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Trends in the Prevalence of Chronic Obstructive Pulmonary Disease Among Adults Aged ≥18 Years — United States, 2011–2021

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Abstract

Chronic obstructive pulmonary disease (COPD) is a leading cause of death in the United States. Overall COPD prevalence declined during 1999–2011. Trends in COPD prevalence during the previous decade have not been reported. CDC analyzed 2011–2021 Behavioral Risk Factor Surveillance System data to assess trends and differences in self-reported physician-diagnosed COPD prevalence among U.S. adults aged ≥18 years. Age-standardized prevalence of COPD did not change significantly from 2011 (6.1%) to 2021 (6.0%). Prevalence was stable for most states and subgroups; however, it decreased significantly among adults aged 18–44 years (average annual percent change [AAPC] = −2.0%) and increased significantly among those aged ≥75 years (AAPC = 1.3%), those living in micropolitan counties (0.8%), and among current (1.5%) or former (1.2%) smokers. COPD prevalence remained elevated in the following groups: women, adults aged ≥65 years, those with a lower education level, unable to work, living in rural areas, and who ever smoked. Evidence-based strategies, especially those tailored for adults disproportionately affected, can reduce COPD prevalence, and address the continued need for prevention, early diagnosis, treatment, and management.

Introduction

Chronic obstructive pulmonary disease (COPD) is a group of progressive lung diseases, including emphysema and chronic bronchitis. COPD accounts for most of the deaths from chronic lower respiratory diseases, the sixth leading cause of death in the United States in 2021 (*1*). Elevated prevalence of COPD has been reported in the following groups: women, older adults (aged ≥65 years), residents in rural areas, adults with a lower education level, and those who ever smoked (*2*). During 1999–2011, estimates from the National Health Interview Survey (NHIS) indicated that the prevalence of self-reported physician-diagnosed COPD significantly declined among U.S. adults (aged ≥25 years) overall and among adults aged 25–44 years (*3*). Trends and differences in COPD prevalence during the previous decade have not been reported overall and by subgroups.

Methods

Data Collection

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual state-based, random-digit–dialed mobile and landline telephone survey among noninstitutionalized U.S. adults aged ≥18 years; the survey covers all 50 states, the District of

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Columbia (DC), and U.S. territories.* The median survey response rate for all states and DC was 49.7% in 2011† and 43.8% in 2021.§ The analytic sample included respondents with complete data for COPD, sex, age, race and ethnicity, education, employment, urban-rural status, and smoking status (2011: 478,788 [96.2% of respondents had complete information]; 2021¶: 386,439 [89.5% of respondents had complete information]). Self-reported physician-diagnosed COPD was defined as 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?"

Data Analysis

CDC estimated age-specific or age-standardized prevalence (standardized to the 2000 projected U.S. population)** of COPD overall, by selected characteristics including urban-rural status,†† and by state. Overall and for all subgroups, linear and nonlinear trends in COPD prevalence during 2011–2021 were assessed using permutation tests in Joinpoint trend analysis software (version 4.8.0.1; National Cancer Institute§§). Annual percent change (APC) for each line segment (when joinpoints were identified) and average annual percent change (AAPC) from 2011 to 2021 were estimated. Differences by selected characteristics (compared with a reference category) in COPD prevalence for years 2011 and 2021 were assessed using *t*-tests. Linear trend tests were performed using orthogonal polynomial contrasts for ordinal variables.¶¶ The statistical significance level for all the tests was set at alpha = 0.05. Analyses were conducted using SAS software (version 9.4; SAS Institute) and SAS-callable SUDAAN software (version 11.0.1; RTI International) to account for the complex sample design and weighting. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.***

Results

Differences by Sociodemographic Characteristics

An estimated 6.4% of U.S. adults (population estimate = 14.3 million) in 2011 and 6.5% (14.2 million) in 2021 had COPD (Table 1). In 2011 and 2021, age-standardized COPD

* https://www.cdc.gov/brfss/

† https://www.cdc.gov/brfss/annual_data/2011/pdf/2011_Summary_Data_Quality_Report.pdf

§ https://www.cdc.gov/brfss/annual_data/2021/pdf/2021-DQR-508.pdf

¶ The sample of 386,439 respondents in 2021 does not include those in Florida. Florida was unable to collect data during enough months to meet the minimum requirements for inclusion in the 2021 public-use dataset.

** https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

†† As defined in the CDC National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties with six urbanization levels: four metropolitan (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan) and two nonmetropolitan (micropolitan and noncore). https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf

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

¶¶ https://www.cdc.gov/nchs/data/series/sr_02/sr02_179.pdf

*** 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

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TABLE 1. Trends and differences in prevalence of chronic obstructive pulmonary disease among adults aged ≥18 years, by sociodemographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2011–2021

Characteristic	2011*			2021*			2011–2021		
	Sample size	No. of adults with COPD (x1,000)	% (95% CI)	Sample size	No. of adults with COPD (x1,000)	% (95% CI)	AAPC, % (95% CI)	No. of joinpoints†	Segment-specific APC, % (95% CI)
Overall									
Crude	478,788	14,276	6.4 (6.2 to 6.5)	386,439	14,170	6.5 (6.4 to 6.7)	0.4 (–0.0 to 0.9)	0	—§
Age-standardized¶	478,788	14,276	6.1 (6.0 to 6.3)	386,439	14,170	6.0 (5.9 to 6.2)	0.0 (–0.6 to 0.6)	0	—
Sex¶									
Men (Ref)	187,876	5,877	5.4 (5.2 to 5.5)	178,716	6,154	5.5 (5.3 to 5.7)	0.2 (–0.3 to 0.6)	0	—
Women	290,912	8,399	6.9 (6.7 to 7.0)**	207,723	8,016	6.5 (6.3 to 6.7)**	–0.3 (–0.8 to 0.2)	0	—
Age group, yrs††									
18–44	130,837	3,443	3.2 (3.0 to 3.4)	117,294	2,739	2.7 (2.6 to 2.9)	–2.0 (–3.1 to –0.9)§§	0	—
45–64	195,611	6,044	7.8 (7.6 to 8.1)	130,157	5,368	7.9 (7.6 to 8.2)	–0.1 (–1.3 to 1.1)	1	2011–2018: 1.1 (0.1 to 2.1)§§ 2018–2021: –2.8 (–6.9 to 1.4)
65–74	82,898	2,634	12.3 (11.8 to 12.7)	80,941	3,462	12.1 (11.6 to 12.7)	0.4 (–0.3 to 1.0)	0	—
≥75	69,442	2,156	11.8 (11.4 to 12.3)	58,047	2,600	13.2 (12.5 to 13.9)	1.3 (0.2 to 2.3)§§	0	—
Race or ethnicity¶									
Hispanic or Latino	30,662	1,071	4.1 (3.7 to 4.5)**	30,697	1,261	3.9 (3.5 to 4.4)**	–0.3 (–2.1 to 1.6)	0	—
American Indian or Alaska Native, non-Hispanic	6,794	256	10.4 (9.0 to 11.9)**	6,555	225	10.2 (8.8 to 11.8)**	0.1 (–1.2 to 1.5)	0	—
Asian, Native Hawaiian, or Pacific Islander, non-Hispanic	9,328	179	2.3 (1.7 to 2.9)**	10,743	209	1.9 (1.2 to 2.8)**	0.6 (–2.4 to 3.6)	0	—
Black or African-American, non-Hispanic	39,277	1,546	6.2 (5.8 to 6.7)	28,213	1,633	6.2 (5.7 to 6.7)	–0.7 (–2.0 to 0.6)	0	—
White, non-Hispanic (Ref)	381,484	10,799	6.4 (6.3 to 6.6)	298,583	10,503	6.5 (6.3 to 6.7)	0.2 (–0.3 to 0.6)	0	—
Other, non-Hispanic	11,243	426	10.7 (9.4 to 12.0)**	11,648	339	8.0 (7.1 to 9.1)**	–2.1 (–3.3 to –0.9)§§	0	—
Education¶,††									
Less than high school diploma	42,171	3,511	9.9 (9.4 to 10.4)	22,115	2,921	10.4 (9.7 to 11.1)	0.2 (–0.8 to 1.3)	0	—
High school diploma or GED	142,038	4,946	7.1 (6.8 to 7.4)	97,878	4,513	7.3 (7.0 to 7.6)	0.6 (–0.1 to 1.4)	0	—
Some college or technical school	129,392	4,132	6.2 (6.0 to 6.5)	107,182	4,774	6.6 (6.4 to 6.9)	0.6 (0.2 to 0.9)§§	0	—
College graduate	165,187	1,686	2.9 (2.8 to 3.1)	159,264	1,961	2.7 (2.5 to 2.8)	–0.7 (–1.5 to 0.1)	0	—
Employment status¶									
Employed (Ref)	237,171	3,978	3.7 (3.5 to 3.9)	200,549	4,032	3.7 (3.5 to 3.9)	–0.2 (–1.0 to 0.6)	0	—
Unemployed	29,270	1,469	8.1 (7.5 to 8.7)**	18,631	976	7.7 (7.0 to 8.6)**	–0.5 (–2.0 to 1.0)	0	—
Retired	134,809	4,157	8.5 (6.1 to 11.6)**	119,126	5,181	11.0 (7.6 to 15.6)**	1.2 (–6.0 to 8.9)	1	2011–2017: –5.9 (–13.8 to 2.7) 2017–2021: 12.8 (–6.6 to 36.2)
Unable to work	34,197	3,556	20.8 (19.8 to 21.8)**	22,876	3,186	19.3 (18.2 to 20.4)**	–0.9 (–1.3 to –0.5)§§	0	—
Homemaker or student	43,341	1,115	5.1 (4.8 to 5.5)**	25,257	795	5.6 (4.8 to 6.4)**	0.7 (–0.8 to 2.2)	0	—
Urban-rural status¶,††									
Large central metropolitan	75,505	3,330	5.2 (4.9 to 5.5)	57,337	3,266	4.8 (4.5 to 5.2)	–0.7 (–1.6 to 0.2)	0	—
Large fringe metropolitan	86,425	3,100	5.6 (5.3 to 5.9)	74,496	3,238	5.4 (5.1 to 5.7)	–0.2 (–1.1 to 0.6)	0	—
Medium metropolitan	106,501	3,117	6.3 (6.1 to 6.6)	80,224	3,033	6.5 (6.1 to 6.8)	0.2 (–0.2 to 0.7)	0	—
Small metropolitan	63,723	1,540	6.9 (6.5 to 7.3)	54,798	1,493	6.7 (6.3 to 7.1)	–0.4 (–1.2 to 0.4)	0	—
Micropolitan	73,761	1,734	7.6 (7.2 to 8.0)	62,619	1,738	8.0 (7.5 to 8.4)	0.8 (0.2 to 1.4)§§	0	—
Noncore	72,873	1,452	7.8 (7.4 to 8.3)	56,965	1,401	8.2 (7.7 to 8.8)	0.4 (–0.7 to 1.5)	1	2011–2018: .7 (0.8 to 2.7)§§ 2018–2021: 2.7 (–6.4 to 1.2)

See table footnotes on the next page.

TABLE 1. (*Continued*) Trends and differences in prevalence of chronic obstructive pulmonary disease among adults aged ≥18 years, by sociodemographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2011–2021

Characteristic	2011*			2021*			2011–2021		
	Sample size	No. of adults with COPD (x1,000)	% (95% CI)	Sample size	No. of adults with COPD (x1,000)	% (95% CI)	AAPC, % (95% CI)	No. of joinpoints†	Segment-specific APC, % (95% CI)
Smoking status¶									
Current smoker	80,833	5,585	13.7 (13.3 to 14.2)**	50,637	4,943	16.2 (15.6 to 16.9)**	1.5 (1.1 to 1.8)§§	0	—
Former smoker	141,395	5,219	7.0 (6.7 to 7.4)**	106,928	5,453	7.7 (7.3 to 8.0)**	1.2 (0.5 to 2.0)§§	0	—
Never smoker (Ref)	256,560	3,473	2.9 (2.7 to 3.0)	228,874	3,774	2.8 (2.6 to 2.9)	−0.4 (−1.2 to 0.4)	0	—

Abbreviations: AAPC = average annual percent change; APC = annual percent change; COPD = chronic obstructive pulmonary disease; GED = general educational development certificate; Ref = referent group.

* Estimates were calculated using sampling weights. The analytic sample included respondents with complete data for COPD, sex, age, race or ethnicity, education, employment status, urban-rural status, and smoking status (weighted estimate for 2011: 224.4 million [95.4% of weighted sample had complete information]; 2021: 216.5 million [89.0% of weighted sample had complete information]). Florida was unable to collect data during enough months to meet the minimum requirements for inclusion in the 2021 public-use dataset.

† Indicates a nonlinear trend if the number of joinpoints is equal to one or more.

§ Dashes indicate that no joinpoints (no line segments) were identified using permutation test in the best-fit joinpoint model.

¶ Age-standardized COPD prevalence was calculated using the 2000 U.S. Census Bureau projected U.S. adult population with five age groups (18–24, 25–34, 35–44, 45–64, and ≥65 years) Distribution #9. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

** Indicates statistically significant difference on the basis of *t*-tests in the COPD prevalence between the reported level of each characteristic and the Ref (p<0.05).

†† Indicates significant linear trend across categories within each (2011 and 2021) year (p<0.05).

§§ Indicates significant linear trend across years using permutation test (p<0.05).

prevalence was higher among women than among men, higher among non-Hispanic American Indian or Alaska Native and non-Hispanic other persons than among non-Hispanic White persons, higher among persons who were unemployed, retired, homemakers or students, and unable to work than among those who were employed, and higher among adults who were current or former smokers than among never smokers; prevalence was lower among non-Hispanic Asian, Native Hawaiian, Pacific Islander, or Hispanic persons than among non-Hispanic White persons. COPD prevalence increased with increasing age, decreasing education level, and decreasing urbanicity.

Trends Over Time

Age-standardized prevalence of COPD from 2011 to 2021 remained stable overall (6.1% in 2011 to 6.0% in 2021; AAPC = 0%) and for most subgroups (Table 1). Significant increases occurred among adults aged ≥75 years (AAPC = 1.3%), respondents with some college or technical school education (AAPC = 0.6%), those living in micropolitan counties (AAPC = 0.8%), and adults who were current smokers (AAPC = 1.5%) or former smokers (AAPC = 1.2%) (Table 1) (Figure). COPD prevalence increased significantly from 2011 to 2018 and remained stable from 2018 to 2021 among adults aged 45–64 years and those living in noncore areas (Table 1). COPD prevalence decreased among adults aged 18–44 years (AAPC = −2.0%) and those who were unable to work (AAPC = −0.9%). Age-standardized COPD prevalence in 2011 ranged from 3.9% in Minnesota to 9.5% in Kentucky and in 2021 from 3.0% in Hawaii to 11.8% in West Virginia (Table 2). From 2011 to 2021, age-standardized COPD prevalence increased significantly in Louisiana (AAPC = 2.4%) and decreased significantly in Hawaii (AAPC = −2.5%), New Mexico (AAPC = −2.4%), Maryland (AAPC = −2.0%), Massachusetts (AAPC = −2.0%), and New York (AAPC = −1.6%). Statistically significant increases in COPD prevalence occurred in Colorado from 2014 to 2021, Utah from 2015 to 2021, and West Virginia from 2011 to 2017; decreases occurred from 2013 to 2021 in Arizona, DC, Washington, and Wyoming.

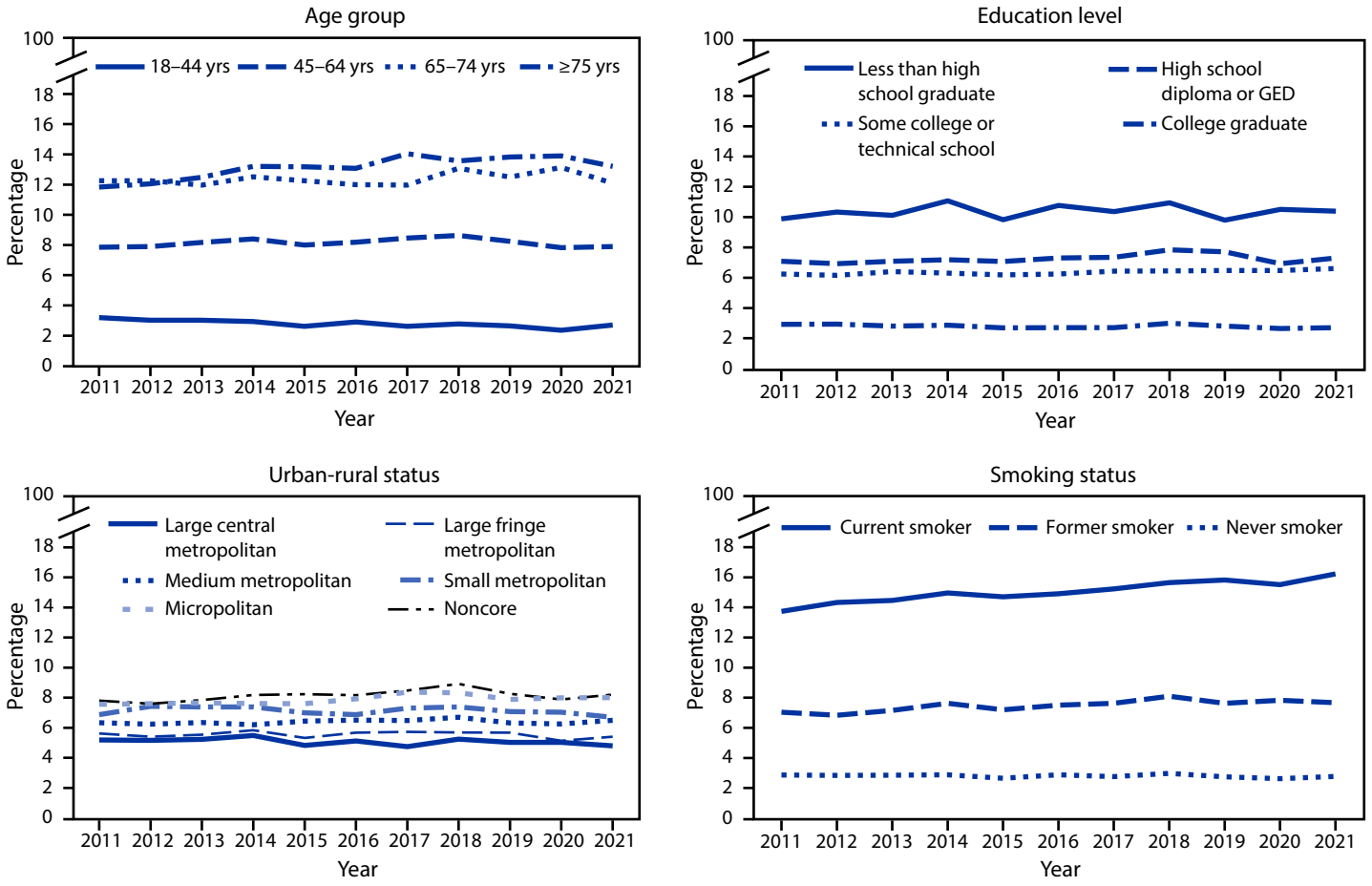
Discussion

An estimated 14.2 million (6.5%) U.S. adults had physician-diagnosed COPD in 2021. Overall prevalence remained unchanged since 2011. These results are consistent with overall COPD mortality rates, which remained unchanged during 1999–2019 (*4*). The prevalence of COPD among adults aged <45 years declined from 2011 to 2021, consistent with the trend during 1999–2011 (*3*). One reason might be the more pronounced decline in prevalence of current smoking among adults aged 18–44 years (36.4% relative decline) than among those aged 45–64 years (22.6%) and those aged ≥65 years (2.1%) from 2005 to 2015 (*5*); cigarette smoking is the dominant cause of COPD among U.S. adults.††† Explanations for the higher prevalence in COPD among those living in micropolitan and noncore counties might include the persistently high prevalence of smoking among adults in rural areas (*6*), the lower rates of persons quitting smoking (*7*), and the increasing proportion of older adults living in rural areas.§§§ The variation in the prevalence of COPD by states is likely related to

††† https://stacks.cdc.gov/view/cdc/21569

§§§ https://www.census.gov/content/dam/Census/library/publications/2019/acs/acs-41.pdf

FIGURE. Prevalence* of chronic obstructive pulmonary disease among adults aged ≥18 years, by selected characteristics — Behavioral Risk Factor Surveillance System, United States, 2011–2021



Abbreviation: GED = general educational development certificate.

* Estimates were calculated using sampling weights and estimates by education level, urban-rural status, and smoking status were age-standardized using the 2000 Census Bureau projected U.S. adult population with five age groups (18–24, 25–34, 35–44, 45–64, and ≥65 years) Distribution #9. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

factors including differences in smoking rates, occupations or industries with higher risk for COPD, and access to health care for screening and detection of COPD (*8*,*9*).

Approximately 25% of adults with COPD (3.8 million) reported having never smoked, similar to 1988–1994 (*10*). In addition to cigarette smoking, secondhand smoke and occupational and environmental exposures are also risk factors for developing COPD among nonsmokers (*8*). Therefore, promotion of smoke-free environments[¶¶¶] and workplace interventions (e.g., raising awareness of harmful work-related respiratory exposures, elimination or substitution of hazardous exposures, and improving ventilation) can help reduce or eliminate COPD-related risk factors.[****]

Limitations

The findings in this report are subject to at least four limitations. First, the diagnosis of COPD, sociodemographic characteristics, and smoking status are all self-reported, and might be subject to recall and social desirability bias. Second, potential systematic bias resulting from low response rates might affect the results. The flat overall trend is also observed in the 2014–2018 NHIS,[††††] suggesting that nonresponse bias did not significantly affect the conclusions of this report. Third, because there were no differences in COPD prevalence in 2020 or 2021 relative to 2019, it appears unlikely that the COVID-19 pandemic influenced reporting of physician-diagnosed COPD. Finally, the findings might not be extrapolated to adults in long-term

[¶¶¶] https://www.cdc.gov/tobacco/secondhand-smoke/index.html

[****] https://www.sciencedirect.com/science/article/pii/S2213260021005063?via%3Dihub

[††††] https://www.lung.org/research/trends-in-lung-disease/copd-trends-brief/copd-prevalence

TABLE 2. Trends in prevalence* of chronic obstructive pulmonary disease among adults aged ≥18 years, by jurisdiction — Behavioral Risk Factor Surveillance System, United States, 2011–2021

	2011	2021	2011–2021		
Jurisdiction	% (95% CI)	% (95% CI)	AAPC % (95% CI)	No. of joinpoints†	Segment-specific APC, % (95% CI)
Alabama	9.3 (8.4 to 10.2)	8.6 (7.5 to 9.8)	−0.4 (−1.5 to 0.7)	0	—§
Alaska	5.9 (4.9 to 7.1)	5.5 (4.7 to 6.3)	−0.7 (−3.3 to 2.0)	0	—
Arizona	5.1 (4.4 to 5.9)	5.0 (4.4 to 5.6)	0.5 (−4.2 to 5.5)	1	2011–2013: 15.1 (−13.8 to 53.6) 2013–2021: −2.8 (−5.1 to −0.5)¶
Arkansas	7.4 (6.5 to 8.4)	8.9 (7.8 to 9.9)	1.3 (−0.1 to 2.8)	0	—
California	4.5 (4.1 to 4.9)	4.4 (3.8 to 5.1)	−0.3 (−1.4 to 0.9)	0	—
Colorado	4.7 (4.2 to 5.2)	4.9 (4.4 to 5.4)	−0.5 (−2.3 to 1.3)	1	2011–2014: −6.0 (−12.0 to 0.2) 2014–2021: 1.9 (0.1 to 3.8)¶
Connecticut	5.8 (4.9 to 6.8)	4.6 (4.0 to 5.2)	−1.2 (−2.8 to 0.3)	0	—
Delaware	4.9 (4.2 to 5.7)	5.7 (4.7 to 6.6)	0.9 (−1.7 to 3.5)	0	—
District of Columbia	4.8 (4.0 to 5.7)	4.8 (3.9 to 5.8)	0.4 (−2.6 to 3.5)	1	2011–2013: 15.2 (−3.3 to 37.1) 2013–2021: −3.0 (−4.9 to −1.1)¶
Florida	7.3 (6.6 to 8.1)	—**	−0.2 (−2.1 to 1.7)**	0	—
Georgia	7.0 (6.4 to 7.8)	6.2 (5.4 to 7.0)	−1.2 (−4.2 to 1.9)	1	2011–2019: 0.6 (−1.0 to 2.3) 2019–2021: −8.2 (−23.0 to 9.7)
Hawaii	4.2 (3.6 to 4.9)	3.0 (2.5 to 3.5)	−2.5 (−4.4 to −0.5)¶	0	—
Idaho	5.1 (4.4 to 5.9)	5.3 (4.6 to 5.9)	0.8 (−0.6 to 2.2)	0	—
Illinois	6.0 (5.2 to 7.0)	5.0 (4.1 to 5.9)	−0.1 (−2.0 to 1.8)	0	—
Indiana	8.0 (7.3 to 8.7)	7.8 (7.1 to 8.4)	0.5 (−0.6 to 1.7)	0	—
Iowa	4.7 (4.2 to 5.4)	6.0 (5.3 to 6.6)	0.9 (−0.7 to 2.5)	0	—
Kansas	6.3 (5.9 to 6.8)	5.8 (5.4 to 6.2)	−0.3 (−1.2 to 0.6)	0	—
Kentucky	9.5 (8.7 to 10.5)	10.2 (9.2 to 11.3)	0.3 (−1.2 to 1.9)	0	—
Louisiana	6.6 (6.0 to 7.4)	8.2 (7.2 to 9.2)	2.4 (1.1 to 3.8)¶	0	—
Maine	7.0 (6.5 to 7.6)	7.4 (6.7 to 8.1)	0.7 (−0.7 to 2.1)	0	—
Maryland	5.8 (5.1 to 6.6)	4.4 (4.0 to 4.9)	−2.0 (−3.2 to −0.7)¶	0	—
Massachusetts	5.5 (5.1 to 6.0)	5.4 (4.6 to 6.1)	−2.0 (−3.8 to −0.1)¶	0	—
Michigan	7.5 (6.8 to 8.3)	7.4 (6.7 to 8.1)	0.0 (−1.5 to 1.4)	0	—
Minnesota	3.9 (3.5 to 4.4)	4.2 (3.8 to 4.6)	0.3 (−0.8 to 1.5)	0	—
Mississippi	8.1 (7.4 to 9.0)	8.7 (7.6 to 9.8)	1.6 (−0.4 to 3.6)	0	—
Missouri	7.7 (6.9 to 8.7)	7.7 (7.0 to 8.4)	0.5 (−0.6 to 1.5)	0	—
Montana	5.5 (4.9 to 6.3)	4.9 (4.3 to 5.6)	−0.6 (−2.5 to 1.3)	0	—
Nebraska	4.8 (4.4 to 5.1)	5.2 (4.7 to 5.7)	0.7 (−0.5 to 2.0)	0	—
Nevada	7.2 (6.2 to 8.4)	6.0 (4.9 to 7.0)	−1.0 (−2.2 to 0.2)	0	—
New Hampshire	6.0 (5.3 to 6.8)	6.4 (5.5 to 7.3)	0.3 (−1.7 to 2.3)	0	—
New Jersey	5.0 (4.5 to 5.5)	4.9 (4.3 to 5.6)	1.1 (−2.3 to 4.7)††	0	—
New Mexico	5.9 (5.4 to 6.6)	4.9 (4.2 to 5.5)	−2.4 (−3.7 to −1.1)¶	0	—
New York	5.8 (5.1 to 6.5)	5.0 (4.6 to 5.4)	−1.6 (−2.9 to −0.3)¶	0	—
North Carolina	6.6 (6.0 to 7.3)	7.1 (6.1 to 8.1)	0.2 (−1.2 to 1.7)	0	—
North Dakota	4.6 (4.0 to 5.4)	4.5 (3.8 to 5.2)	1.5 (−0.3 to 3.2)	0	—
Ohio	7.2 (6.5 to 7.9)	7.9 (7.2 to 8.6)	0.3 (−0.6 to 1.2)	0	—
Oklahoma	8.2 (7.4 to 8.9)	7.4 (6.5 to 8.2)	0.5 (−0.7 to 1.7)	0	—
Oregon	5.5 (4.9 to 6.3)	5.4 (4.7 to 6.1)	−0.6 (−2.3 to 1.2)	0	—
Pennsylvania	6.2 (5.6 to 6.9)	6.2 (5.4 to 6.9)	0.2 (−0.7 to 1.0)	0	—
Rhode Island	5.9 (5.2 to 6.7)	5.2 (4.4 to 6.0)	−0.4 (−2.5 to 1.8)	0	—
South Carolina	7.1 (6.5 to 7.7)	6.9 (6.1 to 7.6)	0.2 (−0.7 to 1.1)	0	—
South Dakota	5.1 (4.3 to 6.0)	5.3 (3.9 to 6.6)	0.4 (−2.3 to 3.2)	0	—
Tennessee	8.8 (7.3 to 10.5)	9.5 (8.4 to 10.5)	0.3 (−1.1 to 1.7)	0	—
Texas	5.6 (5.1 to 6.2)	6.0 (5.2 to 6.8)	0.0 (−1.4 to 1.5)	0	—
Utah	4.3 (3.9 to 4.8)	4.5 (4.0 to 4.9)	0.3 (−1.2 to 1.9)	1	2011–2015: −2.5 (−6.0 to 1.1) 2015–2021: 2.2 (0.0 to 4.4)¶
Vermont	4.5 (4.0 to 5.2)	5.6 (4.8 to 6.4)	0.9 (−0.6 to 2.5)	0	—
Virginia	6.0 (5.3 to 6.8)	6.2 (5.5 to 6.8)	−0.1 (−1.4 to 1.3)	0	—
Washington	4.0 (3.6 to 4.6)	4.8 (4.3 to 5.2)	0.5 (−2.9 to 4.0)	1	2011–2013: 15.4 (−5.4 to 40.7) 2013–2021: −2.9 (−4.8 to −0.9)¶
West Virginia	8.3 (7.4 to 9.2)	11.8 (10.8 to 12.7)	2.5 (−1.3 to 6.3)	1	2011–2017: 7.8 (2.6 to 13.3)¶ 2017–2021: −5.1 (−13.0 to 3.7)
Wisconsin	5.1 (4.2 to 6.2)	5.0 (4.1 to 6.0)	−0.2 (−1.9 to 1.4)	0	—
Wyoming	6.0 (5.3 to 6.8)	5.6 (4.7 to 6.5)	−1.0 (−2.9 to 0.9)	1	2011–2013: 6.6 (−4.4 to 18.8) 2013–2021: −2.9 (−4.1 to −1.6)¶

Abbreviations: AAPC = average annual percent change; APC = annual percent change; COPD = chronic obstructive pulmonary disease.

* Estimates were calculated using sampling weights and age-standardized using the 2000 U.S. Census Bureau projected U.S. adult population with five age groups (18–24, 25–34, 35–44, 45–64, and ≥65 years) Distribution #9 (https://www.cdc.gov/nchs/data/statnt/statnt20.pdf). The analytic sample included respondents with complete data for COPD, sex, age, race and ethnicity, education, employment status, urban-rural status, and smoking status (2011: 478,788 respondents; 2021: 386,439).

† Indicates a nonlinear trend if the number of joinpoints is equal to one or more.

§ Dashes indicate that no joinpoints (no line segments) were identified using permutation test in the best-fit joinpoint model.

¶ Significant linear trend across years using permutation test ($p<0.05$).

** Respondents in Florida were not included in 2021. AAPC was derived on the basis of data available during 2011–2020 (COPD prevalence = 6.2 [5.4–7.1] in 2020).

†† Respondents in New Jersey were not included in 2019. AAPC was derived on the basis of data available during 2011–2018 (COPD prevalence = 5.1 [3.9–6.3] in 2018).

Summary

What is already known about this topic?

Demographic disparities in chronic obstructive pulmonary disease (COPD) prevalence have been reported. COPD prevalence among adults aged ≥25 years declined during 1999–2011.

What is added by this report?

From 2011 to 2021, prevalence of COPD among adults remained stable overall (6.1% to 6.0%) and in most subgroups and states; prevalence increased among adults aged ≥75 years, those living in rural areas, and those who ever smoked. Disparities based on rural residence and smoking status increased.

What are the implications for public health practice?

Evidence-based strategies, especially those tailored for groups disproportionately affected, can reduce COPD prevalence and address the continued need for prevention, early diagnosis, treatment, and management.

care facilities, or in prisons, or those without a telephone because BRFSS collects data only from noninstitutionalized adults with a landline or mobile telephone.

Implications for Public Health Practice

The COPD National Action Plan provides a comprehensive framework for developing and implementing COPD prevention, treatment, and management strategies.[§§§§] Patient and population-based initiatives focusing on COPD prevention (e.g., smoking cessation, smoke-free policies, and workplace interventions), early-diagnosis, treatment (e.g., medication and oxygen therapy), and management (e.g., access to pulmonary rehabilitation and caregiving, efforts to prevent exacerbations) might reduce COPD prevalence, slow the progression of the disease, and lessen symptoms. Although smoking is one of the main risk factors for COPD, it is important that initiatives include strategies for the 25% of U.S. adults with COPD who reported having never smoked. Strategies can be tailored to address the prevention of COPD-related risk factors and the needs of adults disproportionately affected by COPD, including persons aged ≥75 years, those who ever smoked, and residents of rural areas. For example, residents of rural areas have less access to pulmonologists (*9*). Implementation of COPD programs designed for rural communities can address the challenges that people from these areas face, including higher prevalence of tobacco use, cultural barriers, poverty, and lack of specialists or transportation.[¶¶¶¶]

[§§§§] https://www.nhlbi.nih.gov/health-topics/education-and-awareness/COPD-national-action-plan

[¶¶¶¶] https://www.ruralhealthinfo.org/toolkits/copd

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Fatal Occupational Asthma in Cannabis Production — Massachusetts, 2022

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Abstract

Multiple respiratory hazards have been identified in the cannabis cultivation and production industry, in which occupational asthma and work-related exacerbation of preexisting asthma have been reported. An employee working in a Massachusetts cannabis cultivation and processing facility experienced progressively worsening work-associated respiratory symptoms, which culminated in a fatal asthma attack in January 2022. This report represents findings of an Occupational Safety and Health Administration inspection, which included a worksite exposure assessment, coworker and next-of-kin interviews, medical record reviews, and collaboration with the Massachusetts Department of Public Health. Respiratory tract or skin symptoms were reported by four of 10 coworkers with similar job duties. Prevention is best achieved through a multifaceted approach, including controlling asthmagen exposures, such as cannabis dust, providing worker training, and conducting medical monitoring for occupational allergy. Evaluation of workers with new-onset or worsening asthma is essential, along with prompt diagnosis and medical management, which might include cessation of work and workers' compensation when relation to work exposures is identified. It is important to recognize that work in cannabis production is potentially causative.

Introduction

Studies in the cannabis cultivation and production industry have identified multiple respiratory hazards such as microbial and plant allergens and irritants, as well as chemicals, including pesticides, and allergens specific to the cannabis plant itself (*1*–*3*). Employees in some work areas are exposed to large quantities of ground cannabis. Respiratory and skin signs and symptoms, including asthma, allergic rhinitis, and urticaria, have been reported (*2*,*3*). Work-related asthma includes occupational asthma (new-onset asthma induced by sensitizers or irritants) and work-related exacerbation of preexisting asthma, worsened by work exposures (*4*). An employee working in a Massachusetts indoor cannabis facility experienced progressively worsening work-associated respiratory symptoms, which culminated in a fatal occupational asthma attack. This report provides information obtained in the public health investigation performed to determine the cause of this fatality and identify prevention options.

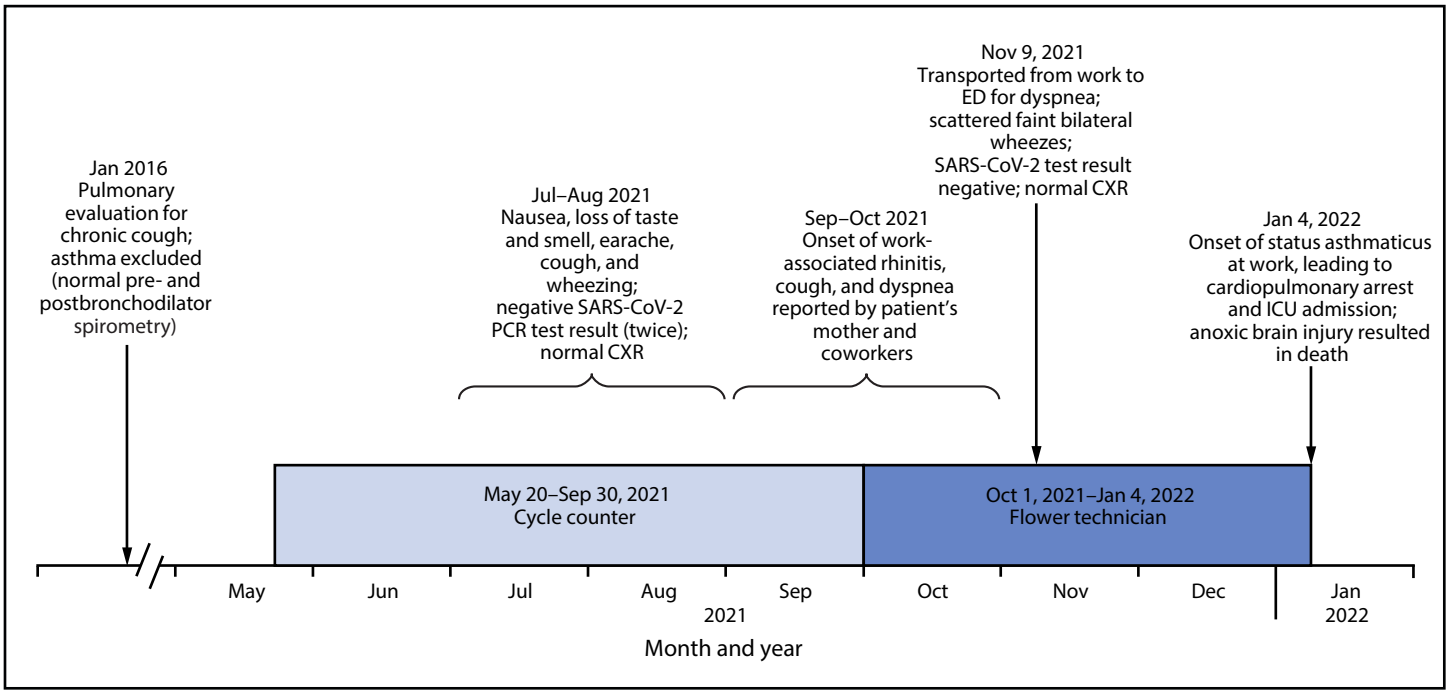
Case Report

The employee, a woman aged 27 years, began work at an indoor cannabis cultivation and processing facility on May 20, 2021. She worked throughout the facility as a cycle counter, including in areas where the cannabis product was ground (Figure). In late July, she experienced onset of nausea, loss of taste and smell, earache, and cough, and her employer required her to obtain SARS-CoV-2 testing; the results of two tests were negative. Bilateral diffuse wheezing was noted when a physical examination was performed during the evaluation for the second test. The patient's mother later reported that, although her daughter had no previous history of asthma, allergies, or skin rash, she had developed work-related runny nose, cough, and shortness of breath after 3–4 months of employment.

On October 1, the employee moved to flower production, which entailed grinding of cannabis flowers for approximately 15 minutes, three times per day, and preparing cannabis cigarettes (prerolls). These activities resulted in increased dust exposure. Dust from the grinder was collected by a shop vacuum; however, the vacuum had no high-efficiency particulate air (HEPA) filter, and visible dust escaped. Additional dust-generating processes included open handling of ground product (e.g., while transferring product from the grinder and filling prerolls). Other flower production coworkers reported that the employee's cough increased, particularly when the grinder was on. Efforts to reduce her exposure included covering the grinder vacuum with plastic (the outside of which became visibly coated with ground cannabis) and moving her workstation outside the grinder room. She also used her own N95 respirator and wore company-required long sleeves and gloves while working.

On November 9, the employee became acutely dyspneic at work and was transported by emergency medical services (EMS) to a local emergency department (Figure). Enroute to the hospital, she received an albuterol nebulizer, and her dyspnea resolved. She reported that she did not have asthma but stated that she might be allergic to something at work because she had had a cough and runny nose for >1 month. Bilateral faint wheezes were noted, and she was prescribed a 5-day course of prednisone, cetirizine, and an albuterol inhaler; follow-up with a primary care physician was recommended. Her mother reported that the employee did not become short of breath at home, except when carrying a heavy load upstairs. She said that her daughter told her before her subsequent fatal asthma attack that the inhaler, which she used primarily at work, was

FIGURE. Timeline of work assignments,* onset of signs and symptoms, and events associated with fatal occupational asthma in a cannabis facility worker — Massachusetts, 2021–2022



Abbreviations: CXR = chest radiograph; ED = emergency department; ICU = intensive care unit; PCR = polymerase chain reaction.
* Cycle counter's responsibilities are counting packaged cannabis products throughout the facility, including in ground product areas; flower technician's responsibilities are grinding cannabis flowers and making prerolls.

nearly empty. This finding suggests that the employee had used most of the approximately 200 inhalations available in her inhaler over a period of approximately 2 months.

On January 4, 2022, the employee told a coworker that her shortness of breath had been getting progressively worse during the preceding 2 weeks. Later that day, while filling prerolls, she began sneezing, and her coughing increased. Despite repeated albuterol inhaler use, her dyspnea worsened, and EMS was called again. She suffered a cardiopulmonary arrest before EMS arrived, and her coworkers began resuscitation. She regained spontaneous circulation. However, she did not regain consciousness. Expiratory wheezing was noted. Anoxic brain death was diagnosed on January 7, 2022, and care was withdrawn. An autopsy was not performed.

Public Health Investigation

The Massachusetts Department of Public Health investigation revealed that the employee had had a pulmonary evaluation in 2016 for chronic cough, which included pre- and postbronchodilator spirometry without a methacholine challenge (a bronchoprovocation test used to help diagnose asthma). The pulmonologist excluded asthma and implicated cigarette and marijuana smoking, gastroesophageal reflux disease, and rhinitis in the etiology of her cough symptoms. Her primary care physician had not seen the employee since 2015, and subsequently had not prescribed any allergy or asthma medication.

The Occupational Safety and Health Administration (OSHA) inspection included personal air sampling after the grinder was connected to a new shop vacuum with HEPA filtration. The 8-hour time-weighted average respirable dust concentration in air from the personal breathing zone of the grinder operator was 0.012 mg/m^3, and for two nearby employees, was nondetectable; OSHA's permissible exposure limit for respirable dust (particulates not otherwise regulated) is 5 mg/m^3.* Additional 8-hour monitoring for endotoxin, a pro-inflammatory contaminant associated with gram-negative bacterial growth on organic materials such as cannabis flowers, revealed 27 endotoxin units per cubic meter of air (EU/m^3) (grinder operator) and 1.8 and 1.9 EU/m^3 (nearby employees); the Dutch Expert Committee on Occupational Safety 8-hour time weighted average recommendation is ≤90 EU/m^3.† A 15-minute personal air sample obtained from the personal

* https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ1

† A recommended short-term exposure limit for endotoxins has not been established. Importantly, airborne respirable dust and endotoxin levels below occupational exposure limits do not exclude work-related triggers of asthma and other allergic signs and symptoms (e.g., cannabis allergens). https://www.healthcouncil.nl/documents/advisory-reports/2010/07/15/endotoxins-health-based-recommended-occupational-exposure-limit

breathing zone of the operator during active grinding was 14 EU/m^3. OSHA interviewed one former and nine current flower production coworkers of the employee during February–April, 2022, four of whom reported work-related respiratory tract or skin signs and symptoms; symptoms in the former employee suggested occupational asthma, because, although he had a past history of asthma, he had not required a bronchodilator inhaler since adolescence. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§]

Discussion

Cannabis industry employees are exposed to large quantities of ground product in some work areas, such as flower grinding and preroll production. Asthma, allergic rhinitis, and urticaria have been reported among cannabis production workers (*2*,*3*). Several allergens have been identified, and irritants are present as well (*1*–*3*). Work-related asthma includes occupational asthma (i.e., new-onset asthma induced by sensitizers or irritants) and work-exacerbated asthma (i.e., preexisting asthma worsened by work exposures) (*4*). In this case, absence of a history of asthma and the temporal relationship between work exposure and asthma signs and symptoms are consistent with a diagnosis of occupational asthma. Airborne respirable dust and endotoxin levels below occupational exposure limits do not exclude a sufficient level of airborne allergen to trigger asthma and other allergic symptoms.

Enhanced surveillance for work-related asthma in the state of Washington identified seven asthma cases among employees in indoor cannabis production facilities (*5*). Three employees with work-exacerbated asthma discontinued cannabis employment; one with occupational asthma was symptomatic in two different cannabis facilities separated by a 2-year asymptomatic period while unexposed.

In a study of employees at an indoor Washington cannabis production facility, 13 of 31 employees had symptoms suggestive of asthma (i.e., presence of either an attack of shortness of breath, an attack of asthma, or the use of asthma medication) (*6*). Among 10 employees with occupational allergy symptoms, seven had abnormal spirometry, and five had skin prick testing consistent with cannabis sensitization. Five employees had abnormal or borderline fractional exhaled nitrogen oxide testing, which is used as a marker of airway inflammation in asthma management; results increased significantly across the work week, indicating an increase in airway inflammation.

Fatal asthma can occur even with disease that is considered mild; disparities in income, education, and access to health care are risk factors associated with death (*7*). Work-related asthma has also been associated with poorer asthma control (*8*). Additional risk factors for the deceased employee in this case report include the emergency department visit, recent use of oral glucocorticoids, increased dyspnea and bronchodilator inhaler use without inhaled glucocorticoids, continued exposure, and lack of a provider with expertise in occupational allergies (*7*,*9*).

Occupational asthma is generally associated with a latency period of months to years between first exposure and symptoms (*10*). For example, fatal occupational asthma related to exposure to powdered shark cartilage was reported 16 months after exposure onset (*10*). Although latency from this employee's first occupational cannabis exposure to symptom onset was short, latency from first exposure was longer because of personal cannabis use. Cross-sensitivity between cannabis and plant allergens might also have predisposed this employee to cannabis sensitization (*3*).

Limitations

The findings in this report are subject to at least three limitations. First, although the employee's course is consistent with fatal asthma triggered by cannabis allergy, this finding was not evaluated by skin testing or specific immunoglobulin E tests. Second, airborne cannabis allergen levels could not be assessed. Finally, as in many occupational fatality cases, investigators were not able to speak with the employee, requiring details to be obtained from other sources such as medical records and interviews with coworkers and next-of-kin.

Implications for Public Health Practice

Providers and public health professionals would benefit from additional research into prevalence and risk factors for cannabis-related occupational allergies. Development and implementation of strategies to protect workers are critical in this rapidly expanding industry. Measures to protect employees might include determination and control of exposures, training of employees and facility managers, correct use of personal protective equipment, and medical management of employees with work-related symptoms, which might require cessation of work and workers' compensation (Box). It is important to recognize that work in cannabis production is a risk for occupational allergies.

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[§] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

BOX. Measures for protecting cannabis industry employees from occupational hazards — United States, 2023

Exposure Assessment[*,†]
- Qualitative assessment to identify areas and processes of highest potential dust exposure
- Quantitative assessment of airborne levels as needed to assist in evaluating controls for dust and other exposures

Environmental Exposure Controls
- Equipment controls (e.g., exhaust ventilation for cannabis grinder) to mitigate risk from dust-producing processes
- Work procedures to reduce airborne dust (e.g., high-efficiency particulate air–filtered vacuuming rather than dry sweeping)

Personal Protective Equipment
- In dusty settings, personal protective equipment for skin (e.g., gloves, long sleeves, or sleeve guards), eyes (e.g., safety glasses or goggles) and respiratory protection (e.g., an N95 particulate respirator) as needed
- However, personal protective equipment might not be effective for persons with signs and symptoms of work-related allergies

Employee Training
- To identify potential job hazards
- To recognize signs and symptoms of occupational allergy (e.g., rhinitis, conjunctivitis, asthma, and urticaria; particularly if new-onset or worse at work)
- To seek prompt medical evaluation for signs and symptoms of occupational allergy
- To use work processes that minimize exposures*
- To use and maintain personal protective equipment

Medical Surveillance
- Directed by a health care provider with expertise in occupational allergy and asthma
- Focused on early detection of signs and symptoms of occupational allergy
- Aggregated analysis of all workers' results to identify exposures and jobs that result in highest risk for allergic sensitization and disease

Medical Management Options and Workers' Compensation
- Workplace restrictions for sensitized persons, recognizing that complete cessation of exposure rather than exposure reduction might be necessary
- Recognition of work-related allergic sensitization potential in cannabis industry employees for workers' compensation claims and regulations

Examples of Current Research Gaps
- Development of exposure assessment methods and exposure controls to facilitate effective prevention of occupational allergic disease
- Assessment of prevalence and risk factors for occupational allergy and disease in cannabis workers
- Development of reliable, clinically available diagnostic tests for cannabis sensitization

* https://stacks.cdc.gov/view/cdc/91903
† https://www.researchgate.net/publication/369800248_The_Emerging_Spectrum_of_Respiratory_Diseases_in_the_US_Cannabis_Industry

Summary

What is already known about this topic?

Occupational allergic diseases, including asthma, are an emerging concern in the rapidly expanding U.S. cannabis industry.

What is added by this report?

In 2022, the first death attributed to occupational asthma in a U.S. cannabis production worker occurred in Massachusetts. This case illustrates missed opportunities for prevention, including control of workplace exposures, medical surveillance, and treatment according to current asthma guidelines.

What are the implications for public health practice?

Prevention is best achieved through a multifaceted approach. It is essential to evaluate workers with new-onset or worsening asthma for relation to work exposures and to recognize work in cannabis production as potentially causative.

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Progress Toward Measles Elimination — Worldwide, 2000–2022

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Abstract

Measles is a highly contagious, vaccine-preventable disease that requires high population immunity for transmission to be interrupted. All six World Health Organization regions have committed to eliminating measles; however, no region has achieved and sustained measles elimination. This report describes measles elimination progress during 2000–2022. During 2000–2019, estimated coverage worldwide with the first dose of measles-containing vaccine (MCV) increased from 72% to 86%, then declined to 81% in 2021 during the COVID-19 pandemic, representing the lowest coverage since 2008. In 2022, first-dose MCV coverage increased to 83%. Only one half (72) of 144 countries reporting measles cases achieved the measles surveillance indicator target of two or more discarded cases per 100,000 population in 2022. During 2021–2022, estimated measles cases increased 18%, from 7,802,000 to 9,232,300, and the number of countries experiencing large or disruptive outbreaks increased from 22 to 37. Estimated measles deaths increased 43% during 2021–2022, from 95,000 to 136,200. Nonetheless, an estimated 57 million measles deaths were averted by vaccination during 2000–2022. In 2022, measles vaccination coverage and global surveillance showed some recovery from the COVID-19 pandemic setbacks; however, coverage declined in low-income countries, and globally, years of suboptimal immunization coverage left millions of children unprotected. Urgent reversal of coverage setbacks experienced during the COVID-19 pandemic can be accomplished by renewing efforts to vaccinate all children with 2 MCV doses and strengthening surveillance, thereby preventing outbreaks and accelerating progress toward measles elimination.

Introduction

Measles is a highly contagious, vaccine-preventable disease that requires high population immunity for transmission to be interrupted. All six World Health Organization (WHO) regions have committed to eliminating measles*; however, no region has achieved and sustained measles elimination. The Immunization Agenda 2030 (IA2030)† includes measles elimination as a core indicator of impact. IA2030 highlights the importance of ensuring rigorous measles surveillance systems to identify immunity gaps, and of achieving equitable 95% coverage with 2 timely childhood doses of measles-containing vaccine (MCV). Because measles is highly infectious, failures of routine immunization services to reach children are rapidly revealed by the occurrence of outbreaks primarily affecting unvaccinated children. Thus, measles infections act as a tracer of the ability of the health system to deliver essential vaccines in childhood. This report describes progress toward measles elimination during 2000–2022, including immunization activities, assessment of surveillance performance, numbers of measles cases, estimates of the number of measles cases and deaths, and elimination verification status, and updates a previous report (*1*).

Methods

Immunization and Surveillance Data Collection and Analysis

WHO and UNICEF estimate coverage with the first and second MCV doses (MCV1 and MCV2, respectively) delivered through routine immunization services§ for all countries, using annual administrative coverage data (the number of vaccine doses administered divided by the estimated target population), national coverage estimates,¶ and vaccination coverage surveys. Countries report the annual number of incident measles cases to WHO and UNICEF, using the Joint Reporting Form, and these data are used to calculate measles incidence.** The Global Measles and Rubella Laboratory Network (GMRLN) consists of 743 laboratories that support measles and rubella surveillance by providing quality-controlled laboratory testing to detect measles-specific immunoglobulin M in serum specimens and to perform genotyping of measles virus from clinical specimens (*2*).

* Measles elimination is defined as the absence of endemic measles virus transmission in a region or other defined geographic area for ≥12 months in the presence of a high-quality surveillance system that meets the targets of key performance indicators.

† https://www.who.int/immunization/immunization_agenda_2030/en/

§ Calculated for MCV1, among children aged 1 year or, if MCV1 is given at age ≥1 year, among children aged 24 months. Calculated for MCV2 among children at the recommended age for the administration of MCV2, according to the national immunization schedule. https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/global-monitoring/immunization-coverage/who-unicef-estimates-of-national-immunization-coverage (Accessed July 31, 2023).

¶ Estimates based on administrative data and any other available information on factors affecting immunization coverage, including private or nongovernmental organization sector contributions to immunization, difficulties with demographic data, and incomplete reporting.

** To calculate incidence, only countries that reported data are included in the numerator and denominator. Countries do not provide WHO with their reasons for not reporting measles cases. https://immunizationdata.who.int/pages/incidence/measles.html (Accessed August 7, 2023).

Modeling Estimates

A previously described model for estimating measles cases and deaths was updated with 2022 measles data and United Nations 2000–2022 population estimates[††] (*3*). Data on case fatality rates from a publicly available statistical package (measlesCFR)[§§] were used in the model to calculate estimates of measles mortality, based on previously published methodology (*4*). These activities were reviewed by CDC, deemed not research, and were conducted consistent with applicable federal law and CDC policy.[¶¶]

Results

Immunization Activities

During the first 2 decades of the millennium (2000–2019), estimated MCV1 coverage worldwide increased from 72% to 86%, then declined to 83% in 2020 during the COVID-19 pandemic, and declined further to 81% in 2021 (Table 1). Coverage in all regions declined during 2019–2021. In 2022, global coverage increased to 83%, and increased in all regions except in the Americas and the European Region. Regional coverage remained below 2019 levels in all regions except the Eastern Mediterranean Region. During 2019–2021, MCV1 coverage in low-income countries fell from 71% to 67%, then to 66% in 2022 (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/135223).

Among the 194 WHO countries, 65 (34%) achieved ≥95% MCV1 coverage in 2022. In 2022, the 21.9 million infants who did not receive MCV1 through routine immunization services represented a decrease of 2.5 million (10%) compared with 2021, and a 2.7 million increase compared with 2019. The 10 countries with the highest number of infants who did not receive MCV1 were Nigeria (3 million), Democratic Republic of the Congo (1.8 million), Ethiopia (1.7 million), India (1.1 million), Pakistan (1.1. million), Angola (0.8 million), Philippines (0.8 million), Indonesia (0.7 million), Brazil (0.5 million), and Madagascar (0.5 million). These 10 countries accounted for 55% of all children worldwide who did not receive MCV1. The top nine countries also had the highest number of children who had not received MCV1 in 2021 (Madagascar replaced Tanzania as the 10th country in 2022).

Estimated MCV2 coverage increased from 17% in 2000 to 74% in 2022,[***] largely as a result of vaccine introductions; however, 11 million children did not receive MCV2 through routine immunization in 2022. The number of countries offering MCV2 increased by 98%, from 95 (49%) in 2000 to 188 (97%) in 2022. Six countries (Chad, Democratic Republic of the Congo, Guinea, Guinea-Bissau, Somalia, and Uganda) introduced MCV2 in 2022, and six countries (Benin, Central African Republic, Gabon, Mauritania, South Sudan, and Vanuatu) have yet to introduce MCV2.[†††]

Approximately 115 million persons received MCV through supplementary immunization activities (SIAs)[§§§] in 44 countries in 2022, and an additional 16 million received MCV during measles outbreak response activities. Among 41 MCV campaigns delayed because of the COVID-19 pandemic, 35 (85%) in 29 countries had been conducted by the end of December 2022.

Surveillance Performance and Reported Measles Incidence

Among the 144 (74%) countries that reported discarded cases[¶¶¶] in 2022, 72 (50%) achieved the measles surveillance sensitivity indicator target of two or more discarded cases per 100,000 population, compared with 47 (35%) of 135 countries reporting in 2021, 45 (31%) of 143 countries reporting in 2020, and 46 (32%) of 144 countries reporting in 2019. In 2022, GMRLN laboratories received 273,080 specimens for measles testing compared with 139,319 in 2021, 121,257 in 2020, and 282,020 in 2019.

[††] State-space model of unobserved measles incidence during 2000–2022 generated using the following inputs from all member countries: 1) total annual reported measles cases; 2) annual MCV1 coverage from WHO and UNICEF estimates of national immunization coverage (WUENIC); 3) annual MCV2 coverage from WUENIC; 4) annual SIAs, with coverage and age targets (subnational SIAs are discounted by the proportion of the total population targeted); 5) total annual population size; 6) total annual births; and 7) list of all countries and years for which reporting was enhanced.

[§§] The measlesCFR model (https://github.com/Measles-Case-Fatality-Ratio-Estimation/measlesCFR) fitted the reported case fatality ratios from the systematic review as a function of the following covariates: 1) gross domestic product per capita, 2) HIV prevalence, 3) maternal education, 4) MCV1 coverage, 5) proportion urban, 6) total fertility rate, 7) mortality rate among children aged <5 years, 8) prevalence of vitamin A deficiency, 9) war and terrorism mortality rate, 10) wasting (weight-for-height more than 1 standard deviation below the reference median) prevalence (https://www.healthdata.org/results/gbd_summaries/2019/child-wasting-level-4-risk), and 11) measles incidence. Annual measles incidence for each country and year was based on this fitted state-space model. High income countries were excluded from this analysis.

[¶¶] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

[***] https://immunizationdata.who.int/listing.html?topic=&location=

[†††] Data as of July 31, 2023. http://immunizationdata.who.int/pages/vaccine-intro-by-antigen/mcv2.html?ISO_3_CODE=&YEAR=

[§§§] Measles SIAs are generally conducted using two target age ranges: 1) an initial catch-up SIA targets children aged 9 months–14 years, with the aim of eliminating susceptibility to measles in the general population, and 2) periodic follow-up SIAs are conducted nationwide every 2–4 years and target all children aged 9–59 months to eliminate any measles susceptibility that has accumulated in recent birth cohorts because of low MCV coverage and to protect the estimated 2%–5% of children who did not respond to MCV1. Countries can provide additional data to WHO, and data are updated retrospectively.

[¶¶¶] A discarded measles case is defined as a suspected case that has been investigated and determined to be neither measles nor rubella by using either 1) laboratory testing in a proficient laboratory or 2) epidemiologic linkage to a laboratory-confirmed outbreak of a communicable disease that is not measles or rubella. The discarded case rate is used to measure the sensitivity of measles surveillance.

TABLE 1. Estimates of regional immunization coverage with the first and second doses of measles-containing vaccine administered through routine immunization services, reported measles cases, and measles incidence, by World Health Organization region — worldwide, 2000–2022

WHO region/yr (no. of countries in region)	Percentage				No. of reported measles cases[§] (% of total cases)	Measles incidence [§,¶,**]
	MCV1 coverage*	Countries with ≥95% MCV1 coverage[†]	MCV2 coverage*	Reporting countries with <5 measles cases per 1 million population[§,¶]		
Total (all regions)						
2000 (191)	**72**	**28**	**17**	**33**	**853,479 (100.0)**	**145.3**
2010 (193)	**84**	**45**	**42**	**59**	**343,806 (100.0)**	**49.7**
2016 (194)	**85**	**42**	**67**	**64**	**132,490 (100.0)**	**18.1**
2019 (194)	**86**	**44**	**71**	**44**	**873,022 (100.0)**	**119.5**
2020 (194)	**83**	**30**	**72**	**57**	**159,073 (100.0)**	**21.3**
2021 (194)	**81**	**29**	**71**	**68**	**123,171 (100.0)**	**16.7**
2022 (194)	**83**	**34**	**74**	**58**	**205,153 (100.0)**	**28.8**
African						
2000 (46)	53	2	5	6	**520,102 (60.9)**	832.3
2010 (46)	72	17	5	30	**199,174 (57.9)**	231.5
2016 (47)	69	17	22	49	**36,269 (27.4)**	36.5
2019 (47)	71	13	33	34	**618,595 (70.9)**	559.8
2020 (47)	70	6	40	30	**115,369 (72.5)**	106.3
2021 (47)	68	4	41	34	**88,789 (72.1)**	81.9
2022 (47)	69	11	45	21	**97,237 (47.4)**	81.6
Americas						
2000 (35)	93	40	65	89	**1,754 (0.2)**	2.1
2010 (35)	93	49	67	100	**247 (0.1)**	0.3
2016 (35)	92	46	80	97	**97 (0.1)**	0.1
2019 (35)	87	40	73	89	**21,971 (2.5)**	32.3
2020 (35)	85	20	72	97	**9,996 (6.3)**	9.8
2021 (35)	85	14	75	97	**682 (0.6)**	0.7
2022 (35)	84	17	76	86	**47 (—)**	0.1
Eastern Mediterranean						
2000 (21)	71	29	27	14	**38,592 (4.5)**	86.9
2010 (21)	76	52	52	38	**10,072 (2.9)**	16.5
2016 (21)	82	57	73	52	**6,275 (4.7)**	9.5
2019 (21)	83	48	76	38	**18,458 (2.1)**	26.4
2020 (21)	83	38	77	48	**6,769 (4.3)**	10.3
2021 (21)	82	43	77	52	**26,089 (21.2)**	39.8
2022 (21)	83	48	78	38	**56,401 (27.5)**	82.4
European						
2000 (52)	91	45	48	38	**37,421 (4.4)**	50.0
2010 (53)	94	64	80	68	**30,625 (8.9)**	34.2
2016 (53)	93	49	88	77	**4,440 (3.4)**	5.2
2019 (53)	96	60	92	30	**106,130 (12.2)**	116.6
2020 (53)	94	43	91	70	**10,945 (6.9)**	13.5
2021 (53)	94	47	92	92	**99 (0.1)**	0.1
2022 (53)	93	49	91	85	**825 (0.4)**	1.1
South-East Asia						
2000 (10)	62	18	3	0	**78,558 (9.2)**	50.5
2010 (11)	83	45	15	36	**54,228 (15.8)**	29.7
2016 (11)	89	55	75	27	**27,530 (20.8)**	14.0
2019 (11)	94	64	83	27	**29,389 (3.4)**	14.7
2020 (11)	88	45	80	45	**9,389 (5.9)**	4.8
2021 (11)	86	45	78	55	**6,448 (5.2)**	3.3
2022 (11)	92	55	85	64	**49,201 (24.0)**	23.8
Western Pacific						
2000 (27)	85	30	2	26	**177,052 (20.7)**	106.0
2010 (27)	97	44	87	63	**49,460 (14.4)**	27.5
2016 (27)	96	52	93	48	**57,879 (43.7)**	30.9
2019 (27)	95	59	93	41	**78,479 (9.0)**	41.0
2020 (27)	94	44	93	37	**6,605 (4.2)**	3.5
2021 (27)	90	41	91	56	**1,064 (0.9)**	0.6
2022 (27)	92	44	91	44	**1,442 (0.7)**	0.8

Abbreviations: MCV1 = first dose of measles-containing vaccine; MCV2 = second dose of measles-containing vaccine; WHO = World Health Organization.

* https://immunizationdata.who.int/pages/coverage/mcv.html (Accessed July 31, 2023).

† Denominator is the number of WHO member states.

§ https://immunizationdata.who.int/pages/incidence/measles.html (Accessed August 7, 2023).

¶ Population data from United Nations Department of Economic and Social Affairs, Population Division, 2022. Any country not reporting measles cases for that year was removed from both the numerator and denominator in calculating incidence.

** Cases per 1 million population.

During 2000–2016, the number of reported measles cases declined 85%, from 853,479 to 132,490, corresponding to an 88% decrease in incidence, from 145 cases to 18 cases per 1 million population. During 2019, the number of reported cases (837,922) and reported measles incidence (120 per million) increased more than fivefold compared with 2016. The number of cases then declined to 123,171 in 2021 (incidence of 17 per million) but increased 67% to 205,153 in 2022; incidence increased 71% from 17 to 29 per 1 million population from 2021 to 2022.

In 2022, 37 countries in four WHO regions were affected by large or disruptive measles outbreaks,**** an increase of 68% compared with 22 countries in two regions the preceding year. Among these 2022 outbreaks, 28 of 37 (76%) occurred in countries in the African Region, six (16%) in the Eastern Mediterranean Region, two (5%) in the South-East Asia Region, and one (3%) in the European Region (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/135223). Overall, 31 of 72 countries (43%) achieving the measles surveillance sensitivity indicator target had large or disruptive measles outbreaks during 2022.

Genotypes detected from measles cases†††† were reported by 35 (33%) of the 105 countries reporting at least one measles case in 2022, compared with 22 (27%) of 82 such countries in 2021. As a result of global elimination activities, the number of genotypes detected has been decreasing over time, from 13 in 2002 to two in 2021 and 2022. A total of 800 sequences were reported in 2021, among which 608 (76%) were genotype B3 and 192 (24%) were genotype D8; among 1,470 reported sequences in 2022, 772 (53%) were genotype D8 and 698 (47%) were genotype B3.

Measles Cases and Mortality Estimates

On the basis of the revised model for estimating measles cases and deaths and 2022 data, the estimated number of measles cases decreased 75%, from an estimated 36,463,000 in 2000 to 9,232,300 in 2022; the estimated annual number of measles deaths decreased 82%, from 772,900 in 2000 to 136,200 in 2022 (Table 2). The estimated number of cases increased 18% and deaths increased 43% in 2022 compared with an estimated 7,802,000 cases and estimated 95,000 deaths in 2021. During 2000–2022, measles vaccination prevented an estimated 57 million deaths globally, compared with no vaccination (Figure).

Regional Verification of Measles Elimination

By the end of 2022, 83 countries (43% of all countries) had been verified by independent regional commissions to have achieved or maintained measles elimination, although no WHO region had achieved and sustained elimination, and no African Region country had yet been verified to have eliminated measles (Supplementary Table 3, https://stacks.cdc.gov/view/cdc/135223). WHO's Region of the Americas achieved verification of measles elimination in 2016; however, endemic measles transmission was reestablished in Brazil and Venezuela. Since 2016, endemic transmission has been reestablished in seven other countries (Albania, Czechia, Lithuania, Slovakia, and Uzbekistan in the European Region; and Cambodia and Mongolia in the Western Pacific Region) that had previously achieved verification of measles elimination. The United Kingdom was verified to have achieved measles elimination in 2021, after reestablishment of transmission in 2018 after initial verification of elimination in 2016.

Discussion

Globally, the decline in MCV coverage during the COVID-19 pandemic has shown some recovery in 2022; however, the trend is not consistent across regions, and no region has achieved the recommended 95% coverage with 2 doses of MCV necessary for elimination (5). Vaccination coverage declined most in low-income countries where risk for death from measles is likely highest. SIAs provide essential means to decrease immunity gaps and vaccinate children who missed MCV doses during routine immunization activities.§§§§ Immunization programs will need to accelerate immunization program recovery to close these immunity gaps and reduce disease incidence.

Although measles surveillance performance has improved, half of all countries did not meet the surveillance sensitivity target indicator in 2022. In addition, the discarded case rate might have increased because of increased testing of suspected measles cases during outbreaks in 2022 rather than an actual improvement in surveillance performance. Measles incidence declined during 2020 and 2021, potentially because of decreased virus transmission related to COVID-19 mitigation measures, surveillance disruptions, and immunity acquired through high rates of infection during the global measles resurgence during 2017–2019. From 2021 to 2022, reported measles cases increased 67% globally, and the number of countries experiencing large or disruptive outbreaks increased by 68% as COVID-19 mitigation measures were lifted, surveillance improved, and declining MCV coverage left millions of children unprotected from measles.

Limitations

The findings in this report are subject to at least three limitations. First, vaccination coverage might be affected by data

**** IA2030 global monitoring framework defines large or disruptive outbreaks as having ≥20 cases per 1 million population.

†††† Data as of August 23, 2023. https://who-gmrln.org/means2

§§§§ https://apps.who.int/iris/handle/10665/360891; https://apps.who.int/iris/handle/10665/340657

TABLE 2. Estimated number of measles cases and deaths,* by World Health Organization region — worldwide, 2000 and 2022

WHO region/yr (no. of countries in region)	Estimated no. (95% CI)		Measles 2000–2022	
	Measles cases	Measles deaths	% Estimated reduction in mortality	Cumulative no. of deaths averted by vaccination
Total (all regions)				
2000 (191)	**36,462,747 (27,651,303–49,998,176)**	**772,854 (580,969–1,064,580)**	**82**	**57,193,384**
2022 (194)	**9,232,288 (6,163,724–14,176,076)**	**136,216 (97,058–190,234)**		
African				
2000 (46)	11,789,801 (8,663,242–16,377,945)	352,856 (265,311–482,300)	76	19,503,394
2022 (47)	5,138,698 (3,706,922–6,748,362)	85,417 (59,449–117,685)		
Americas				
2000 (35)	8,770 (4,385–35,080)	3	91	6,078,056
2022 (35)	825 (413–3,300)	1†		
Eastern Mediterranean				
2000 (21)	4,183,126 (2,699,324–7,632,325)	134,250 (94,319–222,647)	71	9,109,711
2022 (21)	1,193,257 (827,241–1,928,555)	39,656 (30,318–53,601)		
European				
2000 (52)	866,396 (453,826–1,504,507)	3,584 (2,206–5,503)	98	1,449,774
2022 (53)	63,707 (19,753–167,892)	70 (20–201)		
South-East Asia				
2000 (10)	13,943,036 (11,008,470–17,255,557)	255,133 (197,243–321,745)	96	16,362,284
2022 (11)	1,896,917 (1,322,645–2,910,260)	9,542 (6,839–14,248)		
Western Pacific				
2000 (27)	5,671,618 (4,822,056–7,192,761)	27,028 (21,889–32,373)	94	4,690,166
2022 (27)	938,883 (286,751–2,417,707)	1,531 (432–4,498)		

Abbreviation: WHO = World Health Organization.
* The measles mortality model used to generate estimated measles cases and deaths is rerun each year using the new and revised annual WHO/UNICEF estimates of national immunization coverage data, as well as updated surveillance data.
† Estimated measles mortality rounded to 1.

quality issues, leading to inaccurate estimations. Second, the number of specimens submitted for genotyping represents a small proportion of measles cases, so the distribution of genotypes presented might not reflect the global distribution. Finally, the output from modeling estimates is dependent on the data input into the model and is thus subject to some uncertainty.

Implications for Public Health Practice

Since 2000, measles vaccination has averted an estimated 57 million deaths worldwide; however, the COVID-19 pandemic disrupted global vaccination activities, which in 2021 resulted in the lowest MCV1 coverage levels since 2008. Measles immunization coverage began improving in 2022 but has not reached 2019 prepandemic levels and remains far from the ≥95% 2-dose MCV coverage target. Approximately 21.9 million children did not receive any dose of MCV in 2022, leaving a large population susceptible to measles infection and outbreaks. Only 36 (19%) of 194 countries exceeded 2019 coverage levels by 2022, resulting in an accumulation of susceptible children born during the pandemic years. Global measles surveillance, after setbacks during the COVID-19 pandemic, still needs improvement. The Measles and Rubella Strategic Framework,¶¶¶¶ which aligns with IA2030, includes strategies that countries can draw upon to improve routine immunization, prioritize comprehensive surveillance, and employ data-driven decision-making to strengthen national and subnational capacity for outbreak preparedness and response and address immunity gaps to reach all children. It is critical that all countries and global partners work to accelerate the recovery of vaccination and surveillance programs toward the end goal of regional measles elimination.

¶¶¶¶ https://www.who.int/publications/i/item/measles-and-rubella-strategic-framework-2021-2030

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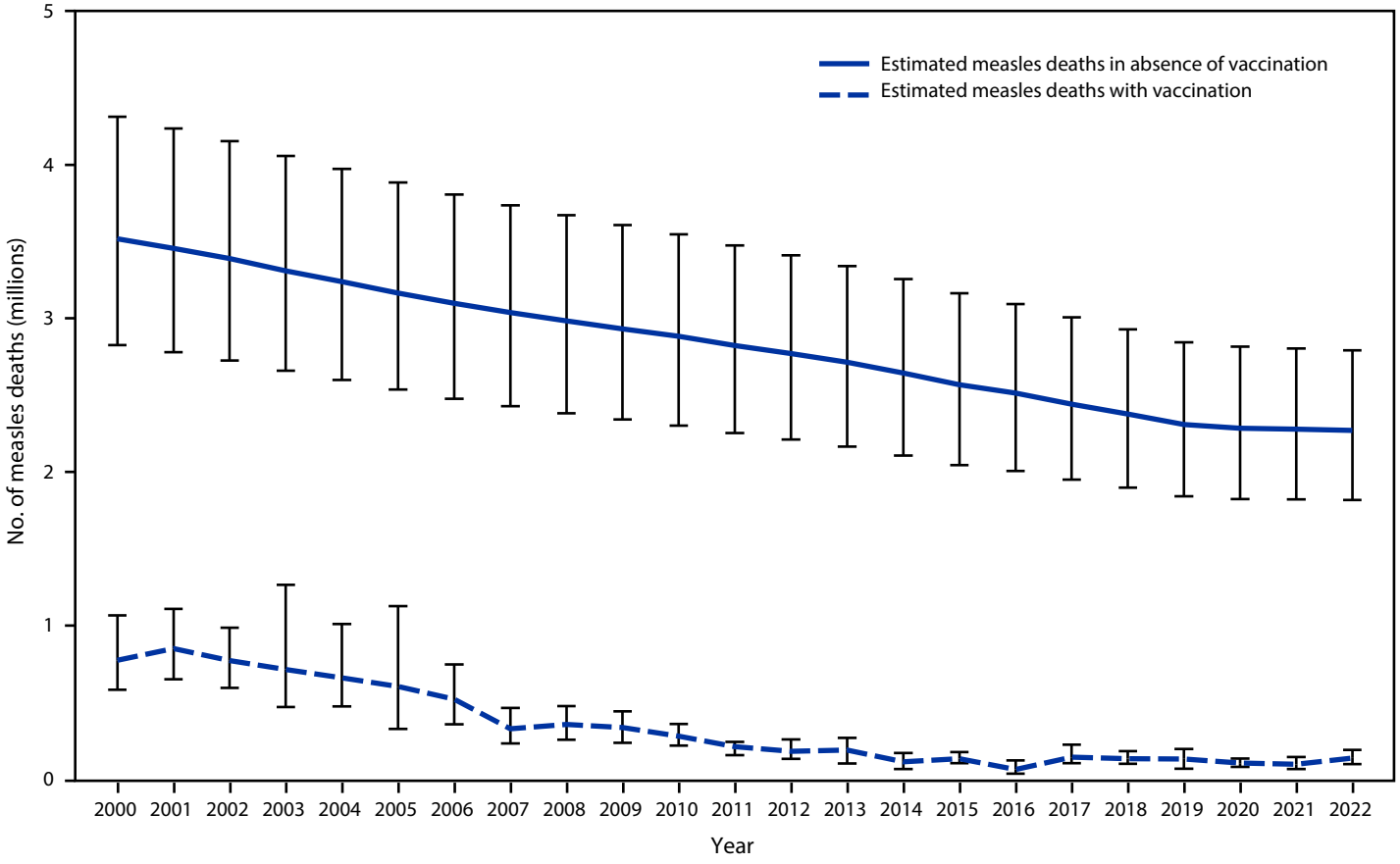
FIGURE. Estimated number of annual measles deaths with measles vaccination and in the absence of measles vaccination — worldwide, 2000–2022*,†



* With 95% CIs indicated by error bars.

† Deaths prevented by vaccination are estimated by the area between estimated deaths with vaccination and those without vaccination. A cumulative total of 57 million deaths were estimated to have been prevented by vaccination during 2000–2022.

Summary

What is already known about this topic?

Global coverage with measles-containing vaccine (MCV) declined during the COVID-19 pandemic to the lowest levels since 2008, and measles surveillance was suboptimal.

What is added by this report?

During 2000–2022, estimated measles vaccination prevented approximately 57 million deaths worldwide. However, millions of children missed vaccinations during the COVID-19 pandemic, resulting in an 18% increase in estimated measles cases and a 43% increase in estimated measles deaths in 2022 compared with 2021. Large or disruptive outbreaks were reported in 37 countries. Measles surveillance remains suboptimal.

What are the implications for public health practice?

To continue progress toward measles elimination, all children should receive 2 MCV doses to address pandemic-related immunity gaps and measles surveillance should be strengthened.

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Vital Signs: Missed Opportunities for Preventing Congenital Syphilis — United States, 2022

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Abstract

Introduction: Congenital syphilis cases in the United States increased 755% during 2012–2021. Syphilis during pregnancy can lead to stillbirth, miscarriage, infant death, and maternal and infant morbidity; these outcomes can be prevented through appropriate screening and treatment.

Methods: A cascading framework was used to identify and classify missed opportunities to prevent congenital syphilis among cases reported to CDC in 2022 through the National Notifiable Diseases Surveillance System. Data on testing and treatment during pregnancy and clinical manifestations present in the newborn were used to identify missed opportunities to prevent congenital syphilis.

Results: In 2022, a total of 3,761 cases of congenital syphilis in the United States were reported to CDC, including 231 (6%) stillbirths and 51 (1%) infant deaths. Lack of timely testing and adequate treatment during pregnancy contributed to 88% of cases of congenital syphilis. Testing and treatment gaps were present in the majority of cases across all races, ethnicities, and U.S. Census Bureau regions.

Conclusions and implications for public health practice: Addressing missed opportunities for prevention, primarily timely testing and appropriate treatment of syphilis during pregnancy, is important for reversing congenital syphilis trends in the United States. Implementing tailored strategies addressing missed opportunities at the local and national levels could substantially reduce congenital syphilis.

Introduction

In a time when perinatal infections such as HIV and hepatitis B are declining in the United States (*1*,*2*), cases of congenital syphilis, a disease resulting from perinatal transmission of syphilis, have been increasing substantially. During 2012–2021, the number of reported congenital syphilis cases increased 755%, from 335 during 2012 to 2,865 during 2021 (*3*,*4*). Congenital syphilis can lead to stillbirth, miscarriage, or neonatal death, and surviving infants who are not adequately treated might develop blindness, deafness, developmental delay, or skeletal abnormalities (*5*). Congenital syphilis is preventable through timely testing and adequate treatment of syphilis during pregnancy (*5*). Increases in congenital syphilis mirror trends observed in rates of primary and secondary syphilis cases in women of reproductive age, which increased 676% (from 2.1 to 16.3 per 100,000 population) during 2012–2021 (*4*). Racial and geographic disparities in rates of congenital syphilis and rates of syphilis among women exist (*4*). To reduce perinatal transmission, CDC recommends screening for syphilis during pregnancy at the first prenatal care visit. Where access to prenatal care is not optimal, screening and treatment (if indicated) should be performed as soon as pregnancy is identified (*6*). CDC recommends screening at 28 weeks' gestation and at delivery for those who 1) live in communities with high rates of syphilis, 2) are at high risk for syphilis acquisition during pregnancy (e.g., substance use or a new sex partner), or 3) were not previously tested during the pregnancy (*6*). Appropriate screening for syphilis during pregnancy, as well as screening of sexually active persons when appropriate, has been shown to prevent syphilis morbidity (*5*,*6*). Identifying missed opportunities (e.g., lack of screening and inadequate treatment) to prevent congenital syphilis and treat syphilis during pregnancy is critical to understanding drivers of the current congenital syphilis surge and to better direct public health interventions (*7*,*8*).

Methods

Study Population

Cases of congenital syphilis that meet the 2018 Council of State and Territorial Epidemiologists congenital syphilis case definition* are reported to CDC's National Notifiable Diseases Surveillance System (NNDSS). Data are from all 50 states, the District of Columbia, and U.S. territories and freely associated states.

Classification of Missed Opportunities

To identify potential missed prevention opportunities among congenital syphilis-associated pregnancies, a mutually exclusive six-part cascading framework of risk factors was developed that includes 1) no documented testing or nontimely testing, 2) late identification of seroconversion during pregnancy, 3) no treatment or nondocumented treatment, 4) inadequate treatment, 5) clinical evidence of congenital syphilis despite documentation of adequate maternal treatment, and 6) insufficient data to identify a missed prevention opportunity for the case. Using a stepwise approach, cases of congenital syphilis reported via NNDSS in 2022 were examined and assigned to one of the six framework categories, starting with determining whether timely testing occurred during pregnancy, defined as testing completed ≥30 days before delivery (*9*). Cases for which documentation of timely testing was absent were categorized as "nontimely or no documented testing." Cases for which the syphilis diagnosis was received late in pregnancy (<30 days before delivery), after earlier nonreactive testing (i.e., testing without evidence of syphilis), were categorized as late identification of seroconversion. Congenital syphilis cases for which timely testing led to a syphilis diagnosis during pregnancy were assessed based on whether treatment adequate to prevent congenital syphilis, defined as a penicillin-based regimen initiated ≥30 days before delivery, with dosing and spacing appropriate for the stage of syphilis (*5*,*6*), was documented. Cases without adequate documentation of treatment were categorized as either 1) inadequate treatment or 2) no or nondocumented treatment. Finally, those congenital syphilis cases that occurred despite documentation of timely testing and adequate treatment were categorized as either 1) clinical evidence of congenital syphilis despite adequate treatment during pregnancy or 2) insufficient data to identify the missed opportunity despite careful review.

Data Analysis

Numbers of congenital syphilis cases and rates of primary and secondary syphilis among females aged 15–44 years in 2022 were compared with annual data from 2012 through 2021. Missed opportunities for prevention were stratified by U.S. Census Bureau region and by race and ethnicity of the birth parent. Prenatal testing and treatment status were stratified according to whether at least one prenatal care visit had occurred during the pregnancy. Analyses were completed using Stata statistical software (version 15.1; StataCorp). This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.†

Results

Congenital Syphilis Cases and Outcomes

In 2022, a total of 3,761 congenital syphilis cases were reported via NNDSS, including 231 (6%) stillbirths and 3,530 (84%) liveborn infants (with 51 [1%] infant deaths). This represents a 31.7% increase in congenital syphilis cases from those reported during 2021, concurrent with a 17.2% increase in rates of primary and secondary syphilis cases among females aged 15–44 years (from 16.3 to 19.1 per 100,000 population) (Figure 1). More than 10 times as many congenital syphilis cases were reported in 2022 (3,761) than in 2012 (334).

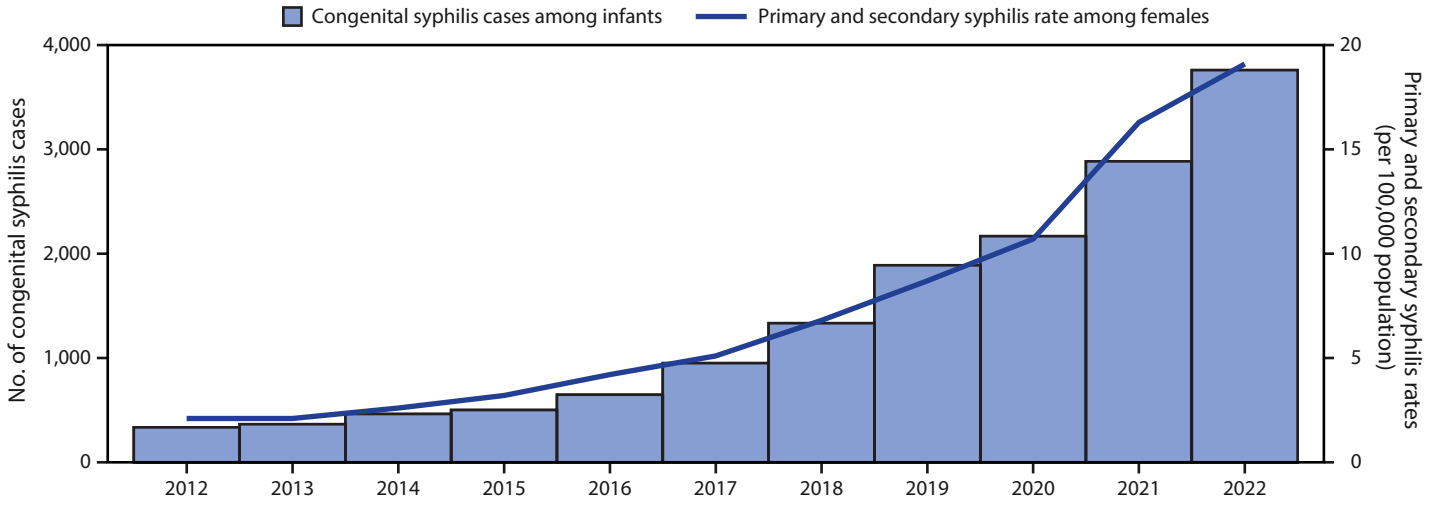
Missed Opportunities for Prevention of Congenital Syphilis

Among all (3,761) congenital syphilis cases reported in 2022, the birth parent of most patients (3,302; 87.8%) received either no or nontimely testing (1,385; 36.8%), or no or nondocumented (423; 11.2%) or inadequate (1,494; 39.7%) treatment during pregnancy. Among 197 (5.2%) congenital syphilis cases, syphilis was diagnosed late in pregnancy, after earlier nonreactive testing (Figure 2). Among 2,179 (57.9%) cases for which timely testing and no late identification of syphilis had occurred, more than two thirds (1,494; 39.7% of all congenital syphilis cases) had documentation of inadequate treatment during pregnancy, nearly 20% (423; 19.4% [11.2% of all cases]) received no treatment or nondocumented treatment, and the remaining 262 (12.0% [7.0% of all cases]) received adequate treatment. Among these 262 cases, clinical evidence of congenital syphilis (e.g., on the basis of physical exam, radiographic findings, or laboratory findings) was noted in the newborn despite documentation of adequate treatment in one half (130; 3.5% of all cases), and insufficient data were available to identify missed opportunities to prevent congenital syphilis in the remaining patients (132; 3.5% of all cases).

* https://ndc.services.cdc.gov/case-definitions/syphilis-2018/

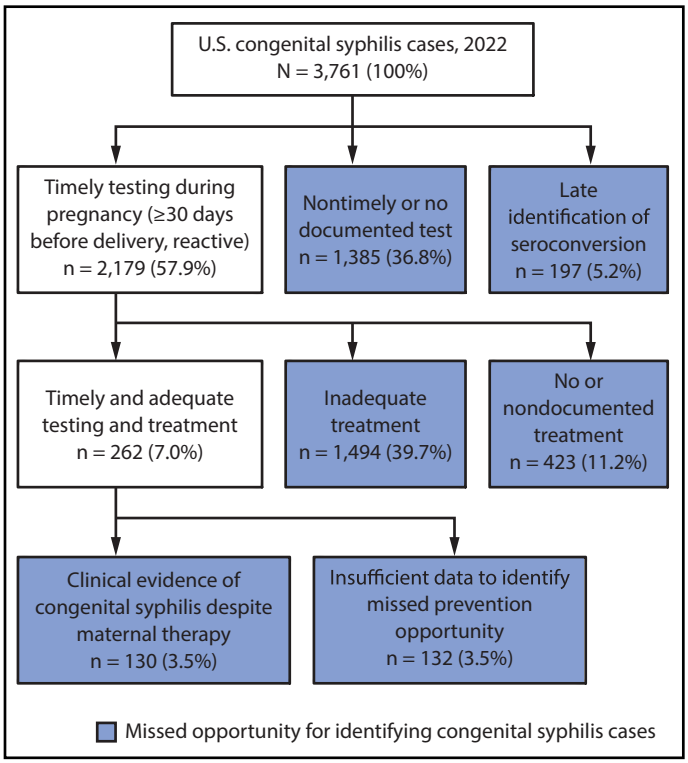
† 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE 1. Reported number of cases of congenital syphilis among infants, by year of birth, and rates* of reported cases of primary and secondary syphilis† among females aged 15–44 years, by year — United States, 2012–2022



* Cases per 100,000 population.
† Primary and secondary syphilis case data for all U.S. territories and freely associated states and outlying areas were not available for all years; therefore, rates presented include only the 50 states and the District of Columbia.

FIGURE 2. Distribution of congenital syphilis cases, by missed prevention opportunities*,†,§ — United States, 2022



* Timely testing is performed ≥30 days before delivery.
† Late identification of seroconversion is a new reactive syphilis test <30 days before delivery after a nonreactive test earlier in pregnancy.
§ Adequate treatment is receipt of a penicillin-based regimen, dosed and spaced appropriately for the stage of syphilis, and commenced ≥30 days before delivery.

Geographic, Racial, and Ethnic Differences in Missed Congenital Syphilis Prevention Opportunities

No testing or nontimely testing accounted for approximately one half of cases in the West (56.2%) and Northeast (50.0%) U.S. Census Bureau regions,§ and for the largest percentage of cases in the Midwest region (40.4%). Inadequate treatment accounted for the majority of missed opportunities in the South region (54.5%). No testing or nontimely testing resulted in the highest percentage of missed opportunities for prevention among non-Hispanic American Indian or Alaska Native (47.4%), non-Hispanic Native Hawaiian or other Pacific Islander (61.0%), and non-Hispanic White (40.8%) birth parents. Inadequate treatment was the most prevalent cause for missed prevention opportunities among non-Hispanic Black or African American (39.2%) and Hispanic or Latino (47.4%) birth parents (Table 1).

Among pregnancies resulting in a congenital syphilis outcome, no prenatal care was documented in 1,426 cases (37.9%). Of the 2,179 cases in which a timely test was obtained during pregnancy, no prenatal care was documented in 445 (20.4%) (Table 2). Among the 1,385 cases of congenital syphilis for which no test or a nontimely test was recorded, no prenatal care was documented for 969 (70.0%).

Discussion

Lack of timely testing and adequate treatment during pregnancy contributed to 88% of congenital syphilis cases in 2022

§ https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

TABLE 1. Prenatal syphilis testing and treatment among birth parents of infants with congenital syphilis, by U.S. Census Bureau region, and by race and ethnicity — United States, 2022

	Missed opportunities to prevent CS, no. (%)						
	Testing		Treatment		Outcome		
Characteristic	None or nontimely*	Late identification of seroconversion†	Inadequate	None or nondocumented	Clinical evidence of CS despite adequate§ prenatal treatment	Insufficient data to identify the missed opportunity	Total
All cases	**1,385 (36.8)**	**197 (5.2)**	**1,494 (39.7)**	**423 (11.2)**	**130 (3.5)**	**132 (3.5)**	**3,761**
U.S. Census Bureau region¶							
Northeast	83 (50.0)	25 (15.1)	26 (15.7)	14 (8.4)	11 (6.6)	7 (4.2)	**166**
Midwest	182 (40.4)	25 (5.5)	140 (31.0)	58 (12.9)	19 (4.2)	27 (6.0)	**451**
South	469 (23.7)	101 (5.1)	1,080 (54.5)	200 (10.1)	74 (3.7)	57 (2.9)	**1,981**
West	650 (56.2)	45 (3.9)	246 (21.3)	150 (13.0)	25 (2.2)	41 (3.5)	**1,157**
U.S. territories and freely associated states	1 (16.7)	1 (16.7)	2 (33.3)	1 (16.7)	1 (16.7)	0 (—)	**6**
Race and ethnicity,††							
AI/AN	81 (47.4)	7 (4.1)	40 (23.4)	27 (15.8)	8 (4.7)	8 (4.7)	**171**
Asian	9 (39.1)	2 (8.7)	8 (34.8)	1 (4.3)	2 (8.7)	1 (4.3)	**23**
Black or African American	353 (31.5)	80 (7.1)	440 (39.2)	153 (13.6)	53 (4.7)	43 (3.8)	**1,122**
NH/OPI	25 (61.0)	1 (2.4)	10 (24.4)	3 (7.3)	0 (—)	2 (4.9)	**41**
White	422 (40.8)	39 (3.8)	370 (35.8)	126 (12.2)	39 (3.8)	38 (3.7)	**1,034**
Hispanic or Latino	384 (34.8)	56 (5.1)	523 (47.4)	89 (8.1)	20 (1.8)	32 (2.9)	**1,104**
Multiracial	29 (42.0)	3 (4.3)	22 (31.9)	10 (14.5)	3 (4.3)	2 (2.9)	**69**
Other	15 (30.6)	4 (8.2)	22 (44.9)	5 (10.2)	1 (2.0)	2 (4.1)	**49**
Unknown	67 (45.3)	5 (3.4)	59 (39.9)	9 (6.1)	4 (2.7)	4 (2.7)	**148**

Abbreviations: AI/AN = American Indian or Alaska Native; CS = congenital syphilis; NH/OPI = Native Hawaiian or other Pacific Islander.
* Timely testing is performed ≥30 days before delivery.
† A new reactive syphilis test <30 days before delivery after a nonreactive test earlier in pregnancy.
§ Receipt of a penicillin-based regimen, dosed and spaced appropriately for the stage of syphilis, and commenced ≥30 days before delivery.
¶ https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf
** Race and ethnicity of the birth parent.
†† Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

TABLE 2. Receipt of prenatal care among birth parents of infants with congenital syphilis, by prenatal syphilis testing and treatment among those with timely testing* — United States, 2022

	Prenatal care, no. (%)	
Prenatal testing and treatment	None documented	One or more prenatal care visit
Testing		
No test or nontimely test	969 (70.0)	416 (30.0)
Late identification of seroconversion†	12 (6.1)	185 (93.9)
Timely test* during pregnancy	445 (20.4)	1,734 (79.6)
Total	**1,426 (37.9)**	**2,335 (62.1)**
Treatment among persons who received timely testing		
No treatment	69 (16.3)	354 (83.7)
Inadequate treatment	362 (24.2)	1,132 (75.8)
Adequate treatment§	14 (5.3)	248 (94.7)
Total	**445 (20.4)**	**1,734 (79.6)**

* Timely testing is performed ≥30 days before delivery.
† A new reactive syphilis test <30 days before delivery after a nonreactive test earlier in pregnancy.
§ Receipt of a penicillin-based regimen, dosed and spaced appropriately for the stage of syphilis, and commenced ≥30 days before delivery.

Summary

What is already known about this topic?

Since 2012, U.S. congenital syphilis cases increased substantially. Syphilis during pregnancy can lead to stillbirth, miscarriage, infant death, and maternal and infant morbidity, which are preventable through appropriate screening and treatment.

What is added by this report?

In 2022, lack of timely testing and adequate treatment contributed to almost 90% of congenital syphilis cases in the United States, including substantial proportions of congenital syphilis cases in all U.S. Census Bureau regions and among all racial and ethnic groups.

What are the implications for public health practice?

Implementing tailored strategies addressing missed opportunities at the local and national levels could improve timeliness of testing and appropriateness of treatment for syphilis during pregnancy and thereby reduce the incidence of congenital syphilis and complications of syphilis during pregnancy.

and represent missed opportunities to prevent maternal syphilis-associated morbidity. Lack of timely testing and adequate treatment contributed to substantial proportions of cases in all geographic areas and in all racial and ethnic groups. Timely testing without evidence of late seroconversion occurred in 58% of cases; however, inadequate treatment occurred in 69% of these cases, and no treatment or nondocumented treatment in 19%. Treatment could be considered inadequate based on

inappropriate selection of an antimicrobial agent, dosing, or spacing of doses, as well as an insufficient interval between initiation of treatment and delivery; ongoing analyses aim to describe specific sources of inadequate treatment to better guide public health action. Strategies that reduce loss to follow-up and decrease the time between testing and treatment could increase the likelihood of adequate treatment. This outcome has been achieved at some medical facilities and health organizations through implementation of rapid syphilis point-of-care testing (*10*), which the World Health Organization recommends during pregnancy in settings where a delay in diagnosis can lead to loss to follow-up (*11*). Innovations in treatment and close follow-up (e.g., field-delivered treatment and disease intervention specialists trained to prevent and control infectious diseases providing linkage to care) can help facilitate adequate treatment (*12*–*14*).

Recommended Treatment for Prevention of Congenital Syphilis

Benzathine penicillin G is the only recommended treatment for syphilis during pregnancy; this drug must be administered as an injection by a trained professional as either a single dose or as 3 doses spaced 7–9 days apart, depending on the stage of infection (*6*). The success rate of this treatment in preventing congenital syphilis has been reported to be as high as 98% (*15*). Although this analysis includes cases with clinical evidence of congenital syphilis despite adequate treatment, some of these cases might be explained by undetected reinfection late in pregnancy. Because the United States is currently facing a shortage of benzathine penicillin G, CDC has encouraged providers and health departments to prioritize benzathine penicillin G for the treatment of syphilis in pregnancy.[¶]

Individual Screening Based on Risk Factors and Community Syphilis Rates

Historically, syphilis screening and interventions have targeted individual risk factors, but for many sexually active persons, their most significant risk factor is living in a community with high rates of syphilis (*4*,*6*). CDC guidelines recommend syphilis screening for sexually active persons in communities with high rates of syphilis (*6*); however, the threshold for a high rate is not defined. Currently, the Healthy People 2030 goal is to reduce the rate of primary and secondary syphilis cases among females aged 15–44 years to 4.6 per 100,000 population.[**] In counties with a rate that exceeds this goal, offering syphilis testing to sexually active females aged 15–44 years and their sex partners might help identify syphilis cases and prevent spread, support progress toward meeting the Healthy People 2030 goals, and reduce congenital syphilis. In 2021, 38% of U.S. counties, accounting for 72% of the U.S. population, had syphilis rates above the goal level[††] . Disparities in syphilis rates by race and ethnicity are not explained by differences in sexual behaviors, but rather reflect access to sexual health care, differences in sexual networks, and persistent and systemic racism in medical care (*6*,*16*). Screening based on geographic risk can decrease stigma and biases associated with screening based on individual risk factors. In counties already at or below the Healthy People 2030 goal level, clinicians should continue to assess individual risk factors (e.g., diagnosis of other sexually transmitted infections, a new partner, history of incarceration, transactional sex work, or being a male aged <29 years) to determine screening needs.[§§]

More than 37% of infants with congenital syphilis were born to persons who had received no prenatal care. Among congenital syphilis cases, no or nontimely testing during pregnancy was the most frequently missed opportunity identified among birth parents without documented prenatal care. Among those with a timely test obtained during pregnancy, 20.4% had no prenatal care documented, suggesting that testing occurred outside prenatal care. In addition to improving access to prenatal care, approaches to providing care outside of clinical settings (e.g., use of rapid tests, field-delivered treatment, active case follow-up, and linkage to care by disease intervention specialists) are needed to ensure appropriate and timely screening and treatment. Any encounter with medical or public health professionals during pregnancy is an opportunity to identify and treat syphilis, thereby preventing congenital syphilis as well as maternal morbidity. Screening for syphilis at encounters outside traditional prenatal care (e.g., emergency department, jail intake, syringe services program, and maternal and child health programs) might help identify and treat persons with syphilis who might not otherwise receive adequate prenatal care (*13*,*14*,*17*–*19*). In addition, the identification of syphilis during pregnancy should be seen as a high priority for rapid follow-up, with a systematic approach to defining who will be responsible for ensuring timely treatment.

Limitations

The findings in this report are subject to at least three limitations. First, national congenital syphilis case data contain limited information about social determinants of health. The underlying individual and structural barriers (e.g., systemic inequities and limited health care access) leading to the missed opportunities described in this report are beyond the scope of this analysis. Second, jurisdictional differences in reporting completeness and accuracy for congenital syphilis cases likely

[¶] www.cdc.gov/std/dstdp/dcl/2023-july-20-Mena-BicillinLA.htm

[**] https://health.gov/healthypeople/objectives-and-data/browse-objectives/sexually-transmitted-infections/reduce-syphilis-rate-females-sti-03

[††] https://www.cdc.gov/nchhstp/atlas/syphilis/index.html

[§§] https://www.cdc.gov/std/treatment-guidelines/screening-recommendations.htm

exist, including differing legal requirements for screening. Differential reporting might have resulted in misclassification of the missed opportunities, amplifying regional differences. Finally, national case data provide limited information on the breadth of syphilis testing during pregnancy (e.g., prepregnancy testing and the titers of syphilis tests measured during pregnancy), which might lead to misclassification both in the context of a history of adequately treated syphilis, as well as seroconversion late in pregnancy. Testing and treatment that occurred but are not documented cannot be assessed.

Implications for Public Health Practice

Congenital syphilis rates are rapidly increasing in the United States and are at the highest level in at least 30 years (*4*). Barriers to congenital syphilis prevention are multifactorial, including those at the patient level, such as substance use and insurance status, and those at the system level, such as structural inequities, limited access to health care, and medication shortages (*5*,*8*,*16*,*17*,*20*). Addressing patient and system-level barriers to accessing testing, treatment, and care could help prevent congenital syphilis. Improvements in timely testing and appropriate treatment of syphilis through tailored strategies at local and national levels will help control the congenital syphilis epidemic in the United States.

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Notes from the Field

Surveillance of Silicosis Using Electronic Case Reporting — California, December 2022–July 2023

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Electronic case reporting (eCR) (*1*) is a promising rapid reporting mechanism, whereby electronic health records (EHRs) automatically generate and transmit a disease report to jurisdictional public health agencies in real time using previously established criteria. All 50 U.S. states and other jurisdictions are connected to the eCR infrastructure. The Reportable Conditions Knowledge Management System (RCKMS),* a component of the eCR infrastructure, is a real-time decision support service that processes reports according to jurisdictional reporting requirements with criteria defined by Council of State and Territorial Epidemiologists' position statements (*1*). Health care organizations automatically generate and send an initial case report to the eCR infrastructure when trigger criteria, such as diagnosis codes or laboratory results, are met within their EHRs. Therefore, for all participating California health care organizations, if a health care encounter involves COVID-19 or mpox, an initial case report is generated and sent to the eCR infrastructure for processing. When there is a match between the initial case report triggered by an EHR, and a reportable condition rule is entered into RCKMS by a jurisdictional public health agency, the initial case report is routed by the eCR infrastructure to the public health agency. Other conditions can be added to public health agency reporting rules.

Silicosis is a progressive, incurable, fibrotic lung disease caused by inhalation of respirable crystalline silica dust produced in industries such as construction, quarrying, and coal mining (*2*). A resurgence of silicosis among young workers fabricating engineered stone (quartz) countertops in California and in countries including Australia, Israel, and Spain has focused attention on the need for timely case identification for primary and secondary prevention (*2–5*). In December 2022, the California Department of Public Health (CDPH) added reporting rules for silicosis to RCKMS, so that any initial case report received by the eCR infrastructure from health care provider EHRs that includes a silicosis diagnosis in the patient's problem list is sent to CDPH for silicosis surveillance. The purpose of this study was to evaluate the utility of eCR for identifying cases of silicosis in California. This study was reviewed and approved by the California Committee for the Protection of Human Subjects institutional review board.†

Investigation and Outcomes

During October 2022–July 2023, CDPH received electronic initial case reports including silicosis for 41 persons. Medical records were reviewed to confirm cases, collect employment and exposure information, and initiate public health follow-up. Overall, nine (22%) of the 41 patients reported were also identified through other reporting sources, including hospital discharge data and direct referral. To date, 35 (85%) silicosis cases were identified, including 19 (46%) confirmed§ and 16 (39%) clinically compatible (probable) cases that lack confirmatory information (such as occupation, imaging, or biopsy) in the medical record. Six (15%) of the 41 reports were considered unlikely cases after medical record review. The median age of the patients with confirmed or probable silicosis was 65 years (range = 33–89 years), and 32 (91%) were male. At least seven of the 19 confirmed silicosis cases were associated with fabrication of engineered stone (quartz) countertops, although occupational or exposure information was missing for two patients. Among the seven persons who were engineered stone workers, the median age was 44 years (range = 33–51 years), and all were Hispanic or Latino; one patient died, two underwent bilateral lung transplantation, and one was evaluated for a lung transplant, all because of their silicosis diagnoses.

Preliminary Conclusions and Actions

The 41 persons reported to date largely represent COVID-19 initial case reports that also include silicosis in the patient's problem list. RCKMS at one health care organization in California has triggered conditions beyond COVID-19 and mpox, including silicosis, which resulted in six more patients (15%) being reported. The number of silicosis cases identified is a fraction of the reports anticipated when more health care organizations implement silicosis trigger criteria in addition to COVID-19 and mpox trigger criteria. These preliminary results illustrate the utility of eCR for identifying silicosis cases, because 32 (78%) of the 41 persons reported through eCR were not identified through other reporting mechanisms. It is important that health care providers routinely ask patients about their work as an important determinant of health. Being aware of the risks associated with work exposures, as well as the regulations, medical monitoring, and prevention strategies

* https://www.rckms.org/about-rckms/
† 45 C.F.R. part 46.114; 21 C.F.R. part 56.114.

§ Silicosis surveillance case definition is a history of occupational exposure to airborne silica dust and either or both of the following criteria: 1) chest radiograph or other imaging technique interpreted as consistent with silicosis, and 2) pathologic findings characteristic of silicosis. https://www.cdc.gov/niosh/topics/surveillance/ords/statesurveillance/reportingguidelines-silicosis.html

that address those risks can help guide patient care. In addition, many public health jurisdictions throughout the United States can add reporting rules for silicosis in RCKMS to receive silicosis electronic initial case reports. Further surveillance and follow-up should be completed to evaluate the effect of earlier reporting on disease outcome and prevention. eCR might help to further elucidate the scope and breadth of this important public health condition among vulnerable workers, with the goal of developing and implementing effective prevention strategies. Moreover, public health jurisdictions can implement eCR criteria for other important public health conditions in addition to silicosis.

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Notes from the Field

A Cluster of Multi-Strain Invasive Pneumococcal Disease Among Persons Experiencing Homelessness and Use of Pneumococcal Conjugate Vaccine — El Paso County, Colorado, 2022

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Persons experiencing homelessness are often at increased risk for invasive pneumococcal disease (IPD)* due to underlying health conditions or risk factors (risk conditions) (*1*,*2*). Homelessness alone is not an indication for pneumococcal vaccination according to current Advisory Committee on Immunization Practices (ACIP) recommendations (*3*): adults aged ≥65 years or 19–64 years with certain underlying medical conditions or risk factors† with no previous or unknown history of receipt of pneumococcal conjugate vaccine (PCV) should receive 1 dose of either 20-valent or 15-valent PCV (PCV20 or PCV15, respectively). On November 29, 2022, El Paso (Colorado) County Public Health (EPCPH) was informed by a single hospital of three cases of IPD among persons experiencing homelessness, with all illness onset dates occurring within a single week.

Investigation and Outcomes

EPCPH initiated active surveillance at all local hospitals to identify additional IPD cases in persons experiencing homelessness. A case was defined as a diagnosis of IPD in a person aged ≥18 years experiencing homelessness in El Paso County, Colorado, during November 1, 2022–January 28, 2023. Analysis of cases was conducted to describe demographic characteristics, clinical presentation, codetection of respiratory viruses (based on testing requested by the treating physician), underlying medical conditions, and shelter use. Pneumococcal isolates from patients with IPD were serotyped at CDC by Quellung reaction§ and whole genome sequencing. The activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶

Twelve persons experiencing homelessness with IPD were identified, six of whom used housing and social services at the same local shelter serving persons experiencing homelessness. Nine of the 12 patients were male, and eight were aged <50 years. All had bacteremia, and nine also received a diagnosis of pneumonia. Ten patients were hospitalized for a median of 9 days (range = 3–14 days); no deaths were reported. Viral coinfections were identified in four patients, including both SARS-CoV-2 and rhinovirus (one patient), respiratory syncytial virus (one), human metapneumovirus (one), and SARS-CoV-2 (one). Underlying health conditions or risk factors included substance abuse (nine patients), current smoking (five), alcoholism (three), and diabetes (one). Seven of 10 pneumococcal isolates with serotyping results were serotype 4. Whole genome sequencing and single nucleotide polymorphism (SNP) analysis of serotype 4 isolates showed that most isolates were not genomically related.** Other serotypes identified were serotype 8 (one), 9N (one), and 19F (one); 90% of serotyped isolates (all except 9N) are contained in PCV20.

Fifteen days after receiving the initial report of IPD cases, EPCPH initiated the first of five vaccination clinics at three local facilities serving persons experiencing homelessness (Figure). To avoid delays in administering the vaccine, clinics were held before the serotyping results were available. A total of 87 PCV20 doses were administered.

Preliminary Conclusions and Actions

Rapid implementation of targeted vaccination clinics for any person aged ≥18 years experiencing homelessness facilitated the efficient delivery of vaccine and served to expand reach to this population. No new IPD cases were reported among persons experiencing homelessness during January 29, 2023–April 15, 2023; however, during this period, one unvaccinated person experiencing homelessness from the cluster with multiple IPD risk conditions experienced recurrent IPD. Since that recurrent infection, one additional case was reported, during the week of August 23, 2023.

IPD among persons experiencing homelessness remains a public health concern. Crowding, substance abuse, chronic health conditions, and lack of consistent health care and access to routine vaccination services place persons experiencing

* Isolation of or identification by polymerase chain reaction of *Streptococcus pneumoniae* from a normally sterile body site.

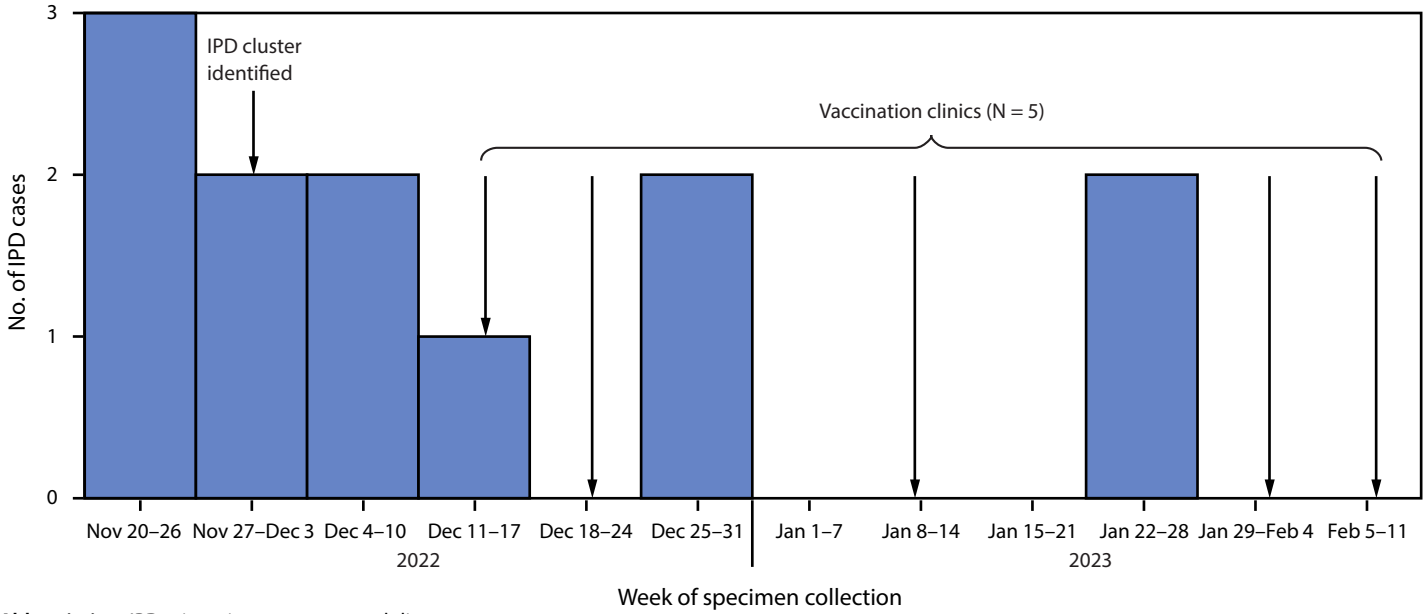
† Underlying medical conditions or risk factors include alcoholism; chronic heart, liver, or lung disease; chronic renal failure; cigarette smoking; cochlear implant; asplenia; cerebrospinal fluid leak; diabetes mellitus; malignancy; HIV; Hodgkin disease; immunodeficiency; iatrogenic immunosuppression; hematopoietic neoplasms; nephrotic syndrome; solid organ transplant; sickle cell disease; and hemoglobinopathies.

§ A method for pneumococcal capsular serotyping involving testing of a pneumococcal cell suspension with specific antisera and microscopic observation of the antigen-antibody reaction.

¶ 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

** The average pairwise SNP distance between serotype 4 isolates was 89 SNPs. The minimum SNP distance was seven SNPs between one pair of isolates, and the maximum SNP distance was 252 SNPs. For isolates to be considered genomically clustered, they should be highly related to each other, generally different by 10 or fewer SNPs. Only two out of seven serotype 4 isolates were highly genomically related.

FIGURE. Weekly number of cases of invasive pneumococcal disease among persons experiencing homelessness and the number of El Paso County Public Health vaccination clinics — El Paso County, Colorado, November 2022–February 2023



Abbreviation: IPD = invasive pneumococcal disease.

homelessness at increased risk for pneumococcal disease (*1*,*2*,*4*). In addition, pneumococcal vaccination coverage among younger U.S. adults who are recommended to receive the vaccine based on risk conditions (*3*) has been inconsistent and low (*5*). In this epidemiologic cluster, most pneumococcal serotypes identified were contained in PCV20, and vaccine was administered to prevent additional IPD cases. Pneumococcal vaccination of persons experiencing homelessness should be considered standard health care if they have risk conditions for which ACIP recommends PCV use (*3*).

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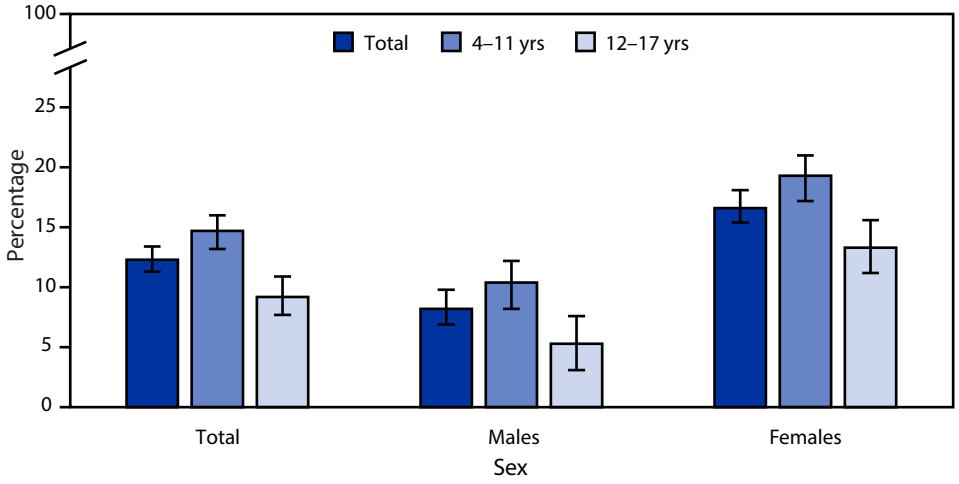
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Children and Adolescents Aged 4–17 Years Who Practiced Yoga During the Past 12 Months,† by Sex and Age Group — National Health Interview Survey,§ United States, 2022



* With 95% CIs indicated by error bars.
† Based on an affirmative response to the survey question, "During the past 12 months, did (child) ever practice yoga as part of a class or on their own?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2022, 12.3% of children and adolescents aged 4–17 years had practiced yoga in the past 12 months. Children and adolescents aged 4–11 years were more likely to have practiced yoga than those aged 12–17 years (14.7% versus 9.2%). The declining percentages with age were found for both males and females: 10.4% versus 5.3% among males, and 19.3% versus 13.3% among females. Males were less likely than females to have practiced yoga in both age groups.

Source: National Center for Health Statistics, National Health Interview Survey, 2022. https://www.cdc.gov/nchs/nhis.htm

Reported by: Cynthia Reuben, MA, creuben@cdc.gov.

For more information on this topic, CDC recommends the following link: https://www.cdc.gov/healthyschools/bam/cards/yoga.html

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