santa Clara County, California, March 2020

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On February 27, 2020, the Santa Clara County Public Health Department (SCCPHD) identified its first case of coronavirus disease 2019 (COVID-19) associated with probable community transmission (i.e., infection among persons without a known exposure by travel or close contact with a patient with confirmed COVID-19). At the time the investigation began, testing guidance recommended focusing on persons with clinical findings of lower respiratory illness and travel to an affected area or an epidemiologic link to a laboratory-confirmed COVID-19 case, or on persons hospitalized for severe respiratory disease and no alternative diagnosis (*1*). To rapidly understand the extent of COVID-19 in the community, SCCPHD, the California Department of Public Health (CDPH), and CDC began sentinel surveillance in Santa Clara County. During March 5–14, 2020, four urgent care centers in Santa Clara County participated as sentinel sites. For this investigation, county residents evaluated for respiratory symptoms (e.g., fever, cough, or shortness of breath) who had no known risk for COVID-19 were identified at participating urgent care centers. A convenience sample of specimens that tested negative for influenza virus was tested for SARS-CoV-2 RNA. Among 226 patients who met the inclusion criteria, 23% had positive test results for influenza. Among patients who had negative test results for influenza, 79 specimens were tested for SARS-CoV-2, and 11% had evidence of infection. This sentinel surveillance system helped confirm community transmission of SARS-CoV-2 in Santa Clara County. As a result of these data and an increasing number of cases with no known source of transmission, the county initiated a series of community mitigation strategies. Detection of community transmission is critical for informing response activities, including testing criteria, quarantine guidance, investigation protocols, and community mitigation measures (*2*). Sentinel surveillance in outpatient settings and emergency departments, implemented together with hospital-based surveillance, mortality surveillance, and serologic surveys, can provide a robust approach to monitor the epidemiology of COVID-19.

During March 5–14, 2020, four urgent care centers in Santa Clara County were selected to participate as sentinel sites based on varied geographic locations throughout the county, diversity in adult and pediatric patient populations served by the centers, and staffing and resource capacity to collect and transport specimens. For this investigation, county residents evaluated with respiratory symptoms (e.g., fever, cough, or shortness of breath) who had no recent travel to an area outside the United States with sustained COVID-19 transmission and no known close contact with a patient with confirmed COVID-19 were identified at one of the four participating urgent care centers. Health care providers obtained a nasopharyngeal swab for influenza virus testing as part of routine clinical care and notified participants that their specimen might be tested for SARS-CoV-2. Because of limited testing capacity, a convenience sample of the first 5–10 specimens that tested negative for influenza virus each day were sent to the Santa Clara County Public Health Laboratory for SARS-CoV-2 testing using the CDC 2019-nCoV real-time reverse transcription–polymerase chain reaction assay (*3*). SARS-CoV-2 test results, age, and sex of each patient were reported to SCCPHD. Potential differences among patients who were and were not tested for SARS-CoV-2 could not be examined in this investigation.

During the investigation period, 226 patients seen at one of the four urgent care centers met the inclusion criteria (i.e., Santa Clara County resident, respiratory symptoms, no recent travel, and no known close contact with a patient with confirmed COVID-19) and were tested for evidence of influenza virus infection; among those, 53 (23%) had positive test results for influenza. Among the remaining 173 patients with negative test results for influenza, 79 specimens were tested for SARS-CoV-2; of those, nine (11%) had evidence of SARS-CoV-2 infection. Persons with positive test results for COVID-19 were adults with a median age of 46 years (range = 30–57 years); six (67%) were female. Among the 70 patients with negative SARS-CoV-2 test results, 51 (73%) were adults aged ≥18 years, and the median age was 31 years (range 6 months–81 years); 39 (56%) were female. Patients with positive test results for COVID-19 were notified and placed in isolation, case investigations and contact tracing were initiated, and positive test results were reported to CDPH and CDC.

Discussion

Identification of cases from this sentinel surveillance system helped confirm community transmission of SARS-CoV-2 in Santa Clara County. Among county residents evaluated at participating urgent care centers in early March with respiratory illness and no known exposure to SARS-CoV-2, approximately one quarter had positive test results for influenza, but 11% of patients with negative test results for influenza had positive test results for COVID-19. If it is assumed there were no influenza and SARS-CoV-2 coinfections and that persons with negative test results for influenza and not tested for SARS-CoV-2 were similar to those who were tested, then an estimated 8% (19 of 226) of persons seen at participating urgent care centers with respiratory symptoms had COVID-19. This is similar to the 5% SARS-CoV-2 infection rate identified among patients evaluated for mild influenza-like illness at one Los Angeles medical center during a similar time frame (*4*).

The findings in this report are subject to at least two limitations. First, SARS-CoV-2 testing was performed on a convenience sample of specimens that tested negative for influenza. Second, the findings are based on a small number of patients evaluated for respiratory illness at four participating sentinel sites and might not be representative of the broader community. However, as a result of these data and an increasing number of cases with no known source of transmission in Santa Clara County, the county initiated a series of community mitigation strategies to slow the spread of SARS-CoV-2. On March 9, the county issued recommendations to cancel gatherings of ≥1,000 people and to take action to protect vulnerable populations (e.g., older adults).* On March 16, Santa Clara County and five adjacent counties joined to order all residents to shelter in place and all schools, businesses, and government agencies to cease nonessential operations (*5*). Santa Clara County also posted updated community mitigation guidance and recommendations for populations at high risk, long-term care facilities, and hospitals (*6*).

Early implementation of community intervention is likely essential to maximize its effectiveness in slowing the spread of SARS-CoV-2 (*2*). Local public health departments can use sentinel surveillance to assess the level of community transmission of COVID-19 and to better guide the selection and implementation of community mitigation measures, including the scale, timing, duration, and settings in which to focus these strategies (*7*). Sentinel surveillance in outpatient settings and emergency departments, implemented together with hospital-based surveillance, mortality surveillance, and serologic surveys, can provide a robust, multifaceted approach to monitor the epidemiology of COVID-19.

* https://www.sccgov.org/sites/phd/DiseaseInformation/novel-coronavirus/Pages/order-cancellation-mass-gatherings.aspx.

Summary

What is already known about this topic?

On February 27, 2020, Santa Clara County, California, identified its first case of coronavirus disease 2019 (COVID-19) associated with probable community transmission.

What is added by this report?

During March 5–14, among patients with respiratory symptoms evaluated at one of four Santa Clara County urgent care centers serving as sentinel surveillance sites, 23% had positive test results for influenza. Among a subset of patients with negative test results for influenza, 11% had positive test results for COVID-19.

What are the implications for public health practice?

COVID-19 cases identified through this sentinel surveillance system helped confirm community transmission in the county. Local health departments can use sentinel surveillance to understand the level of community transmission of COVID-19 and to better guide the selection and implementation of community mitigation measures.

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Coronavirus Disease 2019 in Children — United States, February 12–April 2, 2020

CDC COVID-19 Response Team

On April 6, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

As of April 2, 2020, the coronavirus disease 2019 (COVID-19) pandemic has resulted in >890,000 cases and >45,000 deaths worldwide, including 239,279 cases and 5,443 deaths in the United States (*1*,*2*). In the United States, 22% of the population is made up of infants, children, and adolescents aged <18 years (children) (*3*). Data from China suggest that pediatric COVID-19 cases might be less severe than cases in adults and that children might experience different symptoms than do adults (*4*,*5*); however, disease characteristics among pediatric patients in the United States have not been described. Data from 149,760 laboratory-confirmed COVID-19 cases in the United States occurring during February 12–April 2, 2020 were analyzed. Among 149,082 (99.6%) reported cases for which age was known, 2,572 (1.7%) were among children aged <18 years. Data were available for a small proportion of patients on many important variables, including symptoms (9.4%), underlying conditions (13%), and hospitalization status (33%). Among those with available information, 73% of pediatric patients had symptoms of fever, cough, or shortness of breath compared with 93% of adults aged 18–64 years during the same period; 5.7% of all pediatric patients, or 20% of those for whom hospitalization status was known, were hospitalized, lower than the percentages hospitalized among all adults aged 18–64 years (10%) or those with known hospitalization status (33%). Three deaths were reported among the pediatric cases included in this analysis. These data support previous findings that children with COVID-19 might not have reported fever or cough as often as do adults (*4*). Whereas most COVID-19 cases in children are not severe, serious COVID-19 illness resulting in hospitalization still occurs in this age group. Social distancing and everyday preventive behaviors remain important for all age groups as patients with less serious illness and those without symptoms likely play an important role in disease transmission (*6*,*7*).

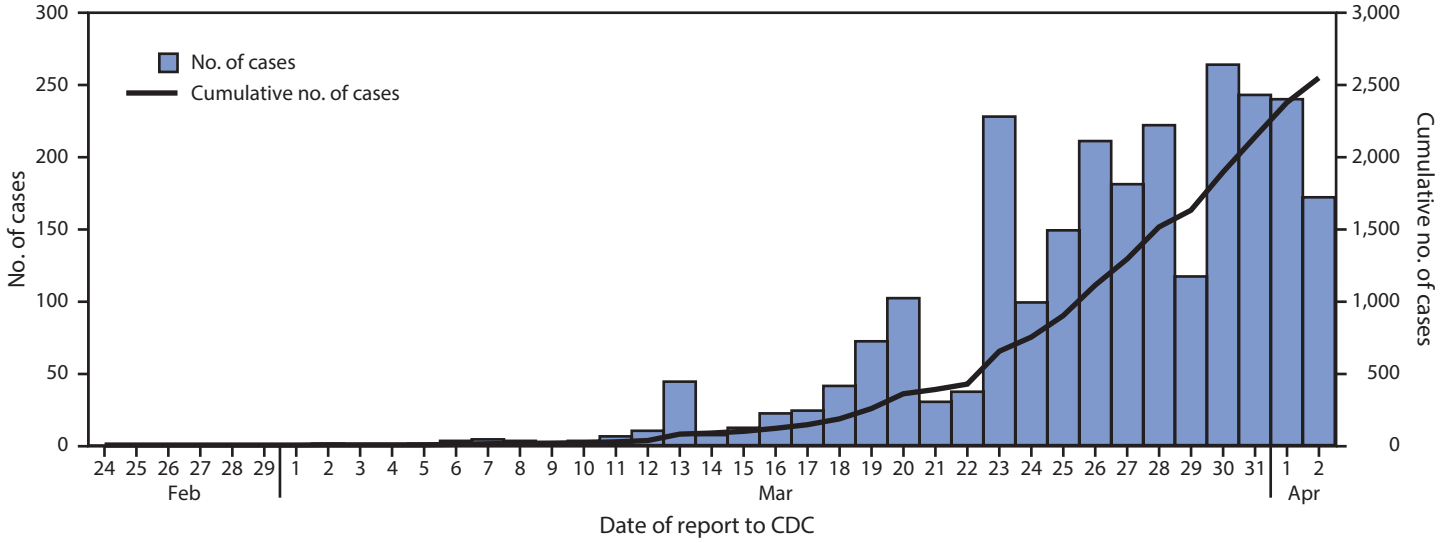
Data on COVID-19 cases were reported to CDC from 50 states, the District of Columbia, New York City, and four U.S territories. Jurisdictions voluntarily report data on laboratory-confirmed cases using a standardized case report form.* Data on cases occurring during February 12–April 2, 2020 and submitted through an electronic case-based COVID-19 surveillance database were reviewed for this report. Data submitted to CDC are preliminary and can be updated by health departments as more data become available. At the time of this analysis, characteristics of interest were available for only a minority of cases, including hospitalization status (33%), presence of preexisting underlying medical conditions (13%), and symptoms (9.4%). Because of the high percentage of cases with missing data and because cases with severe outcomes are more likely to have hospitalization or intensive care unit (ICU) status reported, percentages of patients hospitalized, including those admitted to the ICU, were estimated as a range, for which the denominator for the lower bound included cases with both known and unknown hospitalization or ICU status, and the upper bound included only cases with known hospitalization or ICU status. For other characteristics, percentages were calculated from among the number of cases with known information for that characteristic. Demographics of COVID-19 cases were assessed among cases in children aged <18 years and adults aged ≥18 years. Because clinical severity of COVID-19 is higher among adults aged ≥65 years than in younger age groups (*8*), clinical features including symptoms and hospitalizations were assessed among adults aged 18–64 years and compared with those among the pediatric cases. Statistical comparisons were not performed because of the high percentage of missing data.

As of April 2, 2020, data on 149,760 laboratory-confirmed U.S. COVID-19 cases were available for analysis. Among 149,082 (99.6%) cases for which patient age was known, 2,572 (1.7%) occurred in children aged <18 years and 146,510 (98%) in adults aged ≥18 years, including 113,985 (76%) aged 18–64 years. Among the 2,572 pediatric cases, 850 (33%) were reported from New York City; 584 (23%) from the rest of New York state; 393 (15%) from New Jersey; and the remaining 745 (29%) from other jurisdictions. The distribution of reporting jurisdictions for pediatric cases was similar to that of reporting jurisdictions for cases among adults aged ≥18 years, except that a lower percentage of adult cases was reported from New York state (14%). The first pediatric U.S. COVID-19 case was reported to CDC on March 2, 2020; since March 5, pediatric cases have been reported daily (Figure 1).

Among all 2,572 COVID-19 cases in children aged <18 years, the median age was 11 years (range 0–17 years). Nearly one third of reported pediatric cases (813; 32%) occurred in children aged 15–17 years, followed by those in children aged 10–14 years (682; 27%). Among younger

* https://www.cdc.gov/coronavirus/2019-ncov/downloads/pui-form.pdf.

FIGURE 1. COVID-19 cases in children* aged <18 years, by date reported to CDC (N = 2,549)† — United States, February 24–April 2, 2020§



* Includes infants, children, and adolescents.
† Excludes 23 cases in children aged <18 years with missing report date.
§ Date of report available starting February 24, 2020; reported cases include any with onset on or after February 12, 2020.

children, 398 (15%) occurred in children aged <1 year, 291 (11%) in children aged 1–4 years, and 388 (15%) in children aged 5–9 years. Among 2,490 pediatric COVID-19 cases for which sex was known, 1,408 (57%) occurred in males; among cases in adults aged ≥18 years for which sex was known, 53% (75,450 of 143,414) were in males. Among 184 (7.2%) cases in children aged <18 years with known exposure information, 16 (9%) were associated with travel and 168 (91%) had exposure to a COVID-19 patient in the household or community.

Data on signs and symptoms of COVID-19 were available for 291 of 2,572 (11%) pediatric cases and 10,944 of 113,985 (9.6%) cases among adults aged 18–64 years (Table). Whereas fever (subjective or documented), cough, and shortness of breath were commonly reported among adult patients aged 18–64 years (93% reported at least one of these), these signs and symptoms were less frequently reported among pediatric patients (73%). Among those with known information on each symptom, 56% of pediatric patients reported fever, 54% reported cough, and 13% reported shortness of breath, compared with 71%, 80%, and 43%, respectively, reporting these signs and symptoms among patients aged 18–64 years. Myalgia, sore throat, headache, and diarrhea were also less commonly reported by pediatric patients. Fifty-three (68%) of the 78 pediatric cases reported not to have fever, cough, or shortness of breath had no symptoms reported, but could not be classified as asymptomatic because of incomplete symptom information. One (1.3%) additional pediatric patient with a positive test result for SARS-CoV-2 was reported to be asymptomatic.

Information on hospitalization status was available for 745 (29%) cases in children aged <18 years and 35,061 (31%) cases in adults aged 18–64 years. Among children with COVID-19, 147 (estimated range = 5.7%–20%) were reported to be hospitalized, with 15 (0.58%–2.0%) admitted to an ICU (Figure 2). Among adults aged 18–64 years, the percentages of patients who were hospitalized (10%–33%), including those admitted to an ICU (1.4%–4.5%), were higher. Children aged <1 year accounted for the highest percentage (15%–62%) of hospitalization among pediatric patients with COVID-19. Among 95 children aged <1 year with known hospitalization status, 59 (62%) were hospitalized, including five who were admitted to an ICU. The percentage of patients hospitalized among those aged 1–17 years was lower (estimated range = 4.1%–14%), with little variation among age groups (Figure 2).

Among 345 pediatric cases with information on underlying conditions, 80 (23%) had at least one underlying condition. The most common underlying conditions were chronic lung disease (including asthma) (40), cardiovascular disease (25), and immunosuppression (10). Among the 295 pediatric cases for which information on both hospitalization status and underlying medical conditions was available, 28 of 37 (77%) hospitalized patients, including all six patients admitted to an ICU, had one or more underlying medical condition; among 258 patients who were not hospitalized, 30 (12%) patients had underlying conditions. Three deaths were reported among the pediatric cases included in this analysis; however, review of these cases is ongoing to confirm COVID-19 as the likely cause of death.

TABLE. Signs and symptoms among 291 pediatric (age <18 years) and 10,944 adult (age 18–64 years) patients* with laboratory-confirmed COVID-19 — United States, February 12–April 2, 2020

Sign/Symptom	No. (%) with sign/symptom	
	Pediatric	Adult
Fever, cough, or shortness of breath†	213 (73)	10,167 (93)
Fever§	163 (56)	7,794 (71)
Cough	158 (54)	8,775 (80)
Shortness of breath	39 (13)	4,674 (43)
Myalgia	66 (23)	6,713 (61)
Runny nose¶	21 (7.2)	757 (6.9)
Sore throat	71 (24)	3,795 (35)
Headache	81 (28)	6,335 (58)
Nausea/Vomiting	31 (11)	1,746 (16)
Abdominal pain¶	17 (5.8)	1,329 (12)
Diarrhea	37 (13)	3,353 (31)

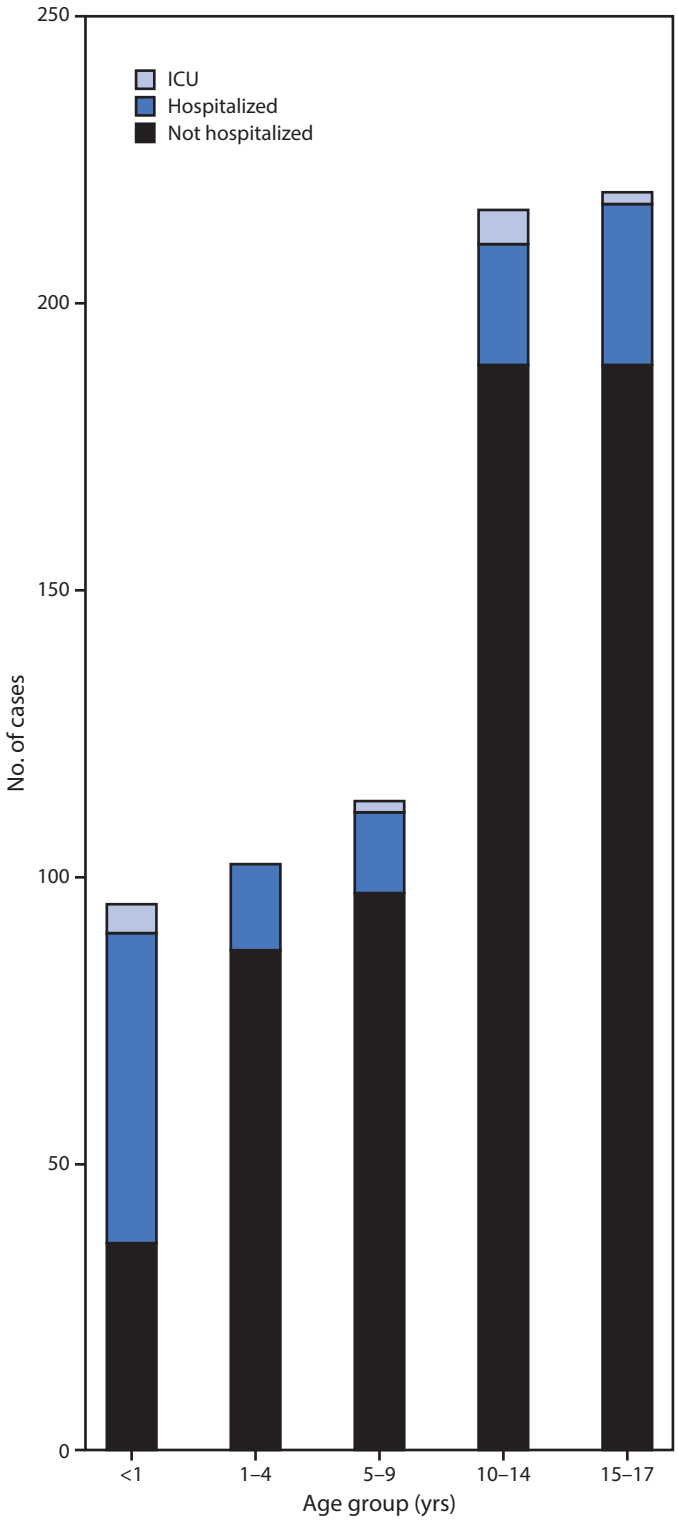
* Cases were included in the denominator if they had a known symptom status for fever, cough, shortness of breath, nausea/vomiting, and diarrhea. Total number of patients by age group: <18 years (N = 2,572), 18–64 years (N = 113,985).
† Includes all cases with one or more of these symptoms.
§ Patients were included if they had information for either measured or subjective fever variables and were considered to have a fever if "yes" was indicated for either variable.
¶ Runny nose and abdominal pain were less frequently completed than other symptoms; therefore, percentages with these symptoms are likely underestimates.

Discussion

Among 149,082 U.S. cases of COVID-19 reported as of April 2, 2020, for which age was known, 2,572 (1.7%) occurred in patients aged <18 years. In comparison, persons aged <18 years account for 22% of the U.S. population (*3*). Although infants <1 year accounted for 15% of pediatric COVID-19 cases, they remain underrepresented among COVID-19 cases in patients of all ages (393 of 149,082; 0.27%) compared with the percentage of the U.S. population aged <1 year (1.2%) (*3*). Relatively few pediatric COVID-19 cases were hospitalized (5.7%–20%; including 0.58%–2.0% admitted to an ICU), consistent with previous reports that COVID-19 illness often might have a mild course among younger patients (*4*,*5*). Hospitalization was most common among pediatric patients aged <1 year and those with underlying conditions. In addition, 73% of children for whom symptom information was known reported the characteristic COVID-19 signs and symptoms of fever, cough, or shortness of breath.

These findings are largely consistent with a report on pediatric COVID-19 patients aged <16 years in China, which found that only 41.5% of pediatric patients had fever, 48.5% had cough, and 1.8% were admitted to an ICU (*4*). A second report suggested that although pediatric COVID-19 patients infrequently have severe outcomes, the infection might be more severe among infants (*5*). In the current analysis, 59 of 147 pediatric hospitalizations, including five of 15 pediatric ICU admissions, were among children aged <1 year; however, most reported U.S. cases in infants had unknown hospitalization status.

FIGURE 2. COVID-19 cases among children* aged <18 years, among those with known hospitalization status (N = 745),† by age group and hospitalization status — United States, February 12–April 2, 2020



Abbreviation: ICU = intensive care unit.
* Includes infants, children, and adolescents.
† Number of children missing hospitalization status by age group: <1 year (303 of 398; 76%); 1–4 years (189 of 291; 65%); 5–9 years (275 of 388; 71%); 10–14 years (466 of 682; 68%); 15–17 years (594 of 813; 73%).

Summary

What is already known about this topic?

Data from China suggest that pediatric coronavirus disease 2019 (COVID-19) cases might be less severe than cases in adults and that children (persons aged <18 years) might experience different symptoms than adults.

What is added by this report?

In this preliminary description of pediatric U.S. COVID-19 cases, relatively few children with COVID-19 are hospitalized, and fewer children than adults experience fever, cough, or shortness of breath. Severe outcomes have been reported in children, including three deaths.

What are the implications for public health practice?

Pediatric COVID-19 patients might not have fever or cough. Social distancing and everyday preventive behaviors remain important for all age groups because patients with less serious illness and those without symptoms likely play an important role in disease transmission.

In this preliminary analysis of U.S. pediatric COVID-19 cases, a majority (57%) of patients were males. Several studies have reported a majority of COVID-19 cases among males (*4*,*9*), and an analysis of 44,000 COVID-19 cases in patients of all ages in China reported a higher case-fatality rate among men than among women (*10*). However, the same report, as well as a separate analysis of 2,143 pediatric COVID-19 cases from China, detected no substantial difference in the number of cases among males and females (*5*,*10*). Reasons for any potential difference in COVID-19 incidence or severity between males and females are unknown. In the present analysis, the predominance of males in all pediatric age groups, including patients aged <1 year, suggests that biologic factors might play a role in any differences in COVID-19 susceptibility by sex.

The findings in this report are subject to at least four limitations. First, because of the high workload associated with COVID-19 response activities on local, state, and territorial public health personnel, a majority of pediatric cases were missing data on disease symptoms, severity, or underlying conditions. Data for many variables are unlikely to be missing at random, and as such, these results must be interpreted with caution. Because of the high percentage of missing data, statistical comparisons could not be conducted. Second, because many cases occurred only days before publication of this report, the outcome for many patients is unknown, and this analysis might underestimate severity of disease or symptoms that manifested later in the course of illness. Third, COVID-19 testing practices differ across jurisdictions and might also differ across age groups. In many areas, prioritization of testing for severely ill patients likely occurs, which would result in overestimation of the percentage of patients with COVID-19 infection who are hospitalized (including those treated in an ICU) among all age groups. Finally, this analysis compares clinical characteristics of pediatric cases (persons aged <18 years) with those of cases among adults aged 18–64 years. Severe COVID-19 disease appears to be more common among adults at the high end of this age range (*6*), and therefore cases in young adults might be more similar to those among children than suggested by the current analysis.

As the number of COVID-19 cases continues to increase in many parts of the United States, it will be important to adapt COVID-19 surveillance strategies to maintain collection of critical case information without overburdening jurisdiction health departments. National surveillance will increasingly be complemented by focused surveillance systems collecting comprehensive case information on a subset of cases across various health care settings. These systems will provide detailed information on the evolving COVID-19 incidence and risk factors for infection and severe disease. More systematic and detailed collection of underlying condition data among pediatric patients would be helpful to understand which children might be at highest risk for severe COVID-19 illness.

This preliminary examination of characteristics of COVID-19 disease among children in the United States suggests that children do not always have fever or cough as reported signs and symptoms. Although most cases reported among children to date have not been severe, clinicians should maintain a high index of suspicion for COVID-19 infection in children and monitor for progression of illness, particularly among infants and children with underlying conditions. However, these findings must be interpreted with caution because of the high percentage of cases missing data on important characteristics. Because persons with asymptomatic and mild disease, including children, are likely playing a role in transmission and spread of COVID-19 in the community, social distancing and everyday preventive behaviors are recommended for persons of all ages to slow the spread of the virus, protect the health care system from being overloaded, and protect older adults and persons of any age with serious underlying medical conditions. Recommendations for reducing the spread of COVID-19 by staying at home and practicing strategies such as respiratory hygiene, wearing cloth face coverings when around others, and others are available on CDC's coronavirus website at https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html.

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Notes from the Field

Seasonal Human Influenza A(H3N2) and Influenza A(H1N1)pdm09 Reassortant Infection — Idaho, 2019

Randi Pedersen, MPH[1]; Vonnita Barton[1]; Jennifer Tripp, MPH[2]; Lenee Blanton, MPH[3]; John Barnes, PhD[3]; Christine Hahn, MD[1]

On February 17, 2019, a male patient aged 13 years with no underlying medical conditions was evaluated in an Idaho hospital emergency department for a 1-day history of fever (103°F [39.4°C]), dry cough, sore throat, headache, and weakness. A respiratory specimen was collected and tested positive for influenza A by rapid influenza diagnostic test (RIDT). The patient was treated with oseltamivir as an outpatient and recovered. As part of routine surveillance, a second specimen collected during the emergency department visit on February 17 was forwarded to the Idaho Bureau of Laboratories (IBL), where CDC's influenza reverse transcription–polymerase chain reaction (RT-PCR) diagnostic panel detected both pandemic influenza A and H3, which suggested an influenza A(H3N2) variant virus of swine origin. The specimen was sent to CDC's influenza diagnostic laboratory for confirmation, and the patient was interviewed.

During the week preceding illness onset, the patient did not travel and reported no animal exposure; he had not received a 2018–19 seasonal influenza vaccine. One household member developed respiratory symptoms on February 23, 2019, and sought care at an outpatient clinic, where a respiratory specimen tested positive for influenza A by RIDT. No specimen was available for additional testing, and no other exposures were identified. No additional household members reported respiratory symptoms.

Next generation sequencing at CDC revealed a new seasonal human influenza A(H3N2) and A(H1N1)pdm09 reassortant virus, rather than an influenza A(H3N2) variant virus of swine origin. Reassortment occurs when two influenza viruses infect a single host cell and exchange gene segments, creating a new virus. Sequencing data suggested that the patient was not coinfected and that the reassortment event likely occurred in another person. Phylogenetic analysis determined that the hemagglutinin genes belonged to human H3 subclade 3C.3a and neuraminidase genes belonged to human N2. Gene segments PB2, PB1, PA, NP, M, and NS displayed genetic similarity to human-origin influenza A(H1N1)pdm09 viruses. Genetic markers that would confer reduced susceptibility to oseltamivir, peramivir, and zanamivir were not detected. Viruses in H3 subclade 3C.3a react poorly by focus reduction assay with ferret antisera raised against A/Singapore/INFMH-16–0019/2016(3C.2a1), signifying that the 2018–19 Northern Hemisphere influenza vaccine* might not be protective against this virus.

As part of enhanced surveillance, the hospital where the patient sought care forwarded an additional 45 specimens that tested positive by RIDT for influenza A, collected during January 1–April 27, 2019, to IBL. Using the CDC influenza RT-PCR diagnostic panel, IBL determined that 23 (51.1%) were influenza A(H1N1)pdm09, 13 (28.9%) were influenza A(H3N2), and influenza was not detected in nine (20.0%) specimens. IBL sent 17 of the 45 specimens to CDC for sequencing; no additional reassortant viruses were identified.

At the time of the patient's illness onset, influenza A(H1N1)pdm09 and A(H3) were cocirculating in Idaho (Figure), increasing the likelihood of coinfection and reassortment. Influenza A reassortment is observed at high rates in animal and cell culture models, but a biologically successful human reassortant virus is rarely reported (*1*–*3*). This is CDC's first detection of this type of seasonal human influenza A(H3N2) and influenza A(H1N1)pdm09 reassortment. CDC recommends that state and local health departments, hospitals, and clinicians maintain surveillance to identify patients who might be transmitting newly emerging influenza viruses.[†,§] CDC will continue virologic surveillance to monitor influenza genetic evolution and inform vaccine strain selection.

* https://www.who.int/influenza/vaccines/virus/recommendations/2018_19_north/en.

† https://www.cdc.gov/flu/weekly/overview.htm.

§ This new reassortant virus was identified and investigated in March 2019. Despite the delay in presenting the results of this investigation, the recommendation for continued surveillance of emerging influenza viruses has particular relevance at this time.

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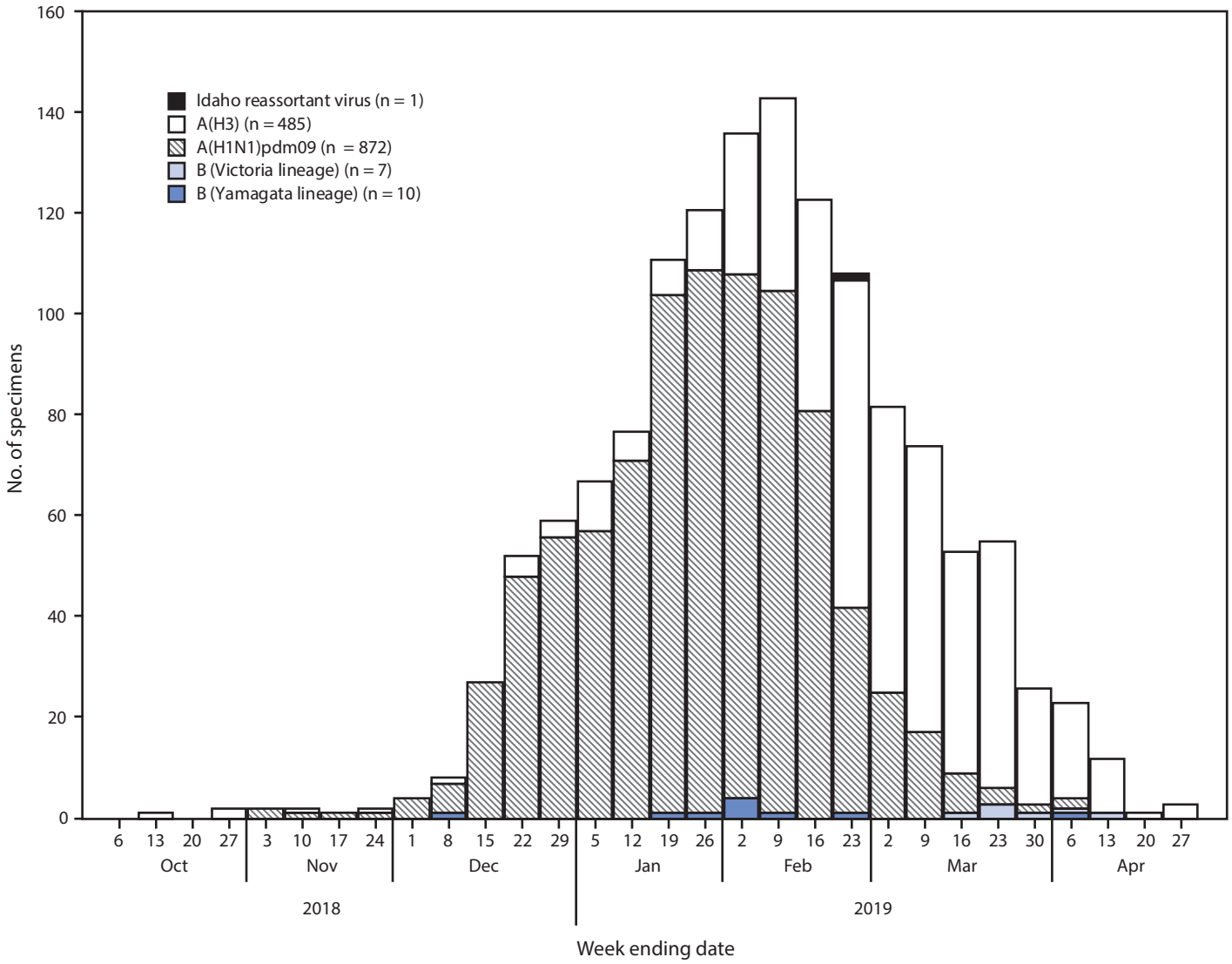
FIGURE. Number of respiratory specimens testing positive for influenza reported by Idaho Bureau of Laboratories, by influenza virus type,* subtype/lineage, and surveillance week (N = 1,375) — Idaho, October 6, 2018–April 27, 2019

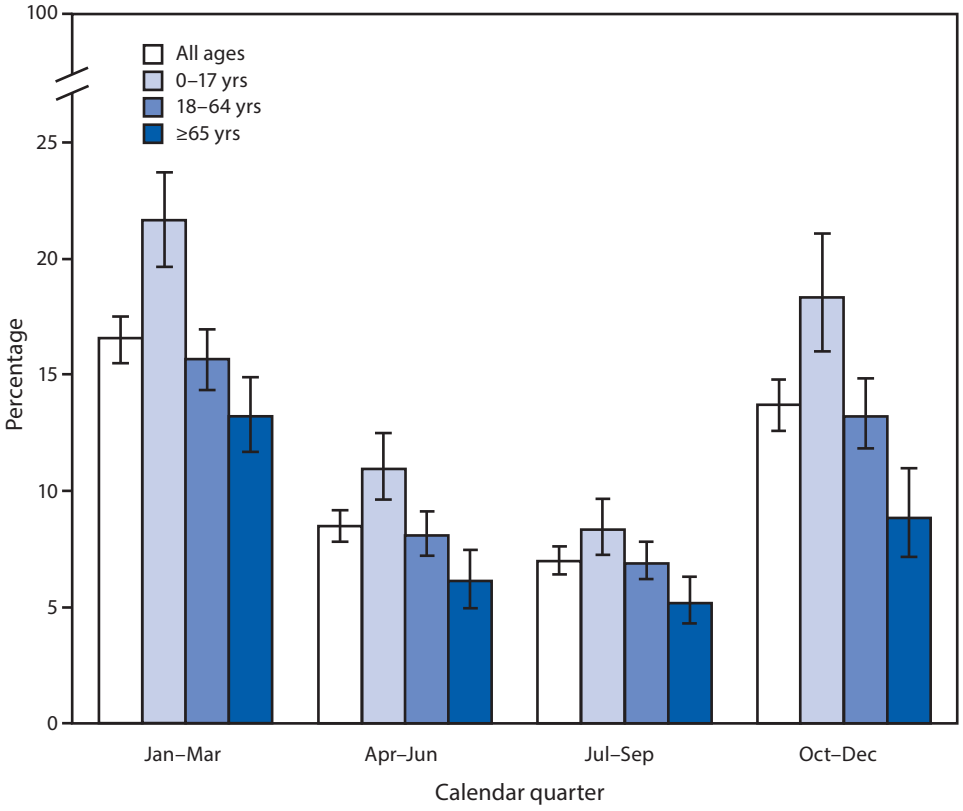


* Illness onset date of Idaho reassortant infection was February 16, 2019.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Persons Who Had a Cold in the Past 2 Weeks,† by Age Group and Calendar Quarter — National Health Interview Survey,§ United States, 2018



* With 95% confidence intervals indicated by error bars.
† Based on the questions in the Sample Child and Sample Adult Interview that ask "Did [you/your child] have a head cold or chest cold that started during the last two weeks?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey Sample Adult and Sample Child components.

In 2018, the percentage of persons of all ages who had a cold during the past 2 weeks was 16.6% in January–March, 8.5% in April–June, 7.0% in July–September, and 13.7% in October–December. Across all calendar quarters, colds were more common in younger persons than in older persons. A higher percentage of persons in each age group had colds in the past 2 weeks in January–March and October–December than had colds in April–June or July–September 2018.

Source: National Health Interview Survey, 2018 data. https://www.cdc.gov/nchs/nhis.htm.

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