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Screening for Lung Cancer — 10 States, 2017

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Lung cancer is the leading cause of cancer death in the United States; 148,869 lung cancer-associated deaths occurred in 2016 (*1*). Mortality might be reduced by identifying lung cancer at an early stage when treatment can be more effective (*2*). In 2013, the U.S. Preventive Services Task Force (USPSTF) recommended annual screening for lung cancer with low-dose computed tomography (CT) for adults aged 55–80 years who have a 30 pack-year* smoking history and currently smoke or have quit within the past 15 years (*2*).† This was a Grade B recommendation, which required health insurance plans to cover lung cancer screening as a preventive service.§ To assess the prevalence of lung cancer screening by state, CDC used Behavioral Risk Factor Surveillance System (BRFSS) data¶ collected in 2017 by 10 states.** Overall, 12.7% adults aged 55–80 years met the USPSTF criteria for lung cancer screening. Among those meeting USPSTF criteria, 12.5% reported they had received a CT scan to check for lung cancer in the last 12 months. Efforts to educate health care providers and provide decision support tools might increase recommended lung cancer screening.

BRFSS is a random-digit–dialed landline and cellular telephone survey of the noninstitutionalized U.S. adult population aged ≥18 years conducted by state health departments in conjunction with CDC.†† In 2017, for the first time, an optional module added questions on lung cancer screening. In combination with core BRFSS questions on age and cigarette smoking status, three questions§§ from the lung cancer screening module enabled calculation of cigarette pack-years smoked. A fourth question asked about receipt of CT scans in the last 12 months with the following possible responses: "Yes, to check for lung cancer"; "No (did not have a CT scan)"; and "Had a CT scan, but for some other reason."

* Pack-years (PYs) are the average of number of 20-cigarette packs smoked per day multiplied by the number of years smoked.

† USPSTF is currently conducting a review and update of this recommendation.

§ Under Section 2713 of the Patient Protection and Affordable Care Act (ACA), individual and group health insurance plans must provide coverage of evidence-based screening services that have a rating of A or B in the current USPSTF recommendations and may not impose cost-sharing (such as copayments, deductibles, or co-insurance) on patients receiving these services. In addition, starting in 2015, the Centers for Medicare and Medicaid Services covered lung cancer screening for Medicare beneficiaries aged 55–77 years who met the USPSTF smoking criteria.

¶ https://www.cdc.gov/brfss/questionnaires/pdf-ques/2017_BRFSS_Pub_Ques_508_tagged.pdf.

** Florida, Georgia, Kansas, Maine, Maryland, Missouri, Nevada, Oklahoma, Vermont, and Wyoming.

†† https://www.cdc.gov/brfss/about/index.htm.

§§ "You've told us that you have smoked in the past or are currently smoking. The next questions are about screening for lung cancer. Q1. How old were you when you first started to smoke cigarettes regularly? (enter: age in years). Q2. How old were you when you last smoked cigarettes regularly? (enter: age in years). Q3. On average, when you {smoke/smoked} regularly, about how many cigarettes {do/did} you usually smoke each day? (enter: number of cigarettes)."

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Ten states administered this module to 85,514 respondents[¶¶] during January 2017–December 2017.[***] Weighted estimates were derived by following BRFSS recommendations for optional modules (*3*) and using SAS-callable SUDAAN (version 11.0; RTI International) to account for the BRFSS stratified, complex sampling design. Current, former, and never cigarette smoking status[†††] and smoking pack-year categories[§§§] were defined for adults aged 55–80 years[¶¶¶] (33,137). Weighted prevalences of smoking status and pack-year categories among adults aged 55–80 years were estimated for each state. Weighted populations for smoking status and pack-year categories were derived by multiplying the state population of persons aged 55–80 years by the weighted percentage of adults in the corresponding smoking status and pack-year category.

Weighted estimates were calculated for self-reported receipt of lung cancer screening among current and former cigarette smokers (hereafter referred to as smokers) aged 55–80 years (14,585) who did and did not meet USPSTF criteria for lung cancer screening.[****] The weighted prevalence of lung cancer screening was calculated by age group, smoking status, sex, race/ethnicity, education, general health status, health care coverage, routine checkup in the past year, and diagnosed chronic obstructive pulmonary disease (COPD), emphysema, or bronchitis.[††††] Logistic regression was used to calculate prevalence ratios (PRs) with 95% confidence intervals, with reported lung cancer screening as the outcome, adjusted for all other variables.

Overall, 12.7% of adults aged 55–80 years met USPSTF criteria for lung cancer screening, with nearly one half (5.6%) being former smokers (Table 1). The percentage of adults

¶¶ 2017 BRFSS combined landline and cellular telephone cooperation and response rates. https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-response-rates-table-508.pdf.

*** All 10 states asked all respondents (including never smokers) Question (Q) 1 to Q3 on pack-years. Six states (Florida, Georgia, Maine, Maryland, Vermont, and Wyoming) asked all respondents (including never smokers) Q4 on lung cancer screening, and four states (Kansas, Missouri, Nevada, and Oklahoma) only asked current or former smokers (excluding never smokers) to respond to Q4.

††† Respondents were categorized as never smokers if they had smoked fewer than 100 cigarettes in their lifetime. Former smokers had smoked at least 100 cigarettes but now smoked cigarettes "not at all." Current smokers had smoked at least 100 cigarettes and now smoked cigarettes "every day" or "some days."

§§§ For current and former cigarette smokers who met USPSTF criteria for lung cancer screening, PY categories were 1) current smokers ≥30 PY and 2) former smokers ≥30 PY who had quit smoking <15 years ago. For current and former smokers who did not meet USPSTF criteria, the smoking PY categories were 1) current smokers 20–29 PY; 2) current smokers <20 PY; 3) former smokers >30 PY who quit smoking ≥15 years ago; 4) former smokers 20–29 PY; and 5) former smokers <20 PY.

¶¶¶ A restricted file with single-year age was used to determine years that smokers quit smoking for former smokers and to determine respondents aged 80 years. The public-use BRFSS combines persons aged ≥81 years with those aged 80 years into a single category aged ≥80 years.

**** The following categories and number of respondents were excluded: history of any cancer or missing smoking PY data (18,267); never smokers (41,537); age <55 years (9,661); and age >80 years (1,464).

†††† Diagnosed COPD was determined by a "yes" response to the question "Has a doctor, nurse, or other health professional ever told you that you had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?"

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meeting USPSTF screening criteria by state ranged from 8.9% (Maryland) to 17.0% (Oklahoma). The population size meeting USPSTF criteria ranged from 16,200 (Vermont) to 610,000 (Florida) (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/85167).

Lung cancer screening was reported by 12.5% of smokers who met USPSTF criteria and ranged from 9.7% (Oklahoma) to 16.0% (Florida) (Table 2). Differences between states ranged from –3.8% (Oklahoma versus Vermont) to 6.3% (Florida versus Oklahoma) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/85168). Lung cancer screening was reported by 7.9% of smokers aged 55–80 years who did not meet USPSTF criteria and ranged from 4.3% (Maryland) to 9.4% (Oklahoma and Florida) (Table 2). Differences between states ranged from –5.1% (Maryland versus Oklahoma) to 5.2% (Florida versus Maryland) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/85168).

TABLE 1. Estimated prevalence of adults* aged 55–80 years who met† and did not meet§ U.S. Preventive Services Task Force (USPSTF) lung cancer screening criteria, by pack-years (PYs)¶ — 10 states, Behavioral Risk Factor Surveillance System, 2017

State	Total no.** of adults aged 55–80 yrs	%†† (95% CI)										
		Met USPSTF criteria			Did not meet USPSTF criteria							
		Current ≥30 PY smokers	Former ≥30 PY smokers, quit <15yrs	Total who met criteria	Current 20–29 PY smokers	Current <20 PY smokers	Former ≥30 PY smokers, quit ≥15yrs	Former 20–29 PY smokers	Former <20 PY smokers	Total who did not meet criteria	Never smokers
Florida	7,936	7.2 (6.1–8.4)	5.8 (4.8–7.0)	13.0 (11.5–14.5)	3.4 (2.6–4.6)	3.7 (2.9–4.8)	3.7 (3.1–4.6)	4.4 (3.7–5.4)	17.4 (15.6–19.5)	32.8 (32.5–35.2)	54.2 (51.8–56.7)
Georgia	2,123	6.0 (4.9–7.5)	3.7 (2.9–4.9)	9.8 (8.3–11.5)	3.0 (2.2–4.1)	5.3 (4.2–6.6)	3.9 (2.9–5.0)	4.2 (3.2–5.4)	15.7 (13.8–17.7)	31.9 (29.5–34.5)	58.3 (55.6–60.9)
Kansas	4,175	7.1 (6.2–8.2)	6.4 (5.5–7.4)	13.5 (12.3–14.8)	3.3 (2.7–4.0)	3.7 (3.0–4.6)	4.7 (4.0–5.6)	4.0 (3.4–4.8)	14.6 (13.4–15.9)	30.4 (28.8–32.1)	56.1 (54.3–57.9)
Maine	1,680	7.3 (5.5–9.5)	5.8 (4.3–7.8)	13.1 (10.8–15.8)	4.2 (3.0–6.0)	3.3 (2.2–5.0)	5.9 (4.6–7.6)	5.7 (4.4–7.5)	21.5 (19.0–24.4)	40.7 (37.4–44.0)	46.3 (42.9–49.7)
Maryland	5,724	4.7 (3.9–5.6)	4.2 (3.6–5.0)	8.9 (7.9–10.0)	2.3 (1.8–2.9)	3.2 (2.7–4.0)	3.7 (3.1–4.4)	4.7 (4.1–5.5)	17.5 (16.2–18.9)	31.4 (29.8–33.2)	59.7 (57.8–61.5)
Missouri	2,896	9.2 (7.7–11.1)	7.4 (6.2–8.8)	16.7 (14.7–18.8)	2.7 (2.0–3.6)	3.7 (2.8–4.8)	3.6 (2.9–4.5)	4.7 (3.8–5.9)	13.4 (11.8–15.2)	28.1 (25.9–30.4)	55.3 (52.8–57.8)
Nevada	1,431	8.5 (6.2–11.7)	4.5 (3.2–6.2)	13.0 (10.3–16.3)	3.4 (2.0–5.7)	7.6 (5.5–10.4)	3.9 (2.8–5.5)	4.5 (3.1–6.5)	14.9 (12.2–18.0)	34.3 (30.4–38.4)	52.7 (48.5–56.9)
Oklahoma	2,520	8.6 (7.3–10.1)	8.4 (7.1–9.9)	17.0 (15.2–19.0)	3.2 (2.4–4.2)	2.9 (2.2–3.8)	4.8 (3.9–5.9)	4.1 (3.3–5.1)	13.7 (12.2–15.4)	28.7 (26.6–30.9)	54.3 (51.9–56.6)
Vermont	2,667	5.0 (4.0–6.2)	5.7 (4.7–7.1)	10.8 (9.3–12.4)	3.0 (2.3–3.9)	2.9 (2.2–3.9)	3.6 (2.8–4.5)	4.7 (3.8–5.7)	22.9 (20.9–25.0)	37.0 (34.7–39.4)	52.2 (49.8–54.6)
Wyoming	1,985	7.4 (6.1–9.0)	5.4 (4.4–6.8)	12.8 (11.1–14.7)	3.5 (2.6–4.7)	3.7 (2.9–4.9)	5.7 (4.6–7.2)	4.9 (3.9–6.2)	15.8 (14.0–17.7)	33.7 (31.3–36.2)	53.5 (50.9–56.1)
Total	**33,137**	**7.1 (6.5–7.7)**	**5.6 (5.1–6.2)**	**12.7 (12.0–13.4)**	**3.2 (2.7–3.7)**	**4.0 (3.6–4.5)**	**4.0 (3.6–4.4)**	**4.5 (4.1–4.9)**	**16.4 (15.5–17.3)**	**32.1 (86.5–88.0)**	**55.3 (54.1–56.5)**

Abbreviations: CI = confidence interval; smokers = cigarette smokers.
* Respondents were excluded if missing age, smoking status, PY information, or if there was a history of prior cancer diagnosis.
† Met USPSTF lung cancer screening criteria: adults aged 55–80 years who had a ≥30 PY cigarette smoking history and currently smoke or quit <15 years ago.
§ Did not meet USPSTF lung cancer screening criteria: adults aged 55–80 years who smoked cigarettes but had <30 PY smoking history or quit ≥15 years ago, or who were never smokers.
¶ The average of number of 20-cigarette packs smoked per day multiplied by the number of years smoked.
** Unweighted number of respondents.
†† Weighted percentage of row total.

TABLE 2. Prevalence of receipt of a computed tomography (CT) scan to check for lung cancer, reported among smokers* aged 55–80 years who met† and did not meet§ U.S. Preventive Services Task Force (USPSTF) lung cancer screening criteria — 10 states, Behavioral Risk Factor Surveillance System, 2017

State	Met USPSTF criteria			Did not meet USPSTF criteria		
		Received CT scan to check for lung cancer			Received CT scan to check for lung cancer	
	Total no.¶	No.**	%†† (95% CI)	Total no.¶	No.**	%†† (95% CI)
Florida	1,115	147	16.0 (11.8–21.3)	2,525	219	9.4 (7.3–12.2)
Georgia	187	21	—§§	650	54	7.6 (5.4–10.6)
Kansas	506	56	10.5 (8.0–13.8)	1,208	81	6.9 (5.3–8.8)
Maine	194	21	—§§	659	36	5.1 (3.2–8.0)
Maryland	517	49	11.2 (7.4–16.5)	1,861	73	4.3 (3.2–5.7)
Missouri	421	55	10.5 (7.4–14.7)	867	74	8.5 (6.2–11.4)
Nevada	179	14	—§§	503	23	—§§
Oklahoma	364	39	9.7 (6.7–13.7)	714	61	9.4 (7.0–12.4)
Vermont	265	40	13.5 (9.1–19.6)	980	56	5.9 (4.2–8.2)
Wyoming	227	22	—§§	643	27	—§§
Total	**3,975**	**464**	**12.5 (10.4–14.9)**	**10,610**	**704**	**7.9 (6.8–9.1)**

Abbreviation: CI = confidence interval.
* Includes both current and former cigarette smokers aged 55–80 years. Respondents were excluded if never smokers, if missing age, smoking status, or pack-year (average number of 20-cigarette packs smoked per day multiplied by number of years smoked) information, or if they had a history of a prior cancer diagnosis.
† Met USPSTF lung cancer screening criteria: adults aged 55–80 years who had a ≥30 pack-year smoking history and who currently smoke or quit <15 years ago.
§ Did not meet USPSTF lung cancer screening criteria: adults aged 55–80 years who smoked but had <30 pack-year smoking history or quit ≥15 years ago.
¶ Unweighted number of smokers.
** Unweighted number of smokers who reported a CT scan to check for lung cancer.
†† Weighted percentage.
§§ Proportions were suppressed where relative standard error ≥30% or n<30.

Among smokers who met USPSTF criteria, higher prevalence of lung cancer screening was associated with diagnosed COPD (PR = 3.01) and lower prevalence of screening with no routine checkup in the past year (PR = 0.54) (Table 3). Among smokers who did not meet USPSTF criteria, higher prevalence of screening was associated with diagnosed COPD (PR = 2.34) and lower prevalences of screening with being a former smoker (PR = 0.63) and fair or poor general health status (PR = 0.68).

Discussion

These findings suggest an opportunity to educate both patients and health care providers, provide decision support tools to reinforce appropriate screening triage, and apply evidence-based interventions from The Community Guide.[§§§§] Previous studies have used data from the 2017 BRFSS optional module on lung cancer screening to analyze utilization by state (*4*) and among sexual minorities (*5*). This report adds information about the prevalence and population size by different categories of pack-year smoking for each participating state. The 2017 BRFSS questions to identify smoking pack-years were similar to those that a health care provider might ask in a clinic.

[§§§§] The Community Guide (The Guide to Community Preventive Services; https://www.thecommunityguide.org/) does not directly address lung cancer screening but describes evidence-based interventions that could be applied. Examples include prevention and control of tobacco use; promoting informed decision making; provider reminder and recall systems; reducing structural barriers; small media targeting clients; one-on-one education for clients; and client out-of-pocket costs.

TABLE 3. Characteristics associated with reported receipt of a computed tomography (CT) scan to check for lung cancer among smokers* aged 55–80 years who met† and did not meet§ U.S. Preventive Services Task Force (USPSTF) lung cancer screening criteria — 10 states, Behavioral Risk Factor Surveillance System, 2017

Characteristic	Smokers who met USPSTF lung cancer screening criteria				Smokers who did not meet USPSTF lung cancer screening criteria			
	Total no.¶	No.**	%†† (95% CI§§)	PR¶¶ (95% CI§§)	Total no.¶	No.**	% (95% CI§§)	PR¶¶ (95% CI§§)
Age group (yrs)								
55–64	2,052	211	11.3 (8.9–14.4)	Referent	4,299	261	7.2 (5.7–9.0)	Referent
65–80	1,851	253	14.8 (11.3–19.1)	0.95 (0.68–1.33)	6,143	443	8.8 (7.2–10.6)	1.26 (0.89–1.80)
Smoking status								
Current smokers	2,120	254	12.6 (9.8–16.1)	Referent	2,062	194	11.1 (8.0–15.1)	Referent
Former smokers	1,783	210	13.1 (10.0–16.9)	0.99 (0.72–1.37)	8,380	510	7.1 (6.1–8.3)	0.63 (0.41–0.95)
Sex								
Male	2,140	256	12.4 (9.6–15.8)	Referent	4,907	325	8.7 (6.9–10.9)	Referent
Female	1,761	208	13.5 (10.5–17.3)	0.90 (0.64–1.28)	5,531	379	7.2 (6.1–8.6)	0.75 (0.56–1.00)
Race/Ethnicity								
White, non-Hispanic	3,425	400	12.9 (10.7–15.5)	Referent	8,704	571	8.1 (6.9–9.4)	Referent)
Other	414	51	—***	—***	1,570	126	8.2 (5.6–11.9)	0.91 (0.63–1.37)
Education								
High school or less	1,938	225	12.5 (9.5–16.2)	Referent	3,731	278	8.9 (7.1–10.9)	Referent
College or technical school	1,958	238	13.3 (10.4–16.7)	1.19 (0.85–1.69)	6,693	426	7.5 (6.1–9.1)	1.05 (0.76–1.46)
General health status								
Excellent/Very good/Good	2,433	222	10.9 (8.3–14.3)	Referent	8,133	438	6.6 (5.5–7.9)	Referent
Fair/Poor	1,462	240	16.2 (12.9–20.1)	0.86 (0.59–1.27)	2,282	265	12.3 (9.5–15.8)	0.68 (0.48–0.95)
Have health care coverage								
Yes	3,577	448	13.7 (11.4–16.4)	Referent	9,913	672	8.2 (7.0–9.5)	Referent
No	313	13	—***	—***	510	31	5.7 (2.7–11.7)	0.55 (0.30–1.02)
Routine check-up in the past year								
Yes	3,036	411	14.4 (11.9–17.4)	Referent	8,630	622	8.3 (7.1–9.7)	Referent
No	783	44	5.6 (3.4–9.7)	0.54 (0.32–0.90)	1,672	69	5.6 (3.4–9.0)	0.78 (0.46–1.32)
Ever told have chronic obstructive pulmonary disease, emphysema, or chronic bronchitis								
Yes	1,410	283	23.4 (19.1–28.4)	3.01 (2.02–4.49)	1,496	224	17.3 (13.8–21.5)	2.34 (1.70–3.22)
No	2,467	180	6.8 (5.2–8.9)	Referent	8,876	472	6.5 (5.4–7.8)	Referent

Abbreviations: CI = confidence interval; PR = prevalence ratio.

* Includes both current and former cigarette smokers. Respondents were excluded if never smokers, if missing age, smoking status, or pack-year (average number of 20-cigarette packs smoked per day multiplied by the number of years smoked) information, or if history of prior cancer diagnosis.

† Met USPSTF lung cancer screening criteria: adults aged 55–80 years who had a ≥30 pack-year smoking history and currently smoke or quit <15 years ago.

§ Did not meet lung cancer screening USPSTF criteria: adults aged 55–80 years who smoked but had <30 pack-year smoking history or quit ≥15 years ago.

¶ Unweighted total number of current and former cigarette smokers aged 55–80 years with the row characteristic.

** Unweighted number of current and former cigarette smokers aged 55–80 years who reported lung cancer screening within this USPSTF category.

†† Weighted percentage.

§§ 95% CIs generated using logit transformation in SUDAAN.

¶¶ Model-adjusted, with adults aged 55–80 years who smoked and reported lung cancer screening as the outcome and adjusted for all other variables listed in the table.

*** Proportions are suppressed where relative standard error ≥30% or n<30.

Summary

What is already known about this topic?

The U.S. Preventive Services Task Force (USPSTF) recommends annual lung cancer screening for adults aged 55–80 years who have a ≥30 pack-year cigarette smoking history and currently smoke or have quit <15 years ago.

What is added by this report?

In 10 states, one in eight persons aged 55–80 years met USPSTF criteria, and, among those meeting USPSTF criteria, only one in eight reported a lung cancer screening exam in the last 12 months.

What are the implications for public health practice?

Public health initiatives to prevent cigarette smoking, increase smoking cessation, and increase recommended lung cancer screening could help reduce lung cancer mortality.

States can use the BRFSS lung cancer screening estimates to identify where increased screening is needed, to develop supplementary research projects to evaluate barriers to screening, ¶¶¶¶ and to monitor the effectiveness of interventions.***** Annual lung cancer screening is a secondary preventive health care strategy (*2*). The most effective primary preventive measures for lung cancer are to never start smoking and for smokers to stop cigarette smoking as soon as possible (*6*). The National Cancer Institute and the Veterans Health Administration are currently supporting clinical trials to test smoking cessation intervention strategies for patients undergoing lung cancer screening (*7*). Evidence-based tobacco cessation interventions in the 2008 U.S. Public Health Service clinical guidelines and The Community Guide include advising patients to quit smoking, providing cessation counseling and medications, and connecting patients to other cessation resources such as 1–800-QUIT-NOW (*6*). Recent studies suggest that training primary care providers on how to conduct shared decision-making discussions and implement effective smoking cessation interventions in the context of lung cancer screening is needed (*7*,*8*).

Cigarette smoking is the leading cause of COPD in the United States (*9*). In the current report, diagnosed COPD was associated with a higher prevalence of lung cancer screening, both in smokers who met and those who did not meet USPSTF criteria. The severity of the reported COPD is unknown. The USPSTF does not recommend lung cancer screening if a health problem is present that would substantially limit life expectancy or the ability to undergo curative lung surgery (*2*).

The findings in this report are subject to at least four limitations. First, lung cancer screening and smoking were self-reported without medical record validation. Self-reported smoking history might be subject to recall bias and social desirability bias. Some respondents might not know the exact type of test they received or the reason that their doctor ordered the test. Second, the 2017 BRFSS module does not address whether current smokers were provided with cessation counseling and medications. Third, the module does not provide information on health care resources that might differ by location within a state, such as the distribution of American College of Radiology–accredited lung cancer screening facilities.†††††† Finally, some caution might be needed when comparing these results with those from other surveys. For example, the prevalence of screening in the 2017 BRFSS among adults who met USPSTF criteria (12.5%) was higher than that reported in the 2015 National Health Interview Survey (4.4%) (*10*). Although an actual increase in screening delivery likely occurred from 2015 to 2017, differences in methods of data collection, question wording, and populations covered could result in different estimates.

Public health initiatives to prevent cigarette smoking, increase smoking cessation, and increase lung cancer screening among those who meet USPSTF criteria could help reduce lung cancer mortality. Avoidance of screening inconsistent with USPSTF criteria could reduce the potential for harms such as overdiagnosis and overtreatment (*10*). Efforts to educate§§§§§ health care providers regarding the benefits of lung cancer screening and to provide decision support tools¶¶¶¶¶ might increase appropriate and timely lung cancer screening.

¶¶¶¶ The Maine Comprehensive Cancer Control Program has used surveys of lung cancer screening facilities to identify barriers to screening such as limited staffing, lack of patient and provider education, screening costs, and data reporting requirements. https://nccd.cdc.gov/nccdsuccessstories/showdoc.aspx?s=14224&dt=0.

***** https://www.cdc.gov/cancer/ncccp/pdf/LungCancerScreeningPrograms.pdf.

†††††† https://www.acraccreditation.org/accredited-facility-search.

§§§§§ https://www.lucatraining.org/course.

¶¶¶¶¶ https://effectivehealthcare.ahrq.gov/decision-aids/lung-cancer-screening/clinicians-checklist.html.

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Fatal Case of Legionnaires' Disease After Home Exposure to *Legionella pneumophila* Serogroup 3 — Wisconsin, 2018

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In January 2018, the Wisconsin Department of Health Services, Division of Public Health (DPH), received a report of a culture-confirmed case of Legionnaires' disease. The patient, who was immunocompromised, had died at a local hospital 10 days after being admitted. DPH and an infection preventionist from the hospital investigated to determine the source of the infection and prevent additional cases. Because the case was suspected to be nosocomial, health care facility water samples were tested for *Legionella*. When these samples were negative, water sources in the patient's home were tested. These tested positive for *Legionella pneumophila,* and the bacteria remained after an attempt to remediate. The patient and home isolates were identified as *L. pneumophila* serogroup 3, sequence type 93, by whole-genome multilocus sequence typing. A second resident of the home did not become ill. This case highlights the potential for immunocompromised persons and others at risk for Legionnaires' disease to be exposed to *Legionella* through home water systems containing the bacteria and demonstrates the difficulty of home remediation. This case also illustrates the role of lower respiratory tract specimens in the identification of less common *Legionella* infections (e.g., *L. pneumophila* serogroup 3) and confirmation of the infection source.

Investigation and Results

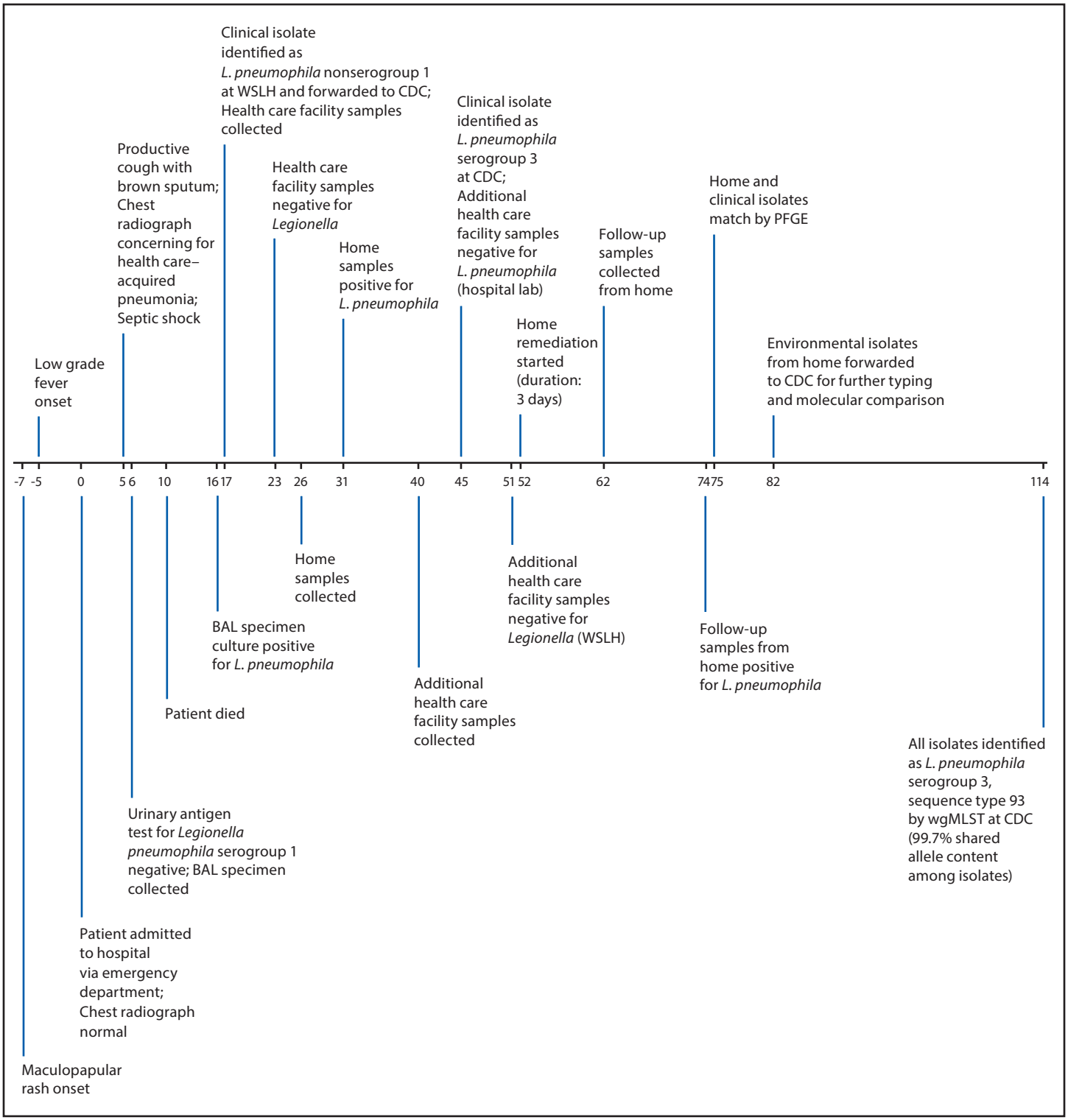
The case occurred in a Wisconsin resident, a nonsmoker aged 70–79 years who had received a 2016 diagnosis of late-onset combined immunodeficiency of undetermined etiology after developing two opportunistic infections that year. The patient was admitted to a local hospital (day 0) (Figure) after evaluation in the emergency department for a rash and fever suspected to be a reaction to oral antibiotics. The patient had been prescribed a 30-day course of oral antibiotics (levofloxacin) following a course of parenteral antibiotics for management of cellulitis of the lower leg with accompanying abscesses. The rash and fever developed near the end of the course of oral antibiotics, which was stopped a day early. On admission, a family member reported recent mental status changes in the patient, and the patient complained of a dry cough and shortness of breath. A respiratory virus panel on sputum detected rhinovirus and parainfluenza 1, but a chest radiograph was normal.

After admission, the fever continued, and mental status changes worsened. The cough became productive with dark brown sputum on day 5; a chest radiograph showed a new right upper lobe opacity. The patient developed septic shock, thought to be attributable to hospital-acquired pneumonia, and was transferred to the intensive care unit. Intravenous aztreonam and vancomycin were initiated, with aztreonam replaced by meropenem later in the day. On day 6, a urinary antigen test for *L. pneumophila* serogroup 1 and culture of a bronchoalveolar lavage (BAL) fluid specimen for *Legionella* were ordered; the urinary antigen test result was negative. Inhaled tobramycin was initiated on day 7. Vancomycin and tobramycin were discontinued on day 8. The patient died on day 10, noted in the medical record as the result of cardiopulmonary arrest secondary to septic shock. On day 16, the Wisconsin State Laboratory of Hygiene (WSLH) isolated *L. pneumophila* from the BAL fluid culture. The isolate was identified on day 17 as *L. pneumophila* nonserogroup 1 by direct fluorescent antibody and determined later in the investigation to be serogroup 3, which is not detected by the urinary antigen test. Serogroup 3 is not often reported as a cause of Legionnaires'; serogroup 1 accounts for most infections (*1*).

The hospital's water management program requires certain actions to be taken in the event that any patient tests positive for *Legionella* by culture or urinary antigen test with symptom onset indicating possible nosocomial acquisition (i.e., inpatient for more than 2 days or discharged from an inpatient location within 10 days). The program was instituted as a result of a Legionnaires' disease outbreak during the 1990s and involves targeted environmental cultures. Whereas targeted sampling is typical, this hospital also had the capacity to culture for *Legionella* in-house. Nine water sources (inpatient and outpatient sink faucets, ice machines, a shower, and a warm water pool) where the patient might have been exposed were sampled (day 17) (Table). Samples were cultured for *Legionella* at the hospital; all culture results were negative. Additional samples were collected on day 40 and cultured for *Legionella* at both the hospital and WSLH for validation. All culture results were negative.

On day 26, and at the request of the patient's family, staff members from the hospital collected and cultured samples from two showers in the patient's residence, a single-family home built in the early 1910s that appeared to be in good condition and was served by a municipal water supply system. Both cultures were positive for *L. pneumophila*. Starting on day 52 and following advice in a 2010 home guidance manual (*2*), a plumber drained, cleaned with chlorine, and superheated

FIGURE. Timeline of events during investigation of a fatal case of Legionnaires' disease — Wisconsin, 2018*



Abbreviations: BAL = bronchoalveolar lavage; PFGE = pulsed-field gel electrophoresis; wgMLST = whole-genome multilocus sequence typing; WSLH = Wisconsin State Laboratory of Hygiene.
* Approximate days before and recorded days after patient's hospital admission (day 0).

TABLE. Environmental sampling and culture results from a health care facility and a personal residence during investigation of a fatal case of Legionnaires' disease — Wisconsin, 2018

Sampling site	Days after patient's hospital admission	Sample type*	Aerator/ Showerhead removed†	Affiliation of laboratory	*Legionella pneumophila* culture result	CFU ml
Health care facility						
Outpatient clinic						
Exam room faucet	17	Bulk (550 ml), initial	No	Hospital	Neg	—
Warm water pool	17	Bulk (550 ml)	N/A	Hospital	Neg	—
Emergency department						
Exam room faucet	17	Bulk (550 ml), initial	No	Hospital	Neg	—
Ice machine	17	Bulk (550 ml)	N/A	Hospital	Neg	—
Inpatient						
Patient room sink faucet	17	Bulk (550 ml), initial	No	Hospital	Neg	—
		Bulk (550 ml), 2 min	No	Hospital	Neg	—
	40	Bulk (550 ml), warm	No	Hospital	Neg	—
				WSLH	Neg	—
		Swab	Yes	Hospital	Neg	—
				WSLH	Neg	—
Patient room shower	17	Bulk (550 ml), initial	No	Hospital	Neg	—
		Bulk (550 ml), 2 min	No	Hospital	Neg	—
	40	Bulk (550 ml), warm	No	Hospital	Neg	—
				WSLH	Neg	—
		Swab	Yes	Hospital	Neg	—
				WSLH	Neg	—
Kitchen sink	17	Bulk (550 ml), initial	No	Hospital	Neg	—
Ice machine	17	Bulk (550 ml)	N/A	Hospital	Neg	—
Intensive care unit						
Patient room sink	17	Bulk (550 ml), initial	No	Hospital	Neg	—
	40	Bulk (550 ml), warm	No	Hospital	Neg	—
				WSLH	Neg	—
		Swab	Yes	Hospital	Neg	—
				WSLH	Neg	—
Patient home samples						
Bathroom 1						
Shower	26	Bulk, 550 ml, warm	No	Hospital	Pos	2.54
	62	Bulk (250 ml), warm	Yes	WSLH	Neg	—
		Swab	Yes	WSLH	Neg	—
Bathroom 2						
Shower	26	Bulk, 550 ml, warm	No	Hospital	Pos	0.36
	62	Bulk (250 ml), warm	Yes	WSLH	Neg	—
		Swab	Yes	WSLH	Neg	—
Shower wand	62	Bulk (250 ml), warm	No	WSLH	Neg	—
Sink	62	Bulk (250 ml), warm	No	WSLH	Pos	0.05
Kitchen						
Sink #1 sprayer	62	Bulk (250 ml), warm	No	WSLH	Pos	0.11
Sink #2 sprayer	62	Bulk (250 ml), warm	No	WSLH	Pos	0.26
Entire home						
Water heater	62	Bulk (250 ml)	N/A	WSLH	Neg	—
Humidifier	62	Swab	N/A	WSLH	Neg	—

Abbreviations: CFU = colony forming units; N/A = not applicable; Neg = no *Legionella pneumophila* isolated; Pos = *Legionella* isolated; WSLH = Wisconsin State Laboratory of Hygiene.

* Bulk samples were either drawn immediately when the faucet was turned on, after 2 minutes of hot water flow, or after running the water until warm.

† Sinks have aerators, and showers have showerheads. Removal of the aerator or showerhead is required to obtain a swab sample. Procedural differences or inability to remove an aerator or showerhead for a fixture caused the variation.

to 148°F (64.4°C) the home's water heater and then flushed the fixtures over a 3-day period. The showerheads were also soaked in vinegar to remove hard water scale. As part of the case investigation and to determine whether remediation was successful, DPH epidemiologists collected samples in the home on day 62. Eight fixtures were sampled: the two showers, one handheld shower wand, a bathroom sink faucet, two kitchen sink sprayers, the water heater tank, and the whole-house humidifier. Samples were cultured for *Legionella* at WSLH. Cultures from the bathroom faucet and the kitchen sprayers were positive for *L. pneumophila*, indicating that the bacteria remained in the home's water system. The home guidance

manual (*2*) was shared with the other resident of the home, who was not immunocompromised and did not become ill. Practices to prevent *Legionella* growth within the water system were discussed, such as adhering to recommended water heater settings and maintenance schedules and flushing fixtures after lack of use (e.g., after returning from vacation). The other resident also was encouraged to seek medical advice if they developed symptoms of respiratory illness.

On day 75, WSLH reported that the isolates from the home environmental samples collected on day 62 and the patient's clinical isolate matched by pulsed-field gel electrophoresis patterns. The isolates were sent to CDC for whole-genome multilocus sequence typing and on day 114 were identified as *L. pneumophila* serogroup 3, sequence type 93, with 99.7% shared allele content among strains. The patient's home was determined to be the most likely source of infection.

Summary

What is already known about this topic?

Legionnaires' disease is a severe pneumonia caused by the waterborne bacteria *Legionella*. The rate of reported cases in the United States increased 4.5-fold from 2000 to 2015.

What is added by this report?

Investigation of a culture-confirmed fatal case of Legionnaires' disease reported in January 2018 identified the patient's home as the infection source. *Legionella* bacteria remained following a remediation attempt.

What are the implications for public health practice?

Increased efforts to understand the burden (i.e., morbidity and mortality) and risk for Legionnaires' disease associated with residential settings and the usefulness and feasibility of testing and remediation in these settings could inform prevention guidance. Lower respiratory tract specimens have value for both patient treatment and public health investigation.

Discussion

In Wisconsin, the number of reported confirmed Legionnaires' disease cases has increased more than 400% from 63 in 2010 to 330 in 2018; this increase is consistent with a national 4.5-fold increase in the incidence rate from 2000 to 2015 (*1*). Approximately 9% of Legionnaires' disease cases in the United States are fatal (*3*), and two thirds of patients with confirmed cases during 2015 had not traveled or been in a health care or assisted living setting during their presumed exposure period (*1*).

This Wisconsin case highlights the potential for persons at risk for Legionnaires' disease (e.g., patients with a weakened immune system) to be exposed to *Legionella* through home water systems containing the bacteria and also demonstrates the difficulty of remediation. Evidence of *Legionella* in residential potable water has been widely documented (*4*). Published guidance for prevention of *Legionella* growth and spread is limited to complex building water systems through water management programs and, when indicated, immediate control measures such as point-of-use filters (*5*,*6*). Evidence regarding the burden (i.e., morbidity and mortality) from home-associated Legionnaires' disease and the usefulness and feasibility of testing and remediation in residential settings is limited. Increased efforts to understand the burden and risk associated with residential settings could inform prevention guidance.

This case also highlights the value of obtaining lower respiratory tract specimens for both patient treatment (identification of less common *Legionella* infections) and public health investigation (confirmation of infection source). Nonserogroup 1 *L. pneumophila* infections cannot be routinely detected using the *Legionella* urinary antigen test but can be detected by polymerase chain reaction or culture of lower respiratory tract secretions (e.g., sputum or BAL fluid). Importantly, sputum specimens can be successfully cultured for *Legionella* even if the specimen is considered low quality (*7*). Because timely antibiotic treatment can affect patient survival, CDC recommends concurrent ordering of *Legionella* urinary antigen test and a culture of lower respiratory tract secretions for patients with suspected Legionnaires' disease (*8*).

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Expansion of HIV Preexposure Prophylaxis to 35 PEPFAR-Supported Early Program Adopters, October 2016–September 2018

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The U.S. President's Emergency Plan for AIDS Relief (PEPFAR), the largest bilateral funder of human immunodeficiency virus (HIV) prevention and control programs worldwide, currently supports implementation of preexposure prophylaxis (PrEP) to reduce HIV incidence among persons at substantial risk for infection, including female sex workers, men who have sex with men (MSM), and transgender women (hereafter referred to as key populations). Recent estimates suggest that 54% of all global new HIV infections in 2018 occurred among key populations and their sexual partners (*1*). In 2016, PEPFAR began tracking initiation of PrEP by key populations and other groups at high risk (*2*). The implementation and scale-up of PrEP programs across 35 PEPFAR-supported country or regional programs* was assessed by determining the number of programs reporting any new PrEP clients during each quarter from October 2016 to September 2018. As of September 2018, only 15 (43%) PEPFAR-supported country or regional programs had implemented PrEP programs; however, client volume increased by 3,351% over the assessment period in 15 country or regional programs. Scale-up of PrEP among general population clients (5,255%) was nearly three times that of key population clients (1,880%). Among key populations, the largest increase (3,518%) occurred among MSM. Factors that helped drive the success of these PrEP early adopter programs included initiation of national, regional, and multilateral stakeholder meetings; engagement of ministries of health and community advocates; revision of HIV treatment guidelines to include PrEP; training for HIV service providers; and establishment of drug procurement policies. These best practices can help facilitate PrEP implementation, particularly among key populations, in other country or regional programs to reduce global incidence of HIV infection.

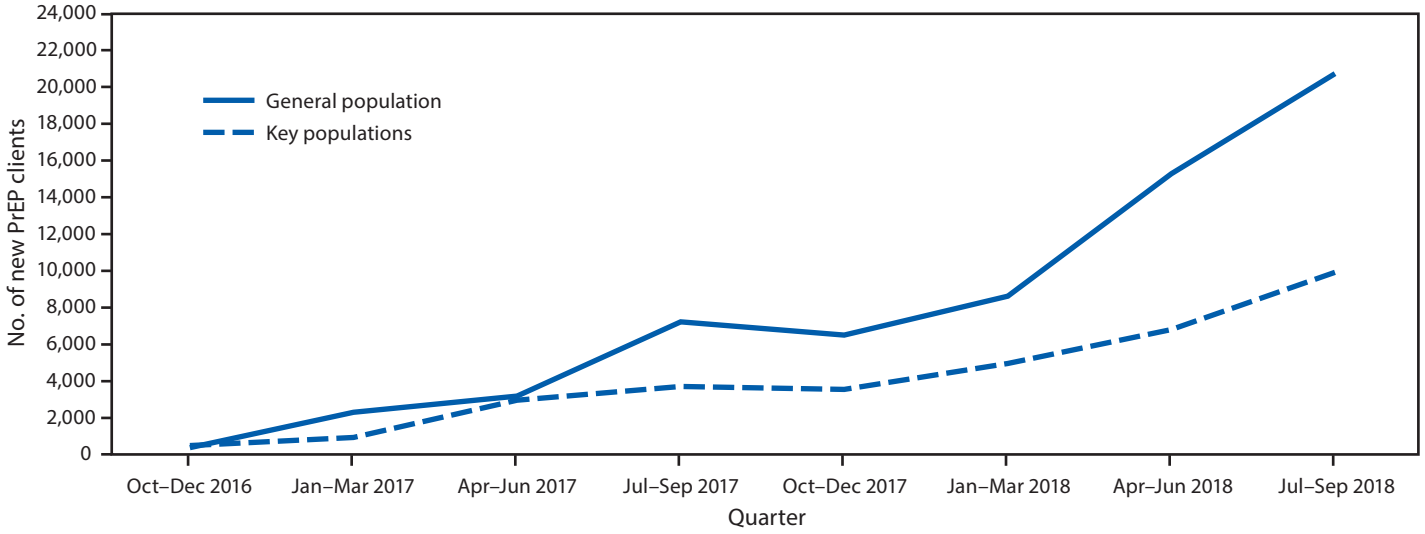
International, national, subnational, nongovernmental, and academic PEPFAR implementing partners reported PrEP data from country or regional programs for eight quarters (i.e., October–December 2016 through July–September 2018). The primary outcome measured was the number of persons (including new enrollees) who received PrEP during the reporting period, disaggregated by key population group (i.e., female sex workers, MSM, and transgender women). To assess implementation and scale-up of PrEP, the number and percentage of the 35 PEPFAR-funded country or regional programs that reported PrEP initiation among key populations or the general population and the number of new PrEP clients in each program were determined. The relative percentage change in PrEP initiation for the general population and that in the key populations over time were also compared.

Country or regional programs with >150 new key population clients across multiple quarters totaling ≥1,000 clients were classified as early adopters of PrEP among key populations. The threshold of 150 clients per quarter was determined by a minimum enrollment rate of 50 key population clients per month during a quarter. Using previous analyses of PrEP implementation (*3*,*4*), critical factors and scale-up accelerators that facilitate early coverage and rapid growth among PrEP programs were identified. This list of factors was provided to implementing partners in the early adopter programs, who were asked to determine whether these factors were relevant to the growth of their respective programs.

During the analysis period, 35 PEPFAR-supported country or regional programs were assessed. Substantial scale-up of PrEP initiation among 15 of these programs took place, commencing with 888 new clients during October–December 2016 and ending with 30,644 during July–September 2018 (Figure), representing a 3,351% overall increase among general population and key population clients over the assessment period. Scale-up of PrEP initiation among the general population (5,255% increase) was nearly three times that among the key populations (1,880%), and the increases in PrEP initiation within the key populations substantially varied among key population groups (Table 1). For example, the largest increase in enrollment of new clients within the key populations occurred among MSM (3,518%), whereas the increase among transgender women was substantially lower (573%). The percentage of new key population clients among all new PrEP clients varied over the analysis period (range = 29%–56%) and was 32% in the most recent quarter (July–September 2018).

*Angola, Asia Region, Botswana, Burma, Burundi, Cambodia, Cameroon, Caribbean Region, Central America Region, Central Asia Region, Côte d'Ivoire, Democratic Republic of the Congo, Dominican Republic, Eswatini, Ethiopia, Ghana, Haiti, India, Indonesia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, Papua New Guinea, Rwanda, South Africa, South Sudan, Tanzania, Uganda, Ukraine, Vietnam, Zambia, and Zimbabwe.

FIGURE. Preexposure prophylaxis (PrEP) initiation among the general population and key populations* — 35 U.S. President's Emergency Plan for AIDS Relief–funded country or regional programs, October 2016–September 2018



Abbreviation: AIDS = acquired immunodeficiency syndrome.
* Key populations are female sex workers, men who have sex with men, and transgender women.

TABLE 1. Preexposure prophylaxis (PrEP) initiation among general and key populations and percentage change in PrEP initiation in general and key populations — 35 U.S. President's Emergency Plan for AIDS Relief–funded country or regional programs, October 2016–September 2018

Characteristic	Quarter								% Increase Oct 2016–Sep 2018
	Oct–Dec 2016	Jan–Mar 2017	Apr–Jun 2017	Jul–Sep 2017	Oct–Dec 2017	Jan–Mar 2018	Apr–Jun 2018	Jul–Sep 2018	
Total PrEP clients enrolled	**888**	**3,250**	**6,155**	**10,945**	**10,062**	**13,588**	**22,086**	**30,644**	**3,351**
General population (%)*	387 (44)	2,308 (71)	3,188 (52)	7,228 (66)	6,509 (65)	8,621 (63)	15,277 (69)	20,723 (68)	5,255
Key populations (%)*	501 (56)	942 (29)	2,967 (48)	3,717 (34)	3,553 (35)	4,967 (37)	6,809 (31)	9,921 (32)	1,880
Female sex workers (%)†	390 (78)	709 (75)	1,470 (50)	2,125 (57)	2,075 (58)	3,106 (63)	4,098 (60)	6,553 (66)	1,580
Men who have sex with men (%)†	89 (18)	186 (20)	1,463 (49)	1,495 (40)	1,411 (40)	1,752 (35)	2,615 (38)	3,220 (32)	3,518
Transgender women (%)†	22 (4)	47 (5)	34 (1)	97 (3)	67 (19)	109 (2)	96 (1)	148 (1)	573
No. of country or regional programs reporting PrEP initiation	5	7	12	11	11	14	15	15	200
No. of country or regional programs reporting PrEP initiation among key populations	3	5	8	6	9	11	14	13	333

Abbreviation: AIDS = acquired immunodeficiency syndrome.
* Percentage of all PrEP clients.
† Percentage of all key population clients.

Overall, among 35 PEPFAR-supported country or regional programs, 15† (34%) have reported providing PrEP services to general population clients, and 13§ have reported providing PrEP services to key population clients.

Among all PEPFAR-supported programs, six (Asia Region, Kenya, South Africa, Uganda, Vietnam, and Zimbabwe) were classified as early adopters of PrEP for key populations. Implementing partners in five of these programs (all except Vietnam) identified critical factors for early adoption of PrEP (Table 2), including national and regional stakeholder meetings with strong ongoing engagement and advocacy from ministries of health, community advocates, and multilateral partners such as the World Health Organization and the Joint United Nations Programme on HIV/AIDS (UNAIDS). Five early adopter programs included PrEP services in national treatment and prevention guidelines despite the lack of favorable legal environments to safeguard key populations from violence and discrimination. Early programs also reported standardized, routine HIV service provider training and the ability of their governments to procure PrEP.

† Asia Region, Botswana, Democratic Republic of the Congo, Dominican Republic, Kenya, Lesotho, Namibia, Nigeria, South Africa, Tanzania, Uganda, Ukraine, Vietnam, Zambia, and Zimbabwe. The Asia Region includes China, Laos, and Thailand.
§ Asia Region, Botswana, Dominican Republic, Kenya, Lesotho, Namibia, Nigeria, South Africa, Tanzania, Uganda, Vietnam, Zambia, and Zimbabwe.

TABLE 2. Critical factors and scale-up accelerators associated with early adoption of expansion of preexposure prophylaxis (PrEP) among key populations in programs supported by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) — Asia Region, Kenya, South Africa, Uganda, and Zimbabwe, October 2016-September 2018

Critical factors and scale-up accelerators	Asia Region	Kenya	South Africa	Uganda	Zimbabwe
National stakeholder consultations and engagement	National consultations on PrEP held in 2012	National and multilateral stakeholders meetings led by MOH in 2016	Extensive stakeholder consultations with academics and key population groups coordinated by NDoH in 2016	Multiple consultations including key population groups, MOH, and multilateral partners in 2017	Wide, multisectoral, multilateral stakeholder meetings including key population groups in 2016
Favorable legal environment for key populations	Not favorable but not criminalized	Not favorable; strong MOH advocacy for key populations and LGBT persons	Legal protection for LGBT persons	Not favorable	Not favorable
Existing PrEP treatment guidelines	National PrEP guidelines published in 2018	PrEP guidelines launched in July 2016	National policy on PrEP developed and published in March 2016	PrEP guidelines developed by MOH and endorsed in 2017	PrEP implementation plan and guidelines developed and launched in 2018
HIV service provider training	Training for health care workers at hospitals and health centers in 13 provinces with high HIV prevalence	Training, CME, and clinical mentorship for HIV service providers	Regular HIV service provider training for accredited PrEP centers	Training manual developed; training provided at 70 sites	Oral PrEP training curriculum developed and launched
Existing drug procurement system	National drug procurement system	National drug procurement system	PrEP procured by NDoH with CDC and PEPFAR funds	National drug procurement system	Funded through PEPFAR and pharmaceutical companies
Provision of other services	PrEP offered as part of general clinical services	PrEP integrated with behavioral and clinical services	Part of HIV combination prevention for all HIV service providers	Part of HIV combination prevention services for all HIV service providers	Part of HIV combination prevention services for all HIV service providers
Government's active ownership	Development of web-based platform to monitor PrEP use	Prioritization of key populations for PrEP service delivery	NDoH coordination of PrEP rollout and data collection	Development of PrEP implementation tools and guidelines	National technical working group to oversee PrEP implementation
Innovative demand creation activities	Promoted through several social media channels, websites, and in key population safe spaces and meeting places	Promoted through national campaign, social media, and at key population clinics and meeting places	Done for each key population with social media and at drop-in centers and meeting places	Promoted through drop-in centers and the assistance of peers, peer educators, and peer navigators	Done for grassroots key population organizations in safe spaces and key population clinics
Multiple service delivery models	PrEP provided at eight key population–led service centers and in approximately 40 public hospitals and health centers	PrEP provided at drop-in centers, mobile outreach services	PrEP provided at drop-in centers and mobile clinics at key population meeting places	PrEP provided by outreach at drop-in centers and integrated into public facilities	PrEP provided at clinics and by mobile outreach

Abbreviations: CME = continuing medical education; HIV = human immunodeficiency virus; LGBT = lesbian, gay, bisexual, and transgender; MOH = ministry of health; NDoH = national department of health.

Factors that accelerated PrEP scale-up included active government ownership of the national PrEP program and innovations in PrEP service delivery. Most governments supported PrEP programs by drafting policies and guidelines, developing or adapting PrEP training curricula, accrediting sites, and collecting and reporting data. PrEP marketing innovations, including promoting PrEP outside the typical clinical platform through drop-in centers or key population safe spaces; on social media; at meeting places such as sex clubs and gay bars; and in the community through peer outreach also were critical accelerators (*5*).

Discussion

PrEP implementation among key populations has been successful in some PEPFAR-supported programs despite the absence of laws and policies to protect key populations who seek HIV services. That key populations accounted for 29%–56% of all PrEP initiations underscores the relative success of PrEP implementation among these populations, given that they might represent a small proportion of the overall population. PrEP early adopter programs shared several critical characteristics and reported common scale-up accelerators, including cooperation among national governments, PrEP implementers, and community advocates. These factors can

Summary

What is already known about this topic?

Preexposure prophylaxis (PrEP) reduces human immunodeficiency virus (HIV) infection incidence.

What is added by this report?

During October 2016–September 2018, in 15 of 35 country or regional programs supported by the U.S. President's Emergency Plan for AIDS Relief, the increase in PrEP coverage among the general population was approximately triple that among female sex workers, men who have sex with men, and transgender women. Critical factors associated with successful PrEP implementation in these populations include stakeholder engagement, existing PrEP delivery guidelines, HIV service provider training, and a drug procurement system.

What are the implications for public health practice?

Sharing best practices could facilitate adoption of PrEP in other country or regional programs and contribute to epidemic control.

provide insights for programs that have not yet introduced or sufficiently scaled PrEP services to reach key populations.

As of October 2018, only 13 of 35 PEPFAR-supported country or regional programs were implementing PrEP for key populations. The findings in this report suggest that global and regional advocacy can help engage community stakeholders and encourage governments to develop national PrEP guidelines in programs that have yet to implement PrEP. For programs currently providing PrEP services, the scale-up accelerators identified in this report can help streamline services to key populations by integrating PrEP into a combination prevention strategy. For example, a successful PrEP program can attract persons seeking to learn their HIV status and subsequently identify HIV-negative persons at substantial risk for HIV, identify previously undiagnosed HIV-positive persons, and link patients with newly diagnosed HIV infection to rapid antiretroviral therapy initiation (*6*). This simultaneous delivery of PrEP and antiretroviral therapy services could synergize prevention, early identification of HIV-positive persons, and treatment to achieve epidemic control (*7*).

Because the effectiveness of PrEP depends upon consistent use among persons at continued risk, monitoring adherence to PrEP and retention in the program is important. Since 2019, PEPFAR has required programs to monitor PrEP adherence, retention, coverage, and potential impact (*2*). Novel PrEP delivery mechanisms (e.g., event-driven PrEP and long-acting PrEP injectable drugs) are being explored as alternatives to daily oral PrEP. One study in Thailand concluded that incorporating PrEP delivery into existing antiretroviral therapy programs could be a cost-effective strategy to prevent HIV infection among MSM (*5*).

The findings in this report are subject to at least two limitations. First, PrEP retention data were not collected; therefore, the impact of PrEP scale-up on epidemic control is unknown. Recognizing the need to quantify how long persons remain on PrEP, PEPFAR introduced a reporting indicator in October 2018 to track retention. Second, it is possible that, because of stigma, some participants did not disclose their status as members of key populations, leading to underestimation of the proportion of key populations initiating PrEP. To improve the correct classification of key population status among PrEP initiates, PEPFAR continues to support the efforts of country or regional programs to collect key population information that is equally important for clinical management of clients.

PrEP implementation in PEPFAR-supported country or regional programs is gradually increasing among general and key populations. Scale-up of this HIV prevention method in all populations at substantial risk and sharing best practices could contribute to faster HIV epidemic control. Cost-effectiveness and mathematical modeling studies might be useful to help identify subpopulations for PrEP delivery to achieve the greatest HIV prevention impact in resource-limited settings, including other PEPFAR programs.

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Update: Public Health Response to the Coronavirus Disease 2019 Outbreak — United States, February 24, 2020

Daniel B. Jernigan, MD[1]; CDC COVID-19 Response Team

On February 25, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

An outbreak of coronavirus disease 2019 (COVID-19) caused by the 2019 novel coronavirus (SARS-CoV-2) began in Wuhan, Hubei Province, China in December 2019, and has spread throughout China and to 31 other countries and territories, including the United States (*1*). As of February 23, 2020, there were 76,936 reported cases in mainland China and 1,875 cases in locations outside mainland China (*1*). There have been 2,462 associated deaths worldwide; no deaths have been reported in the United States. Fourteen cases have been diagnosed in the United States, and an additional 39 cases have occurred among repatriated persons from high-risk settings, for a current total of 53 cases within the United States. This report summarizes the aggressive measures (*2*,*3*) that CDC, state and local health departments, multiple other federal agencies, and other partners are implementing to slow and try to contain transmission of COVID-19 in the United States. These measures require the identification of cases and contacts of persons with COVID-19 in the United States and the recommended assessment, monitoring, and care of travelers arriving from areas with substantial COVID-19 transmission. Although these measures might not prevent widespread transmission of the virus in the United States, they are being implemented to 1) slow the spread of illness; 2) provide time to better prepare state and local health departments, health care systems, businesses, educational organizations, and the general public in the event that widespread transmission occurs; and 3) better characterize COVID-19 to guide public health recommendations and the development and deployment of medical countermeasures, including diagnostics, therapeutics, and vaccines. U.S. public health authorities are monitoring the situation closely, and CDC is coordinating efforts with the World Health Organization (WHO) and other global partners. Interim guidance is available at https://www.cdc.gov/coronavirus/index.html. As more is learned about this novel virus and this outbreak, CDC will rapidly incorporate new knowledge into guidance for action by CDC, state and local health departments, health care providers, and communities.

Person-to-person spread of COVID-19 appears to occur mainly by respiratory transmission. How easily the virus is transmitted between persons is currently unclear. Signs and symptoms of COVID-19 include fever, cough, and shortness of breath (*4*). Based on the incubation period of illness for Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS) coronaviruses, as well as observational data from reports of travel-related COVID-19, CDC estimates that symptoms of COVID-19 occur within 2–14 days after exposure. Preliminary data suggest that older adults and persons with underlying health conditions or compromised immune systems might be at greater risk for severe illness from this virus (*5*).

COVID-19 Cases in the United States

As of February 23, 14 COVID-19 cases had been diagnosed in the following six states: Arizona (one case), California (eight), Illinois (two), Massachusetts (one), Washington (one), and Wisconsin (one). Twelve of these 14 cases were related to travel to China, and two cases occurred through person-to-person transmission to close household contacts of a person with confirmed COVID-19. An additional 39 cases were reported among repatriated U.S. citizens, residents, and their families returning from Hubei province, China (three), and from the Diamond Princess cruise ship that was docked in Yokohama, Japan (36). Thus, there have been 53 cases within the United States. No deaths have been reported in the United States.

CDC Public Health Response

As of February 24, 2020, a total of 1,336 CDC staff members have been involved in the COVID-19 response, including clinicians (i.e., physicians, nurses, and pharmacists), epidemiologists, veterinarians, laboratorians, communicators, data scientists and modelers, and coordination staff members. Of these CDC staff members, 497 (37%) have been deployed to 39 locations in the United States and internationally, including CDC quarantine stations at U.S. ports of entry, state and local health departments, hospitals, and U.S. military bases that are housing quarantined persons, as well as WHO and ministries of health around the world. CDC staff members are working with state, local, tribal, and territorial health departments and other public health authorities to assist with case identification, contact tracing, evaluation of persons under investigation

(PUI) for COVID-19,* and medical management of cases; and with academic partners to understand the virulence, risk for transmission, and other characteristics of this novel virus.

CDC teams are working with the Department of Homeland Security at 11 airports where all flights from China are being directed to screen travelers returning to the United States, and to refer them to U.S. health departments for oversight of self-monitoring. CDC is also working with other agencies of the U.S. government including the U.S. Department of Defense; multiple operational divisions with the U.S. Department of Health and Human Services, including the Assistant Secretary for Preparedness and Response and the Administration for Children and Families; and the U.S. Department of State to safely evacuate U.S. citizens, residents, and their families to the United States from international locations where there is substantial, sustained transmission of COVID-19, and to house them and monitor their health during a 14-day quarantine period.

Specific guidance has been developed and posted online for health care settings, including for patient management; infection control and prevention; laboratory testing; environmental cleaning; worker safety; and international travel.† Guidance is updated as more is learned. To prepare for the possibility of community spread of COVID-19, CDC has developed tailored guidance and communications materials for communities, health care settings, public health, laboratories, schools, and businesses. Chinese and Spanish versions of certain documents are available.

Information for travelers. Several recent travel notices have been posted by CDC to inform travelers and clinicians about current health issues that could affect travelers' health.§ A Level 3 travel notice (avoid all nonessential travel) for China has been in effect since January 27. On February 19, Level 1 travel notices (practice usual precautions) for travelers to Hong Kong and Japan were posted. On February 22, the Level 1 travel notice for Japan was raised to Level 2 (practice enhanced precautions). A Level 2 travel notice was posted for South Korea on February 22, which was updated to Level 3 on February 24. Level 1 travel notices were posted for Iran and Italy on February 23, and then updated to Level 2 on February 24. In addition, CDC has posted information for travelers regarding apparent community transmission in Singapore, Taiwan, Thailand, and Vietnam, and recommendations for persons to reconsider cruise ship voyages in Asia.

Airport screening. As of February 23, a total of 46,016 air travelers had been screened at the 11 U.S. airports to which all flights from China are being directed. Since February 2, travelers to the United States who have been in China in the preceding 14 days have been limited to U.S. citizens and lawful permanent residents and others as outlined in a presidential proclamation.¶ Incoming passengers are screened for fever, cough, and shortness of breath. Any travelers with signs or symptoms of illness receive a more comprehensive public health assessment. As of February 23, 11 travelers were referred to a hospital and tested for infection; one tested positive and was isolated and managed medically. Seventeen travelers were quarantined for 14 days because of travel from Hubei Province, China, an area that was designated as high risk for exposure to COVID-19**; 13 of these 17 have completed their quarantine period.

Persons under investigation (PUIs). Recognizing persons at risk for COVID-19 is a critical component of identifying cases and preventing further transmission. CDC has responded to clinical inquiries from public health officials, health care providers, and repatriation teams to evaluate and test PUIs in the United States for COVID-19 following CDC guidance. As of February 23, 479 persons from 43 states and territories had been or are being tested for COVID-19; 14 (3%) had a positive test, 412 (86%) had a negative test, and 53 (11%) test results are pending.

Laboratory testing. As part of laboratory surge capacity for the response, CDC laboratories are testing for SARS-CoV-2 to assist with diagnosis of COVID-19. During January 18–February 23, CDC laboratories used real-time reverse transcription–polymerase chain reaction (RT-PCR) to test 2,620 specimens from 1,007 persons for SARS-CoV-2. Some additional testing is performed at selected state and other public health laboratories, with confirmatory testing at CDC. CDC is developing a serologic test to assist with surveillance for SARS-CoV-2 circulation in the U.S. population. The test detects antibodies (immunoglobulin [Ig]G, IgA, and IgM) indicating SARS-COV-2 virus exposure or past infection. In addition, CDC laboratories are developing assays to detect SARS-CoV-2 viral RNA and antigens in tissue specimens.

* Criteria to guide evaluation and testing of patients under investigation for SARS-CoV-2 include 1) fever or signs or symptoms of lower respiratory tract illness (e.g., cough or shortness of breath) in any person, including a health care worker, who has had close contact with a patient with laboratory-confirmed SARS-CoV-2 infection within 14 days of symptom onset; 2) fever and signs or symptoms of lower respiratory tract illness (e.g., cough or shortness of breath) in any person with a history of travel from Hubei Province, China, within 14 days of symptom onset; or 3) fever and signs or symptoms of lower respiratory tract illness (e.g., cough or shortness of breath) requiring hospitalization in any person with a history of travel from mainland China within 14 days of symptom onset. Additional information is available at https://emergency.cdc.gov/han/han00427.asp and https://emergency.cdc.gov/han/han00426.asp.

† https://www.cdc.gov/coronavirus/2019-ncov/index.html.

§ https://www.cdc.gov/coronavirus/2019-ncov/travelers/index.html.

¶ Office of the President. Proclamation on suspension of entry as immigrants and nonimmigrants of persons who pose a risk of transmitting 2019 novel coronavirus. Washington, DC: Office of the President; 2020. https://www.whitehouse.gov/presidential-actions/proclamation-suspension-entry-immigrants-nonimmigrants-persons-pose-risk-transmitting-2019-novel-coronavirus/.

** https://www.cdc.gov/coronavirus/2019-ncov/travelers/from-china.html.

Finally, following CDC's establishment of SARS-CoV-2 in cell culture, CDC shared virus isolates with the Biodefense and Emerging Infections Research Resources Repository to securely distribute isolates to U.S. public health and academic institutions for additional research, including vaccine development.

Repatriation flights from areas with substantial COVID-19 transmission. During January 29–February 6, the U.S. government repatriated 808 U.S. citizens, residents, and their families from Hubei Province, China, on five chartered flights. At the time of departure, all travelers were free of symptoms for COVID-19 (fever or feverishness, cough, difficulty breathing). After arriving in the United States, the repatriated travelers were quarantined for 14 days at one of five U.S. military bases. CDC and U.S. government staff members monitored these travelers' health. As of February 23, 28 (3%) of these persons developed COVID-19-related symptoms and were evaluated for infection; three were found to be positive for SARS-CoV-2 and were referred for medical care and isolation. As of February 24, the remaining 805 travelers had completed their 14-day quarantine.

On February 3, passengers and crew of the Diamond Princess cruise ship were quarantined off Yokohama, Japan; a passenger who had recently disembarked in Hong Kong was confirmed to have COVID-19, and ongoing transmission was identified on the ship. By February 16, a total of 355 cases of COVID-19 had been identified among passengers and crew,[††] including 67 U.S. citizens or residents. As a result, during February 16–17, the U.S. government assisted in the repatriation of 329 U.S. citizens or residents from the ship. These travelers returned on two chartered flights. As of February 23, 36 (11%) of these repatriated persons had tested positive for SARS-CoV-2 and are under appropriate medical supervision. The remaining repatriated persons are in quarantine for 14 days. CDC is working with the U.S. embassy in Japan and the Japanese government to support U.S. passengers and crew who remained in Japan.

Discussion

COVID-19 is a serious public health threat. Cases of COVID-19 have been diagnosed in the United States, primarily in travelers from China and quarantined repatriates, and also in two close contacts of COVID-19 patients. Currently, COVID-19 is not recognized to be spreading in U.S. communities. If sustained transmission in U.S. communities is identified, the U.S. response strategy will enhance implementation of actions to slow spread in communities (*2*,*6*). Implementation of basic precautions of infection control and prevention, including staying home when ill and practicing respiratory and hand hygiene will become increasingly important.

Community-level nonpharmaceutical intervention might include school dismissals and social distancing in other settings (e.g., postponement or cancellation of mass gatherings and telework and remote-meeting options in workplaces). These measures can be disruptive and might have societal and economic impact on individual persons and communities (*6*). However, studies have shown that early layered implementation of these interventions can reduce the community spread and impact of infectious pathogens such as pandemic influenza, even when specific pharmaceutical treatments and vaccines are not available (*7*,*8*). These measures might be critical to avert widespread COVID-19 transmission in U.S. communities (*2*,*6*). Mitigation measures implemented in China have included the closing of major transport hubs and preventing exit from certain cities with widespread transmission, cancellation of Chinese New Year celebrations, and prohibition of attendance at school and work (*5*). However, the impact of these measures in China has not yet been evaluated.

In the United States, the National Institutes of Health (NIH) and their collaborators are working on development of candidate vaccines and therapeutics for COVID-19. In China, multiple clinical trials of investigational therapeutics have been implemented, including two clinical trials of remdesivir, an investigational antiviral drug.[§§] An NIH randomized controlled clinical trial of investigational therapeutics for hospitalized COVID-19 patients in the United States was approved by the Food and Drug Administration; the first investigational therapeutic to be studied is remdesivir.[¶¶] In the absence of a vaccine or therapeutic, community mitigation measures are the primary method to respond to widespread transmission and supportive care is the current medical treatment.

COVID-19 symptoms are similar to those of influenza (e.g., fever, cough, and shortness of breath), and the current outbreak is occurring during a time of year when respiratory illnesses from influenza and other viruses, including other coronaviruses that cause the "common cold," are highly prevalent. To prevent influenza and possible unnecessary evaluation for COVID-19, all persons aged ≥6 months should receive an annual influenza vaccine; vaccination is still available and effective in helping to prevent influenza (*9*). To decrease risk for respiratory disease, persons can practice recommended preventive measures.[***] Persons ill with symptoms of COVID-19 who have had contact with a person with COVID-19 or recent travel to countries with apparent community spread[†††] should communicate

[††] https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200216-sitrep-27-covid-19.pdf?sfvrsn = 78c0eb78_2.

[§§] https://clinicaltrials.gov/ct2/show/NCT04257656?cond = remdesivir&draw = 2&rank = 1; https://clinicaltrials.gov/ct2/show/NCT04252664?cond = remdesivir&draw = 2&rank = 2.

[¶¶] https://clinicaltrials.gov/ct2/show/NCT04280705?cond = COVID-19&draw = 4&rank = 22.

[***] https://www.cdc.gov/coronavirus/2019-ncov/about/prevention-treatment.html.

[†††] https://www.cdc.gov/coronavirus/2019-ncov/locations-confirmed-cases.html.

Summary

What is already known about this topic?

An outbreak of coronavirus disease 2019 (COVID-19) has spread throughout China and to 31 other countries and territories, including the United States.

What is added by this report?

Fourteen cases have been diagnosed in the United States, in addition to 39 cases among repatriated persons from high-risk settings, for a current total of 53 cases within the United States. The U.S. government and public health partners are implementing aggressive measures to slow and contain transmission of COVID-19 in the United States.

What are the implications for public health practice?

Interim guidance is available at https://www.cdc.gov/coronavirus/index.html. As more is learned about this virus and the outbreak, CDC will rapidly incorporate new knowledge into guidance for action.

with their health care provider. Before seeking medical care, they should consult with their provider to make arrangements to prevent possible transmission in the health care setting. In a medical emergency, they should inform emergency medical personnel about possible COVID-19 exposure.

Areas for additional COVID-19 investigation include 1) further clarifying the incubation period and duration of virus shedding, which have implications for duration of quarantine and other mitigation measures; 2) studying the relative importance of various modes of transmission, including the role of droplets, aerosols, and fomites; understanding these transmission modes has major implications for infection control and prevention, including the use of personal protective equipment; 3) determining the severity and case-fatality rate of COVD-19 among cases in the U.S. health care system, as well as more fully describing the spectrum of illness and risk factors for infection and severe disease; 4) determining the role of asymptomatic infection in ongoing transmission; and 5) assessing the immunologic response to infection to aid in the development of vaccines and therapeutics. Public health authorities are monitoring the situation closely. As more is learned about this novel virus and this outbreak, CDC will rapidly incorporate new knowledge into guidance for action.

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Notes from the Field

Syndromic Surveillance Used To Monitor Emergency Department Visits During a Synthetic Cannabinoid Overdose Outbreak — Connecticut, August 2018

Sydney A. Jones, PhD[1,2]; Kristen Soto, MPH[2]; Erin Grogan, MS[2]; Alexander Senetcky, MPH[2]; Susan Logan, MS, MPH[2]; Matthew Cartter, MD[2]

On the morning of August 15, 2018, the Connecticut Department of Public Health (CTDPH) learned from media reports about multiple persons found unresponsive in a city park in New Haven County after using synthetic cannabinoids (SCs), manmade psychoactive substances that can cause unpredictable and sometimes severe health effects. Prevalence of acute SC poisonings has increased in the United States in recent years (*1*). Syndromic surveillance data collected in near real-time have been used to track outbreaks of illness and to improve public health authorities' situational awareness about trends in suspected drug overdoses (*2*). CTDPH monitored syndromic surveillance data from emergency department (ED) visit records to identify the magnitude of the SC overdose outbreak and provide situational awareness during the outbreak to state and local health departments.

Since January 2018, CTDPH syndromic surveillance system has collected data on ED visits from all 38 EDs in Connecticut by using the EpiCenter system (Health Monitoring Systems, Inc.). Using Health Level Seven messaging,* EDs transfer visit data (e.g., patient sex, age, ZIP Code of residence, chief complaint, and triage notes) to EpiCenter upon patient registration and discharge in near real-time (i.e., <5 minutes).

Within 20 minutes of receiving the first media report, CTDPH developed an ad hoc syndrome definition to identify ED visits for suspected SC overdoses by querying EpiCenter. The syndrome definition was derived from keywords in the chief complaint, selected in an iterative process from terms in media reports and ED visit record reviews. Initial keywords included terms for SCs (e.g., "K2," "spice," or "weed") and later refined to include terms for location (e.g., "green," "bench," or "park"). By midday on August 15, a total of 25 suspected outbreak-related ED visits had been identified; by 5:00 p.m. on August 16, the number had increased to 55, all in New Haven County. CTDPH leadership and the local health department were updated with these data via periodic e-mails. The outbreak response ended on August 17. The U.S. Department of Justice Drug Enforcement Administration determined that SCs implicated in this outbreak contained AMB-FUBINACA, an ultrapotent SC with strong depressant effects (*3*,*4*).

On August 20, CTDPH further refined the syndromic case definition to include keywords in either chief complaint or triage notes to retrospectively identify outbreak-related ED visits during August 15–16 that were missed by near real-time chief complaint analysis. For this retrospective analysis, an outbreak-related ED visit was defined as an ED visit in New Haven County during August 15–16 with SC- or location-related keywords in the chief complaint or triage notes. Among 2,086 ED visits in New Haven County during August 15–16, a total of 72 met the updated outbreak-related SC overdose syndrome definition. Those 72 ED visits comprised 53 unique patients, 12 of whom returned to the ED up to five times for SC overdose visits, indicating possible reexposure to SC containing AMB-FUBINACA. Median patient age was 43 years (interquartile range = 35–51 years), and 41 (77%) patients were male. Among 63 ED visits with discharge disposition data, patients were discharged after 57 ED visits (90%), and six (10%) left without being seen; none died.

Near real-time syndromic surveillance data provided timely situational awareness to public health departments about the approximate magnitude of the outbreak; a follow-up analysis allowed the extent of the SC outbreak to be characterized and confirmed that the outbreak had ended. After this outbreak, CTDPH created additional substance- and location-specific overdose syndrome definitions to help detect future drug overdose–related events and built an exploratory data analysis dashboard to facilitate near real-time data analysis. This outbreak also led to development of CTDPH standard operating guidelines for information sharing and resource allocation with response partners during overdose-related events. CTDPH shared best practices and the syndrome definition from this investigation with the National Syndromic Surveillance Program Community of Practice.† Syndromic surveillance has the potential to be an important tool to provide public health officials with situational awareness of substance use–related morbidity.

* Health Level Seven is a nationally recognized standard for electronic data exchange between systems housing health care data, which enables two-way exchange of information using a standardized vocabulary and syntax. https://www.cdc.gov/nssp/documents/guides/syndrsurvmessagguide2_messagingguide_phn.pdf.

† The National Syndromic Surveillance Program Community of Practice is a collaboration among CDC, federal partners, state and local health departments, academic institutions, and private sector partners. https://www.cdc.gov/nssp/overview.html.

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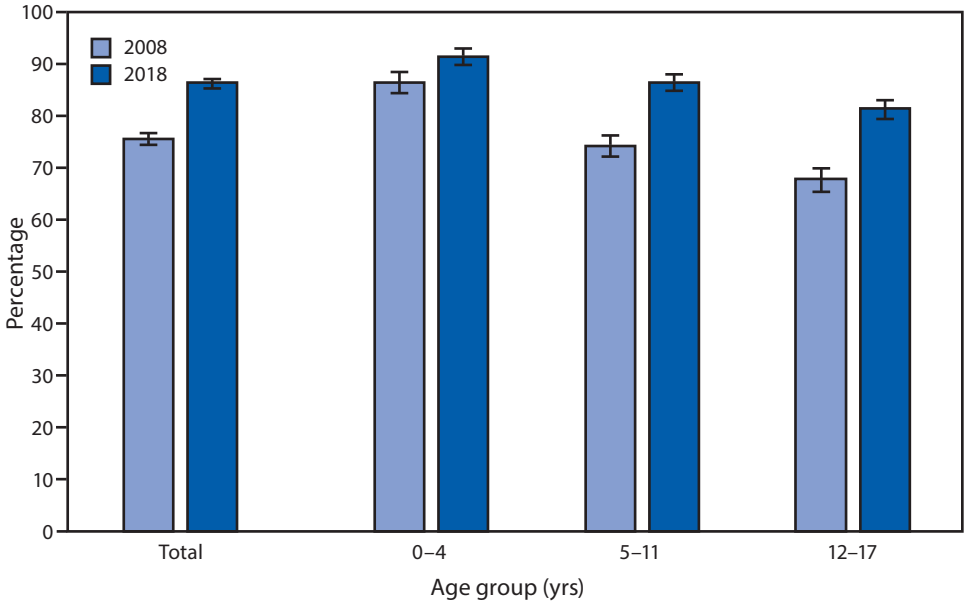
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Children† Aged <18 Years Who Received a Well-Child Checkup in the Past 12 Months,§ by Age Group and Year — National Health Interview Survey, United States, 2008 and 2018¶



* Percentages shown with 95% confidence intervals.
† Children defined here as infants, children, and adolescents (i.e., persons aged 0–17 years).
§ Based on the response of "yes" to the survey question "During the past 12 months did (sample child) receive a well-child checkup — that is, a general checkup when (he/she) was not sick or injured?"
¶ 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 child component.

The percentage of children aged 0–17 years who received a well-child checkup increased from 75.8% in 2008 to 86.5% in 2018. Receipt of a well-child checkup increased for all age groups: from 86.7% to 91.9% among those aged 0–4 years, from 74.5% to 86.9% among those aged 5–11 years, and from 68.0% to 81.7% among those aged 12–17 years. For both 2008 and 2018, the percentage of children who received a well-child checkup decreased as age increased.

Source: National Health Interview Survey, 2008 and 2018 data. https://www.cdc.gov/nchs/nhis.htm.

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