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Vaccination Coverage with Selected Vaccines and Exemption Rates Among Children in Kindergarten — United States, 2018–19 School Year

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State and local school vaccination requirements exist to ensure that students are protected against vaccine-preventable diseases (*1*). This report summarizes data collected by state and local immunization programs* on vaccination coverage among children in kindergarten in 49 states, exemptions for kindergartners in 50 states, and provisional enrollment and grace period status for kindergartners in 30 states. Nationally, vaccination coverage† was 94.9% for the state-required number of doses of diphtheria and tetanus toxoids, and acellular pertussis vaccine (DTaP); 94.7% for 2 doses of measles, mumps, and rubella vaccine (MMR); and 94.8% for the state-required doses of varicella vaccine. Whereas 2.5% of kindergartners had an exemption from at least one vaccine,§ 2.8% of kindergartners were not up to date for MMR and did not have a vaccine exemption. Nearly all states could achieve the recommended ≥95% MMR coverage if all nonexempt kindergartners were vaccinated in accordance with local and state vaccination policies.

In accordance with state and local school entry requirements, parents and guardians submit children's vaccination records or exemption forms to schools, or schools obtain records from state immunization information systems. Federally funded immunization programs collaborate with departments of education, school nurses, and other school personnel to assess vaccination coverage and exemption status of children enrolled in public and private kindergartens and to report unweighted counts, aggregated by school type, to CDC via a web-based questionnaire in the Secure Access Management System.¶ CDC uses these counts to produce state-level and national-level estimates of vaccination coverage. During the 2018–19 school year, 49 states reported coverage for all state-required vaccines

* Federally funded immunization programs are located in the 50 states and the District of Columbia (DC), five other cities, and eight U.S territories and freely associated states (territories). Two cities reported data to CDC, which were also included in data by their state, to calculate medians and national estimates. Immunization programs in U.S. territories reported vaccination coverage and exemptions to CDC; however, these data were not included in overall national calculations.

† National and median vaccination coverage was determined using estimates for 49 states; Alaska and DC did not report school coverage data because of problems with data collection. Data from cities were included with their state data. Data from territories were not included in national and median calculations.

§ National and median exemption rates were determined using estimates for all 50 states; Colorado, Illinois, Minnesota, and Missouri did not collect information on the number of kindergartners with an exemption but instead reported the number of exemptions for each vaccine, which could count some children more than once. For these states, the percentage of kindergartners exempt from the vaccine with the highest number of exemptions (the lower bound of the potential range of exemptions) was included in the national and median exemption rates. DC did not report school exemption data because of problems with data collection. Data from cities were included with their state data. Data from territories were not included in national estimates.

¶ Assessment date varied by state and area. Six states assess on the first day of school; 16 states assess by December 31; 14 states assess by some other date, ranging from 30 days after admission to April 25; 14 states assess on a rolling basis.

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among public school kindergartners; 48 states reported on private school kindergartners.** All 50 states reported exemption data among public school kindergartners; 49 states reported on private school kindergartners. Overall national and median vaccination coverage for the state-required number of doses of DTaP, MMR, and varicella vaccine are reported. Coverage with hepatitis B and poliovirus vaccines, which are required in most states but not included in this report, are available at SchoolVaxView (*2*). Thirty states reported data on kindergartners who, at the time of assessment, attended school under a grace period (attendance without proof of complete vaccination or exemption during a set interval) or provisional enrollment (school attendance while completing a catch-up vaccination schedule). Coverage and exemptions from the U.S. territories and affiliated jurisdictions are included in this report; however, national estimates, medians, and summary measures include only U.S. states.

Vaccination coverage and exemption estimates were adjusted according to survey type and response rates.†† For the 2018–19 school year, CDC is reporting national-level estimates alongside the state-level median estimates. The national estimates complement the medians by addressing the limitation that the median estimates weight every state equally regardless of population size. Reported estimates for the 2018–19 school year are based on 3,634,896 kindergartners surveyed for vaccination coverage, 3,643,598 for exemptions, and 2,813,482 for grace period and provisional enrollment among the 4,001,404 children reported as enrolled in kindergarten by the 50 state immunization programs.§§ Potentially achievable

** Nine states reported coverage and exemption data for at least some homeschooled kindergartners. California included data for 17 independent study schools and at least two virtual schools registered with the California Department of Education in public school data, and data for homeschools with six or more students in private school data. Delaware reported the only documented homeschool in the state within private school data. New Mexico included students from one public online academy in public school data. North Dakota reported some homeschool data separately. Oregon reported a convenience sample of homeschooled students enrolled through online public schools separately; some children enrolled in public online homeschools were included in the public school data. Pennsylvania included all homeschooled students in their public school data. Utah included students enrolled in public online academies in public school data, and students enrolled in private online academies in private school data. Vermont included homeschooled students in their public and private school data if the students were enrolled in one or more classes at a school. Wyoming reported at least some homeschooled students in public school data.

†† Most immunization programs that used census or voluntary response provided CDC with data aggregated at the state or local (city or territory) level. Coverage and exemption data based on a census or voluntary response were adjusted for nonresponse using the inverse of the response rate, stratified by school type (public, private, and homeschool, where available). Programs that used complex sample surveys provided CDC with deidentified data aggregated at the school or county level for weighted analysis. Weights were calculated to account for sample design and adjusted for nonresponse for data collected through complex sample design wherever possible.

§§ The totals reported here are the summations of the kindergartners surveyed among programs reporting data for coverage, exemptions, grace periods, and provisional enrollment. Data from cities and territories were not included in these totals.

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coverage with MMR, defined as the sum of the percentage of children up to date with 2 doses of MMR and those with no documented vaccination exemption but not up date, was calculated for each state. Nonexempt students include those provisionally enrolled, in a grace period, or otherwise without documentation of vaccination. SAS (version 9.4; SAS Institute) was used for all analyses.

Vaccination assessments varied by immunization program because of differences in states' required vaccines and doses, vaccines assessed, methods, and data reported (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/81811). Most states reported kindergartners as up to date for a given vaccine if they had received all doses of that vaccine required for school entry,¶¶ except seven states*** that reported kindergartners as up to date for any given vaccine only if they had received all doses of all vaccines required for school entry.

Nationally, 2-dose MMR coverage was 94.7% (range = 87.4% [Colorado] to ≥99.2% [Mississippi]). Coverage of ≥95% was reported by 20 states and coverage of <90% by two (Table). DTaP coverage was 94.9% (range = 88.8% [Idaho] to ≥99.2% [Mississippi]). Coverage of ≥95% was reported by 21 states, and coverage of <90% by one. Varicella vaccine coverage was 94.8% (range=86.5% [Colorado] to ≥99.2% [Mississippi]), with 20 states reporting coverage ≥95%, and four reporting <90% coverage.

The percentage of kindergartners with an exemption from one or more required vaccines (not limited to MMR, DTaP, and varicella vaccines) was 2.5% in 2018–19 (range = 0.1% [Mississippi] to 7.7% [Idaho and Oregon]). This is slightly higher than the 2.3% during the 2017–18 school year and 2.1% in 2016–17. (Table) (Figure 1). Nationally, 0.3% of kindergartners had a medical exemption, and 2.2% had a nonmedical exemption (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/81810).

The percentage of kindergartners attending school within a grace period or provisionally enrolled among the 30 states reporting these data was 2.0% (range = 0.2% [Georgia] to 6.7% [Ohio]) (Table). In 10 of these states, the percentage of children provisionally enrolled or within a grace period at the time of assessment exceeded the percentage of children with exemptions from one or more vaccines. Forty-four states could potentially achieve ≥95% MMR coverage if all nonexempt kindergartners, many of whom are within a grace period or provisionally enrolled, were vaccinated (Figure 2). Follow-up could assure all missing vaccinations are completed and all missing documentation of vaccination is provided to schools.

Discussion

Measles outbreaks affecting school-age children across multiple states during the 2018–19 school year underscore the importance of both school vaccination requirements for preventing disease spread and school coverage assessments to identify pockets of undervaccination (*3*). During the 2018–19 school year, national coverage with MMR, DTaP, and varicella vaccines remained near 95% (*2*,*4*). However, coverage and exemption rates varied by state. Recent measles outbreaks in states with high overall MMR coverage, such as New York, highlight the need for assessing vaccination coverage at the local level. CDC encourages programs to use their local-level school assessment data to identify populations of undervaccinated students and to partner with schools and providers to reduce barriers to vaccination and improve coverage.

Although the overall percentage of children with an exemption increased slightly for the second consecutive school year, children with exemptions still represent a small proportion of kindergartners nationally and in most states. More importantly, in 25 states, the number of nonexempt undervaccinated kindergartners exceeded the number of those with exemptions. In many states, nonexempt undervaccinated students are attending school in a grace period or are provisionally enrolled. Fifteen states allow grace periods, with 30 days the most common length, and 47 states allow provisional enrollment for students in the process of completing the vaccination schedule (R McCord, CDC, unpublished data, 2019). Follow-up with parents of these students to verify that vaccinations and related documentation are complete typically falls to school nurses or other school staff members (R Seither, CDC, unpublished data, 2019). The California Department of Public Health's immunization program collaborated with the state Department of Education and with individual schools to reduce provisional enrollment substantially over several years, which resulted in measurable increases in vaccination coverage, through training on the correct application of the relevant rules so that only those children who were completing a catch-up schedule were provisionally enrolled, and audits to assess the implementation by school staff members (*5*,*6*). Almost all states could achieve ≥95% MMR coverage if undervaccinated nonexempt

¶¶ All states required 2 doses of a measles-containing vaccine. Local DTaP requirements varied. Nebraska required 3 doses, four states (Illinois, Maryland, Virginia, and Wisconsin) required 4 doses, and all other states required 5 doses, unless the 4th dose was administered on or after the fourth birthday. The reported coverage estimates represent the percentage of kindergartners with the state-required number of DTaP doses, except for Kentucky, which required 5 doses of DTaP by age 5 years but reported 4-dose coverage for kindergartners. Seven states required 1 dose of varicella vaccine; 44 states required 2 doses.

*** Alabama, Florida, Georgia, Iowa, Mississippi, New Hampshire, and New Jersey considered kindergartners up to date only if they had received all doses of all vaccines required for school entry.

TABLE. Estimated* vaccination coverage† for measles, mumps, and rubella vaccine (MMR), diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), and varicella vaccine, grace period or provisional enrollment,§ and any exemption¶ among children enrolled in kindergarten, by immunization program — United States, territories, and associated states, 2018–19 school year

Immunization program	Kindergarten population**	No. (%) surveyed††	MMR, 2 doses (%)§§	DTaP, 5 doses (%)¶¶	Varicella, 2 doses (%)***	Grace period or provisional enrollment (%)	Any exemption (%)	Percentage point change in any exemption from 2017 to 2018
National estimate†††	**4,001,404**	**3,634,896**	**94.7**	**94.9**	**94.8**	**2.0**	**2.5**	**0.2**
Median†††	**Not applicable**	**Not applicable**	**94.2**	**94.6**	**94.3**	**1.8**	**2.6**	**0.4**
State								
Alabama§§§,¶¶¶	77,739	77,739 (100.0)	≥90.6	≥90.6	≥90.6	NP	0.8	−0.1
Alaska¶¶¶,****	10,316	8,702 (84.4)	NR	NR	NR	NR	7.1	0.1
Arizona§§§,††††	79,981	79,981 (100.0)	92.9	92.7	95.6	NR	6.0	0.2
Arkansas§§§§	39,257	37,466 (95.4)	94.2	93.4	93.8	4.5	1.8	0.1
California¶¶¶,††††,§§§§	568,947	555,735 (97.7)	96.5	96.0	97.9	1.7	0.6	−0.1
Colorado§§§,¶¶¶¶	64,191	64,191 (100.0)	87.4	90.3	86.5	0.6	4.9	0.2
Connecticut§§§,¶¶¶	38,230	38,230 (100.0)	95.9	96.1	95.7	NP	2.7	0.4
Delaware¶¶¶	10,798	1,021 (9.5)	97.8	97.8	97.6	NR	1.2	−0.2
District of Columbia****	NA	NA	NR	NR	NR	NR	NR	NA
Florida§§§,¶¶¶,*****	224,641	224,641 (100.0)	≥93.8	≥93.8	≥93.8	2.9	3.2	0.3
Georgia§§§,¶¶¶	131,275	131,275 (100.0)	≥93.6	≥93.6	≥93.6	0.2	2.5	−0.2
Hawaii¶¶¶	16,051	1,081 (6.6)	91.5	92.4	94.0	1.3	4.4	1.3
Idaho	22,995	22,769 (99.0)	89.5	88.8	88.3	2.2	7.7	0.6
Illinois§§§,¶¶¶¶	143,876	143,876 (100.0)	94.7	94.7	94.4	1.1	1.8	0.2
Indiana¶¶¶	82,324	79,350 (96.4)	91.2	94.4	93.5	NR	1.3	0.4
Iowa§§§,¶¶¶	40,624	40,624 (100.0)	≥93.3	≥93.3	≥93.3	3.0	2.4	0.4
Kansas¶¶¶,§§§§,†††††	37,838	8,744 (23.1)	90.8	91.0	89.2	NR	2.1	0.4
Kentucky¶¶¶,§§§§,*****	55,587	55,024 (99.0)	93.4	94.1	92.8	NR	1.4	0.0
Louisiana§§§	56,203	56,203 (100.0)	95.5	97.7	95.4	NA	1.2	0.1
Maine	13,419	12,875 (95.9)	93.8	94.5	95.9	NR	6.2	0.9
Maryland¶¶¶,§§§§	71,431	71,423 (100.0)	97.4	97.7	97.1	NR	1.5	0.1
Massachusetts§§§,¶¶¶,§§§§	65,279	65,279 (100.0)	96.9	97.1	96.5	NP	1.4	0.1
Michigan§§§	118,632	118,632 (100.0)	94.6	94.8	94.3	0.6	4.5	0.3
Minnesota¶¶¶¶,*****	70,085	68,779 (98.1)	92.6	92.5	92.0	NR	3.7	0.2
Mississippi§§§,¶¶¶,††††	37,775	37,775 (100.0)	≥99.2	≥99.2	≥99.2	0.6	0.1	0.0
Missouri§§§,¶¶¶¶	72,687	72,687 (100.0)	94.8	94.8	94.5	NR	2.7	0.4
Montana§§§,¶¶¶	12,480	12,480 (100.0)	93.3	93.0	92.9	1.9	4.5	0.2
Nebraska¶¶¶,§§§§,	26,925	26,548 (98.6)	96.9	97.4	96.3	1.3	2.1	−0.1
Nevada¶¶¶	37,971	1,811 (4.8)	95.1	95.0	94.7	1.0	3.3	0.1
New Hampshire¶¶¶	12,421	12,421 (100.0)	≥91.8	≥91.8	≥91.8	4.9	3.3	0.4
New Jersey§§§,¶¶¶	109,161	109,161 (100.0)	≥95.0	≥95.0	≥95.0	1.1	2.5	0.3
New Mexico¶¶¶	25,269	25,170 (99.6)	96.1	96.0	95.7	1.9	1.5	−0.2
New York (including New York City)§§§,¶¶¶	220,495	220,495 (100.0)	97.2	96.7	96.7	1.9	1.3	0.2
New York City§§§,¶¶¶	96,912	96,912 (100.0)	97.7	97.0	97.1	1.2	0.7	0.0
North Carolina¶¶¶,§§§§,*****	124,343	113,074 (90.9)	93.2	93.2	93.1	1.6	1.6	−0.4
North Dakota	10,382	10,315 (99.4)	93.6	93.6	93.8	NR	4.3	0.9
Ohio	139,679	132,589 (94.9)	91.6	91.9	91.2	6.7	2.9	0.3
Oklahoma*****	54,806	50,456 (92.1)	92.2	92.7	95.8	NR	2.6	0.4
Oregon§§§, §§§§	45,870	45,870 (100.0)	93.0	92.4	94.3	NR	7.7	0.1
Pennsylvania	143,560	133,945 (93.3)	96.4	96.6	95.8	2.6	2.9	0.1
Rhode Island§§§,¶¶¶,§§§§,*****	10,964	10,964 (100.0)	97.4	97.4	97.0	NR	1.3	0.2
South Carolina¶¶¶	58,442	15,797 (27.0)	94.2	94.6	93.5	0.9	2.6	0.6
South Dakota¶¶¶	12,062	12,052 (99.9)	96.2	95.8	95.5	NR	2.6	0.4
Tennessee§§§,¶¶¶,§§§§	78,630	78,630 (100.0)	96.5	96.2	96.2	1.6	1.9	0.4
Texas (including Houston)§§§§,*****	390,034	387,530 (99.4)	96.9	96.7	96.5	1.5	2.4	0.4
Houston§§§§,*****	37,897	37,675 (99.4)	96.6	96.6	95.9	1.4	1.5	0.3
Utah§§§	50,179	50,179 (100.0)	92.8	92.4	92.5	2.3	5.7	0.4
Vermont§§§,¶¶¶	6,126	6,126 (100.0)	93.0	92.9	92.3	5.1	4.7	0.9
Virginia¶¶¶,†††††	100,394	4,422 (4.4)	95.0	98.0	93.6	NR	1.7	0.2
Washington*****	87,510	84,771 (96.9)	90.8	90.8	89.7	1.7	5.0	0.3
West Virginia¶¶¶,††††,§§§§§	19,442	15,426 (79.3)	98.8	98.7	98.5	2.3	0.8	0.6
Wisconsin§§§§,*****,†††††	66,344	1,530 (2.3)	92.6	96.2	91.6	4.9	5.9	0.5
Wyoming	7,734	7,734 (100.0)	95.1	95.3	94.7	2.5	2.9	NA

See table footnotes on the next page.

TABLE. (*Continued*) Estimated* vaccination coverage† for measles, mumps, and rubella vaccine (MMR), diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), and varicella vaccine, grace period or provisional enrollment,§ and any exemption¶ among children enrolled in kindergarten, by immunization program — United States, territories, and associated states, 2018–19 school year

Immunization program	Kindergarten population**	No. (%) surveyed††	MMR, 2 doses (%)§§	DTaP, 5 doses (%)¶¶	Varicella, 2 doses (%)***	Grace period or provisional enrollment (%)	Any exemption (%)	Percentage point change in any exemption from 2017 to 2018
Territories and associated states								
American Samoa¶¶¶	NA	NA	NA	NA	NReq	NP	NA	NA
Federated States of Micronesia§§§	1,786	1,786 (100.0)	91.3	80.2	NReq	NR	0.0	0.0
Guam¶¶¶	2,563	735 (28.7)	88.4	90.7	NReq	NR	0.1	−0.3
Marshall Islands§§§,¶¶¶,††††	1,114	1,114 (100.0)	95.1	83.8	NReq	NR	0.0	0.0
Northern Mariana Islands§§§	812	812 (100.0)	97.7	79.4	98.2	NR	0.0	0.0
Palau§§§,¶¶¶¶¶	304	304 (100.0)	100.0	100.0	NReq	NR	0.0	0.0
Puerto Rico	26,353	1,545 (5.9)	94.7	91.4	94.7	NR	1.6	NA
U.S. Virgin Islands	NA	NA	NA	NA	NA	NA	NA	NA

Abbreviations: NA = not available; NP = no grace period/provisional policy; NR = not reported to CDC; NReq = not required.

* Estimates are adjusted for nonresponse and weighted for sampling where indicated.

† Estimates based on a completed vaccine series (i.e., not vaccine-specific) use the "≥" symbol. Coverage might include history of disease or laboratory evidence of immunity.

§ A grace period is a set number of days during which a student can be enrolled and attend school without proof of complete vaccination or exemption. Provisional enrollment allows a student without complete vaccination or exemption to attend school while completing a catch-up vaccination schedule. In states with one or both of these policies, the estimates represent the number of kindergartners within a grace period, provisionally enrolled, or some combination of these categories.

¶ Exemptions, grace period, provisional enrollment, and vaccine coverage status might not be mutually exclusive. Some children enrolled under a grace period or provisional enrollment might be exempt from one or more vaccinations, while children with exemptions might be fully vaccinated with one or more required vaccines.

** The kindergarten population is an approximation provided by each program. The national total excludes the 8,075 kindergartners from the District of Columbia for which data were not reported.

†† The number surveyed represents the number of kindergartners surveyed for vaccination coverage. For Alaska, this number represents the number surveyed for exemptions because coverage was not reported. The national total excludes the 8,702 kindergartners from Alaska. Exemption estimates are based on 31,792 kindergartners for Kansas, 95,875 kindergartners for Virginia, and 66,652 kindergartners for Wisconsin.

§§ Most states require 2 doses of MMR; Alaska, New Jersey, and Oregon require 2 doses of measles, 1 dose of mumps, and 1 dose of rubella vaccines. Georgia, New York, New York City, North Carolina, and Virginia require 2 doses of measles and mumps, 1 dose of rubella vaccines. Iowa requires 2 doses of measles and 2 doses of rubella vaccines.

¶¶ Pertussis vaccination coverage might include some diphtheria, tetanus toxoids, and pertussis vaccine (DTP) vaccinations if administered in another country or by a vaccination provider who continued to use DTP after 2000. Most states require 5 doses of DTaP for school entry, or 4 doses if the 4th dose was received on or after the 4th birthday; Illinois, Maryland, Virginia, and Wisconsin require 4 doses; Nebraska requires 3 doses. The reported coverage estimates represent the percentage of kindergartners with the state-required number of DTaP doses, except for Kentucky, which requires ≥5 doses but reports ≥4 doses of DTaP.

*** Most states require 2 doses of varicella vaccine for school entry; Alabama, Arizona, California, Hawaii, Maine, New Jersey, Oklahoma, and Oregon require 1 dose. Reporting of varicella vaccination status for kindergartners with a history of varicella disease varied within and among states; some were reported as vaccinated against varicella and others as medically exempt.

††† National coverage estimates and medians calculated from data from 49 states (i.e., does not include Alaska). National grace period or provisional enrollment estimate and median were calculated from data from 30 states that have either a grace period or provisional enrollment policy and reported relevant data to CDC. National exemption estimate and median were calculated from data from 50 states. Other jurisdictions excluded were Houston, Texas, New York City, American Samoa, Guam, Marshall Islands, Federated States of Micronesia, Northern Mariana Islands, Palau, Puerto Rico, and U.S. Virgin Islands. Data reported from 3,634,896 kindergartners assessed for coverage, 3,643,598 for exemptions and 2,813,482 for grace period/provisional enrollment. Estimates represent rates for populations of 3,991,088; 4,001,404; and 3,025,009 kindergartners for coverage, exemptions and grace period/provisional enrollment, respectively.

§§§ The proportion surveyed likely was <100% but is reported as 100% based on incomplete information about the actual current enrollment.

¶¶¶ Philosophical exemptions were not allowed.

**** Kindergarten vaccination coverage (Alaska and District of Columbia) and exemption data (District of Columbia) were not reported because of problems with data collection.

†††† Religious exemptions were not allowed.

§§§§ Counted some or all vaccine doses received regardless of Advisory Committee on Immunization Practices recommended age and time interval; vaccination coverage rates reported might be higher than those for valid doses.

¶¶¶¶ Program did not report the number of children with exemptions, but instead reported the number of exemptions for each vaccine, which could count some children more than once. Lower bounds of the percentage of children with any exemptions were estimated using the individual vaccines with the highest number of exemptions.

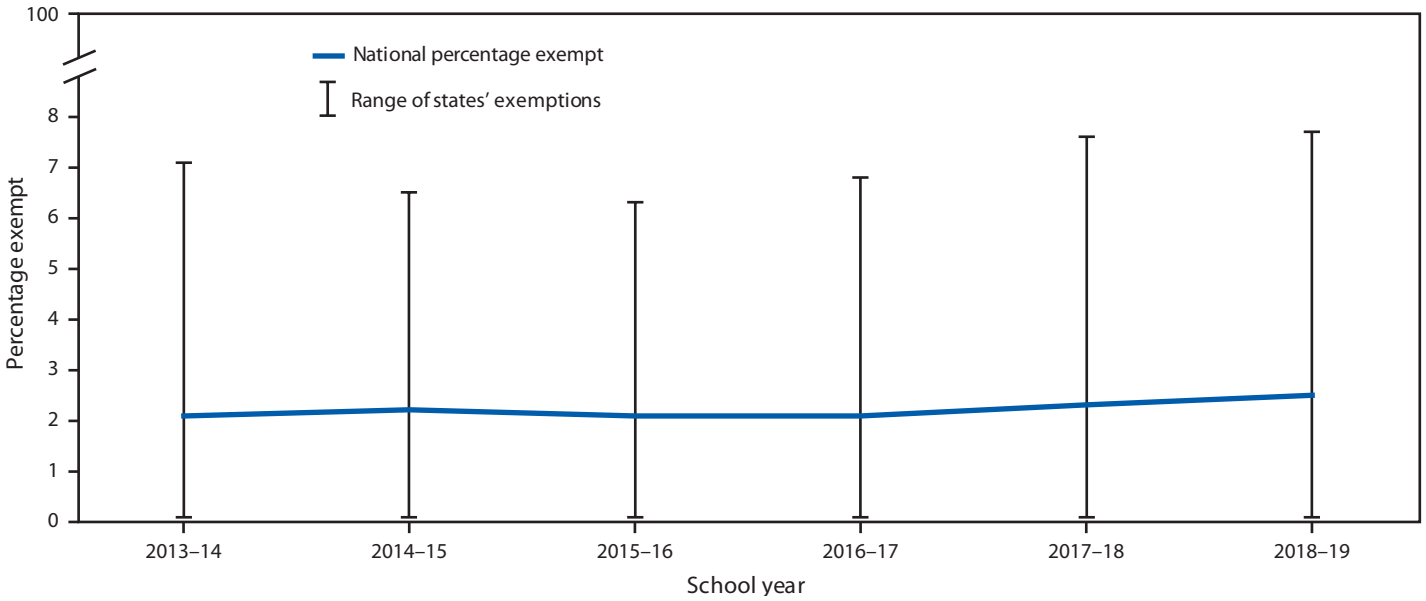
***** Did not include some types of schools, such as online schools or those located on military bases, in correctional facilities, or on tribal lands.

††††† Kindergarten vaccination coverage data were collected from a sample, and exemption data were collected from a census of kindergartners.

§§§§§ Reported public school data only.

¶¶¶¶¶ For Palau, estimates represent coverage among children in first grade.

FIGURE 1. Estimated national percentage exempt and range of states' exemptions from one or more vaccines among kindergartners — United States, 2013–14 to 2018–19 school years



children were vaccinated in accordance with local and state vaccination policies.

The findings in this report are subject to at least five limitations. First, comparability is limited because of variation in states' requirements, data collection methods, and definitions of grace period and provisional enrollment. Second, representativeness might be negatively affected because of data collection methods that miss some schools or students, such as homeschooled students, or assess vaccination status at different times. Third, actual vaccination coverage, exemption rates, or both might be underestimated or overestimated because of inaccurate or absent documentation or missing schools. Fourth, national coverage estimates include only 49 of 50 states, exemption estimates include all states but use lower-bound estimates for four states, and grace period or provisional enrollment estimates include only 30 states for the 2018–19 school year. Finally, because most states do not report vaccine-specific exemptions, estimates of potentially achievable MMR coverage are approximations. However, if reported exemptions were for a vaccine or vaccines other than MMR, potentially achievable MMR coverage would be higher than that presented.

Kindergarten vaccination requirements help ensure that students are fully vaccinated with recommended vaccines upon school entry. CDC works with immunization programs to collect and report data on school vaccination coverage, exemption rates, and grace period and provisional enrollment each year. Immunization programs can use these data to identify schools and communities with high concentrations of undervaccinated students and inform strategies to increase vaccination coverage. Such strategies include education campaigns to counteract misinformation in areas with high numbers of vaccine exemptions and increased follow-up of undervaccinated students without exemptions to ensure these children are vaccinated in accordance with local and state vaccination policies (*7*) to reduce the risk for transmission of vaccine-preventable diseases.

Summary

What is already known about this topic?

State immunization programs conduct annual kindergarten vaccination assessments to monitor school-entry vaccination coverage with all state-required vaccines.

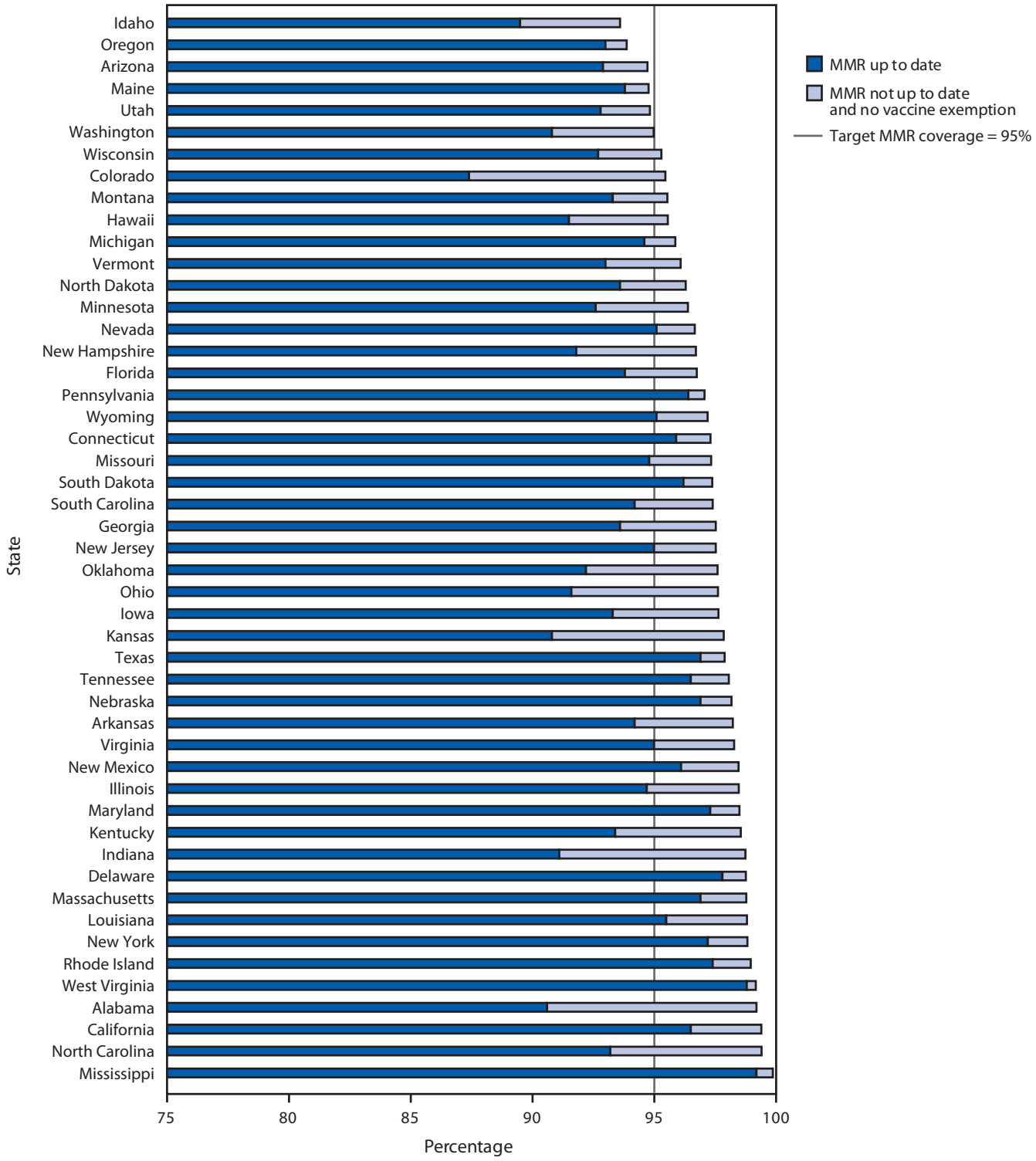
What is added by this report?

For the 2018–19 school year, coverage was 94.7% for 2 doses of measles, mumps, and rubella vaccine (MMR) and 94.9% for the state-required number of doses of diphtheria and tetanus toxoids and acellular pertussis vaccine, and 94.8% for varicella vaccine. Although the exemption rate slightly increased to 2.5%, most states could achieve the recommended ≥95% MMR coverage if undervaccinated children without an exemption were completely vaccinated.

What are the implications for public health practice?

State and local immunization programs can use school coverage assessments to detect pockets of undervaccination and guide strategies to increase vaccination coverage.

FIGURE 2. Potentially achievable coverage*,†,§ with measles, mumps, and rubella vaccine (MMR) among kindergartners — 49 states, 2018–2019 school year



* Potentially achievable coverage is estimated as the sum of the percentage of students with up-to-date MMR and the percentage of students without up-to-date MMR and without a vaccine exemption.

† The exemptions used to calculate the potential increase in MMR coverage for Arizona, Arkansas, Colorado, Idaho, Illinois, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, Texas, Utah, Vermont, and Wyoming are the number of children with exemptions specifically for MMR vaccine. For all other states, numbers are based on an exemption to any vaccine.

§ Alaska and the Disctrict of Columbia did not report kindergarten vaccination coverage for the 2018-19 school year and are excluded from this analysis.

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Vaccination Coverage by Age 24 Months Among Children Born in 2015 and 2016 — National Immunization Survey-Child, United States, 2016–2018

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The Advisory Committee on Immunization Practices (ACIP) recommends that children be vaccinated against 14 potentially serious illnesses during the first 24 months of life (*1*). CDC used data from the National Immunization Survey-Child (NIS-Child) to assess vaccination coverage with the recommended number of doses of each vaccine at the national, state, territorial, and selected local levels* among children born in 2015 and 2016. Coverage by age 24 months was at least 90% nationally for ≥3 doses of poliovirus vaccine, ≥1 dose of measles, mumps, and rubella vaccine (MMR), ≥3 doses of hepatitis B vaccine (HepB), and ≥1 dose of varicella vaccine, although MMR coverage was <90% in 20 states. Children were least likely to be up to date by age 24 months with ≥2 doses of influenza vaccine (56.6%). Only 1.3% of children born in 2015 and 2016 had received no vaccinations by the second birthday. Coverage was lower for uninsured children and for children insured by Medicaid than for those with private health insurance. Vaccination coverage can be increased by improving access to vaccine providers and eliminating missed opportunities to vaccinate children during health care visits. Increased use of local vaccination coverage data is needed to identify communities at higher risk for outbreaks of measles and other vaccine-preventable diseases.

The NIS-Child is a random-digit–dialed telephone survey† of parents or guardians of children aged 19–35 months. Respondents are asked to provide contact information for all providers who administered vaccines to their children. With parental consent, a survey is mailed to each identified provider, requesting the child's vaccination history. Multiple responses for an individual child are synthesized into a comprehensive vaccination history which is used to estimate vaccination coverage. To estimate coverage for the 25,059 children with adequate provider data§ born in 2015 and 2016, NIS-Child data from 2016–2018 were combined; for survey year 2018, the Council of American Survey Research Organizations' response rate was 24.6%, and 54.0% of children with household interviews had adequate provider data.¶ With this report, CDC has transitioned to reporting NIS-Child data by birth year rather than survey year. Vaccination coverage by age 24 months was estimated using Kaplan-Meier (time to event) analysis to account for children who were aged <24 months on the date vaccination status was assessed. Coverage with ≥2 doses of hepatitis A vaccine (HepA) was assessed at 35 months (the maximum age included in the survey), because the second dose of HepA can be administered as late as age 41 months under the current schedule. Previous NIS-Child weighting methods were modified to optimize estimation by birth year and to reflect the shift from a dual landline and cellular telephone sample frame to an exclusively cellular telephone sampling frame in 2018.** Differences in coverage estimates were evaluated using

* Estimates for states, selected local areas, and the territory of Guam are available online at https://www.cdc.gov/vaccines/imz-managers/coverage/childvaxview/data-reports/index.html. Certain local areas that receive federal Section 317 immunization funds are sampled separately and included in the NIS-Child sample every year (Chicago, Illinois; New York, New York; Philadelphia County, Pennsylvania; Bexar County, Texas; and Houston, Texas). Other local areas in Texas have been sampled in some survey years and not others, including El Paso County (survey years 2014–2017); Dallas County (survey years 2016 and 2017); Hildago County (survey years 2015 and 2018); Tarrant County (survey year 2018); and Travis County (survey year 2017). The NIS-Child was also conducted in Guam, Puerto Rico, and U.S. Virgin Islands; however, data collection in Puerto Rico and U.S. Virgin Islands was suspended during 2017 because of the severity of the hurricane season and did not occur at all in 2018, resulting in insufficient data for estimation of vaccination coverage by 24 months among children born during 2015–2016. National estimates in this report exclude all territories.

† NIS-Child used a landline-only sampling frame from 1995 through 2010. From 2011 through 2017, the survey was conducted using a dual-frame design, with both cellular and landline sampling frames included. In 2018, the NIS-Child returned to a single-frame design, with all interviews conducted by cellular telephone.

§ Children with at least one vaccination reported by a provider and those who had received no vaccinations were considered to have adequate provider data. "No vaccinations" indicates that the vaccination status is known because the parent indicated there were no vaccinations and the providers returned no immunization history forms or returned them indicating that no vaccinations had been given.

¶ The Council of American Survey Research Organizations (CASRO) household response rate is calculated as the product of the resolution rate (percentage of the total telephone numbers called that were classified as nonworking, nonresidential, or residential), screening completion rate (percentage of known households that were successfully screened for the presence of age-eligible children), and the interview completion rate (percentage of households with one or more age-eligible children that completed the household survey). The CASRO household response rate is equivalent to the American Association for Public Opinion Research type 3 response rate http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf. For CASRO response rates and the proportions of children with household interviews that had adequate provider data for survey years 2013–2017, see: https://www.cdc.gov/vaccines/imz-managers/nis/downloads/NIS-PUF17-DUG.pdf, (Appendix G).

** https://www.cdc.gov/vaccines/imz-managers/coverage/childvaxview/pubs-presentations/NIS-child-vac-coverage-estimates-2014-2018.html.

t-tests on weighted data; p-values of <0.05 were considered statistically significant. Analyses were performed using SAS (version 9.4; SAS institute) and SUDAAN (version 11.0.1; Research Triangle Institute). No evidence for a change in survey accuracy from the 2017 to 2018 survey year was detected (https://www.cdc.gov/vaccines/imz-managers/coverage/childvaxview/pubs-presentations/NIS-child-vac-coverage-estimates-2014-2018-tables.html#supp-table-01) (*2*).

National Vaccination Coverage

Coverage by age 24 months was ≥90% for ≥3 doses of poliovirus vaccine (92.7%), ≥1 dose of MMR (90.4%), ≥3 doses of HepB (91.0%), and ≥1 dose of varicella vaccine (90.0%) (Table 1). Compared with estimates for children born in 2013 and 2014, coverage for children born during 2015–2016 increased for the HepB birth dose (3.2 percentage points), ≥1 dose of HepA (1.5 percentage points), and ≥2 doses of influenza vaccine (3.6 percentage points). Coverage with ≥2 HepA doses by age 35 months increased from 74.0% for children born during 2013–2014 to 76.6% for children born during 2015–2016. Children were least likely to be up to date by age 24 months with ≥2 doses of influenza vaccine (56.6%) and the combined 7-vaccine series[††] (68.5%).

Vaccination Coverage by Selected Characteristics and Geographic Location

For most of the vaccines assessed, uninsured children, and children with Medicaid or other nonprivate insurance, had lower coverage than did privately insured children (Table 2). Compared with privately insured children, coverage disparities were largest among uninsured children, ranging from 7.8 percentage points for the HepB birth dose to 33.8 percentage points for ≥2 doses of influenza vaccine. The proportion of children who received no vaccinations was higher among uninsured children (7.4%) than among those with private insurance (0.8%). Disparities were also observed for race/ethnicity (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/81681), poverty level (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/81682), and metropolitan statistical area[§§] (MSA) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/81682) but tended to be smaller than those seen with health insurance status. Coverage varied widely by state/local area for many vaccines (Supplementary Table 3, https://stacks.cdc.gov/view/cdc/81683). Coverage with ≥1 dose of MMR was <90% in 20 states; only six states had coverage of 94% or higher (Figure).

Summary

What is already known about this topic?

The Advisory Committee on Immunization Practices recommends that children be vaccinated against 14 potentially serious illnesses before age 24 months.

What is added by this report?

Among children born in 2015 and 2016, coverage was high and stable for most vaccines. There were sociodemographic disparities in coverage, especially by health insurance status. The proportion of completely unvaccinated children remained small.

What are the implications for public health practice?

Coverage can be improved with increased access to providers and health insurance, administration of all recommended vaccines during office visits, and more effective patient education about vaccine safety and efficacy. Actionable local level data are a priority for creating targeted interventions to prevent outbreaks of measles and other vaccine-preventable diseases.

Trends in Vaccination Coverage

Vaccination coverage was stable by single birth year from 2011 through 2016 (https://www.cdc.gov/vaccines/imz-managers/coverage/childvaxview/pubs-presentations/NIS-child-vac-coverage-estimates-2014-2018-tables.html#supp-figure-01), except for an increase in ≥2 doses of HepA by age 35 months from 71.1% (2011) to 76.6% (2016). The proportion of children that received no vaccinations by age 24 months increased slightly across birth years 2011 through 2016, with an estimated change per year of 0.09 percentage points (https://www.cdc.gov/vaccines/imz-managers/coverage/childvaxview/pubs-presentations/NIS-child-vac-coverage-estimates-2014-2018-tables.html#supp-figure-02). Only 1.3% of children born in 2015 and 2016 received no vaccinations (Table 1).

Discussion

Vaccination coverage by the second birthday among children born during 2015–2016 remained high, with small increases in coverage with hepatitis A and B and influenza vaccines; only 1.3% of children received no vaccinations. However, several opportunities for improvement were apparent. Coverage was lower for children without private health insurance, especially those with no insurance, as well as those living below the poverty level and in more rural areas. Vaccination coverage also varied by state, with 20 states having MMR coverage <90%.

[††] The combined 7-vaccine series (4:3:1:3*:3:1:4) includes ≥4 doses of diphtheria and tetanus toxoids and acellular pertussis vaccine; ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 or ≥4 doses (depending upon product type) of *Haemophilus influenzae* type b conjugate vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of pneumococcal conjugate vaccine.

[§§] MSA status was determined based on household reported city and county of residence and was grouped into three categories: MSA principal city, MSA nonprincipal city, and non-MSA. MSAs and principal cities were as defined by the U.S. Census Bureau (https://www.census.gov/programs-surveys/metro-micro.html). Non-MSA areas include urban populations not located within an MSA as well as completely rural areas.

TABLE 1. Estimated vaccination coverage by age 24 months* among children born during 2013–2016 for selected vaccines and doses — National Immunization Survey-Child, United States, 2014–2018

Vaccine/Dose	% (95% CI)		
	Birth years†		Difference
	2013–2014	2015–2016	(2013–2014) to (2015–2016)
DTaP§			
≥3 doses	93.6 (93.0 to 94.2)	93.8 (93.1 to 94.5)	0.2 (-0.7 to 1.1)
≥4 doses	80.6 (79.7 to 81.6)	80.3 (79.0 to 81.5)	-0.4 (-1.9 to 1.2)
Poliovirus (≥3 doses)	91.7 (91.0 to 92.4)	92.7 (92.0 to 93.4)	1.0 (0.0 to 2.0)
MMR (≥1 dose)¶	90.0 (89.3 to 90.7)	90.4 (89.5 to 91.2)	0.3 (-0.8 to 1.5)
Hib**			
Primary series	92.7 (92.1 to 93.3)	92.7 (91.8 to 93.5)	0.0 (-1.1 to 1.0)
Full series	80.2 (79.3 to 81.1)	79.6 (78.3 to 80.9)	-0.6 (-2.1 to 1.0)
HepB			
Birth dose††	71.8 (70.7 to 72.8)	75.0 (73.7 to 76.2)	3.2 (1.6 to 4.9)§§
≥3 doses	90.9 (90.2 to 91.6)	91.0 (90.2 to 91.9)	0.1 (-1.0 to 1.2)
Varicella (≥1 dose)¶	89.3 (88.6 to 90.1)	90.0 (89.1 to 90.9)	0.7 (-0.5 to 1.8)
PCV			
≥3 doses	91.9 (91.2 to 92.5)	92.0 (91.1 to 92.8)	0.1 (-1.0 to 1.2)
≥4 doses	81.5 (80.6 to 82.4)	81.0 (79.8 to 82.3)	-0.4 (-2.0 to 1.1)
HepA			
≥1 dose	83.2 (82.4 to 84.1)	84.7 (83.6 to 85.8)	1.5 (0.1 to 2.9)§§
≥2 doses (by 35 months)	74.0 (72.8 to 75.3)	76.6 (74.7 to 78.4)	2.6 (0.4 to 4.8)§§
Rotavirus (by 8 months)¶¶	72.4 (71.3 to 73.4)	73.6 (72.2 to 74.9)	1.2 (-0.5 to 2.9)
Influenza (≥2 doses)***	53.0 (51.9 to 54.1)	56.6 (55.2 to 58.0)	3.6 (1.8 to 5.4)§§
Combined 7-vaccine series†††	68.4 (67.3 to 69.5)	68.5 (67.1 to 69.9)	0.1 (-1.7 to 1.9)
No vaccinations	1.1 (1.0 to 1.3)	1.3 (1.1 to 1.5)	0.1 (-0.2 to 0.4)

Abbreviations: CI = confidence interval; DTaP = diphtheria, tetanus toxoids, and acellular pertussis vaccine; HepA = hepatitis A vaccine; HepB = hepatitis B vaccine; Hib = *Haemophilus influenzae* type b conjugate vaccine; MMR = measles, mumps, and rubella vaccine; PCV = pneumococcal conjugate vaccine.

* Includes vaccinations received by age 24 months (before the day the child turns 24 months), except for the HepB birth dose, rotavirus vaccination, and ≥2 HepA doses by 35 months. For all vaccines, except the HepB birth dose and rotavirus vaccination, the Kaplan-Meier method was used to estimate vaccination coverage to account for children whose vaccination history was ascertained before age 24 months (35 months for ≥2 HepA doses).

† Data for the 2013 birth year are from survey years 2014, 2015, and 2016; data for the 2014 birth year are from survey years 2015, 2016, and 2017; data for the 2015 birth year are from survey years 2016, 2017, and 2018; data for the 2016 birth year are considered preliminary and come from survey years 2017 and 2018 (data from survey year 2019 are not yet available).

§ Includes children who might have received diphtheria and tetanus toxoids vaccine or diphtheria, tetanus toxoids, and pertussis vaccine.

¶ Includes children who might have received measles, mumps, rubella, and varicella combination vaccine.

** Hib primary series: receipt of ≥2 or ≥3 doses, depending on product type received; full series: primary series and booster dose, which includes receipt of ≥3 or ≥4 doses, depending on product type received.

†† One dose HepB administered from birth through age 3 days.

§§ Statistically significantly different from 0 at p<0.05.

¶¶ Includes ≥2 doses of Rotarix monovalent rotavirus vaccine, or ≥3 doses of RotaTeq pentavalent rotavirus vaccine. The maximum age for the final rotavirus dose is 8 months, 0 days.

*** Doses must be at least 24 days apart (4 weeks with a 4-day grace period).

††† The combined 7-vaccine series (4:3:1:3*:3:1:4) includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, the full series of Hib (≥3 or ≥4 doses, depending on product type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

Coverage with ≥2 doses of influenza vaccine was the lowest among all recommended childhood vaccines.

The importance of achieving and sustaining high vaccination coverage across all communities is illustrated by the 22 measles outbreaks occurring in the United States in 2019, with 1,249 measles cases identified during January 1–October 1, 2019 (*3*). Most cases have been among persons who were not vaccinated against measles. Pockets of low vaccination coverage, because of lack of access to vaccination services or to hesitancy resulting from the spread of inaccurate information about vaccines, increase the likelihood of a measles outbreak. Strategies are needed to increase access to vaccination services, identify communities at risk, and implement initiatives to counter inaccurate vaccine information (*4*).

Lower vaccination coverage among children who are uninsured, insured by Medicaid or other nonprivate insurance, living below the poverty level, and living in rural areas suggests challenges with access to affordable vaccinations or optimal vaccination services. Uninsured children are eligible for vaccine at no cost through the Vaccines for Children¶¶ program, but efforts to promote the program might not be reaching this population and therefore might need to be modified.

¶¶ https://www.cdc.gov/vaccines/programs/vfc/index.html.

TABLE 2. Estimated vaccination coverage by age 24 months* among children born during 2015–2016,† by selected vaccines and doses and health insurance status§ — National Immunization Survey-Child, United States, 2016–2018

Vaccine/Dose	Health insurance status, % (95% CI)			
	Private only (referent) (n = 12,702)	Any Medicaid (n = 9,442)	Other insurance (n = 2,141)	Uninsured (n = 774)
DTaP¶				
≥3 doses	96.9 (96.3–97.5)	91.8 (90.5–93.1)**	93.9 (92.2–95.3)**	80.6 (75.2–85.5)**
≥4 doses	87.1 (85.7–88.5)	75.8 (73.6–77.9)**	78.8 (75.4–82.0)**	59.8 (53.8–65.9)**
Poliovirus (≥3 doses)	96.1 (95.4–96.7)	90.7 (89.3–92.0)**	92.3 (90.4–94.0)**	79.3 (73.9–84.3)**
MMR (≥1 dose)††	93.7 (92.8–94.5)	88.6 (87.0–90.1)**	89.8 (87.6–91.8)**	73.2 (67.4–78.7)**
Hib§§				
Primary series	95.7 (94.5–96.8)	90.7 (89.3–92.1)**	93.7 (91.9–95.1)	78.4 (72.8–83.5)**
Full series	85.5 (83.7–87.1)	75.9 (73.8–78.0)**	79.1 (75.8–82.1)**	58.1 (52.1–64.2)**
HepB				
Birth dose¶¶	75.6 (73.9–77.2)	76.1 (74.0–78.1)	68.2 (64.3–71.9)**	67.8 (61.9–73.2)**
≥3 doses	93.0 (91.8–94.0)	90.0 (88.5–91.4)**	91.9 (89.9–93.6)	78.6 (73.3–83.5)**
Varicella (≥1 dose)††	93.2 (92.3–94.0)	88.6 (86.9–90.1)**	89.1 (86.8–91.2)**	70.3 (64.5–75.9)**
PCV				
≥3 doses	94.9 (93.5–96.0)	90.3 (88.9–91.7)**	92.0 (90.1–93.7)**	77.2 (71.7–82.4)**
≥4 doses	87.3 (85.6–88.8)	76.8 (74.7–78.9)**	80.9 (77.7–83.9)**	62.5 (56.7–68.3)**
HepA				
≥1 dose	87.5 (85.9–89.0)	83.7 (81.9–85.4)**	84.0 (81.2–86.6)**	65.5 (59.7–71.3)**
≥2 doses (by 35 months)	80.5 (77.9–83.1)	75.2 (72.2–78.0)**	76.8 (71.3–81.9)	48.2 (41.0–56.0)**
Rotavirus (by 8 months)***	83.5 (81.9–85.0)	65.9 (63.5–68.1)**	72.4 (68.5–76.0)**	59.8 (53.8–65.5)**
Influenza (≥2 doses)†††	68.5 (66.6–70.4)	48.2 (45.9–50.5)**	52.7 (48.6–56.9)**	34.7 (29.4–40.7)**
Combined 7-vaccine series§§§	75.4 (73.5–77.2)	64.3 (62.0–66.6)**	65.9 (62.1–69.6)**	46.7 (40.9–52.9)**
No vaccinations	0.8 (0.6–1.0)	1.2 (0.9–1.6)	1.8 (1.2–2.6)**	7.4 (4.7–10.7)**

Abbreviations: CI = confidence interval; DTaP = diphtheria, tetanus toxoids, and acellular pertussis vaccine; HepA = hepatitis A vaccine; HepB = hepatitis B vaccine; Hib = *Haemophilus influenzae* type b conjugate vaccine; MMR = measles, mumps, and rubella vaccine; PCV = pneumococcal conjugate vaccine.

* Includes vaccinations received by age 24 months (before the day the child turns 24 months), except for the HepB birth dose, rotavirus vaccination, and ≥2 HepA doses by 35 months. For all vaccines, except the HepB birth dose and rotavirus vaccination, the Kaplan-Meier method was used to estimate vaccination coverage to account for children whose vaccination history was ascertained before age 24 months (35 months for ≥2 HepA doses).

† Data for the 2015 birth year are from survey years 2016, 2017, and 2018; data for the 2016 birth year are considered preliminary and come from survey years 2017 and 2018 (data from survey year 2019 are not yet available).

§ Children's health insurance status was reported by parent or guardian. "Other insurance" includes the Children's Health Insurance Program, military insurance, coverage via the Indian Health Service, and any other type of health insurance not mentioned elsewhere.

¶ Includes children who might have received diphtheria and tetanus toxoids vaccine or diphtheria, tetanus toxoids, and pertussis vaccine.

** Statistically significant ($p<0.05$) difference compared with the referent group.

†† Includes children who might have received measles, mumps, rubella, and varicella combination vaccine.

§§ Hib primary series: receipt of ≥2 or ≥3 doses, depending on product type received; full series: primary series and booster dose, which includes receipt of ≥3 or ≥4 doses, depending on product type received.

¶¶ One dose HepB administered from birth through age 3 days.

*** Includes ≥2 doses of Rotarix monovalent rotavirus vaccine (RV1), or ≥3 doses of RotaTeq pentavalent rotavirus vaccine (RV5). The maximum age for the final rotavirus dose is 8 months, 0 days.

††† Doses must be at least 24 days apart (4 weeks with a 4-day grace period).

§§§ The combined 7-vaccine series (4:3:1:3*:3:1:4) includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, the full series of Hib (≥3 or ≥4 doses, depending on product type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

Targeted programs to address logistical issues such as expanded office hours and transportation to vaccination appointments could facilitate access to vaccination services, regardless of the child's type of insurance. Providers need to use every patient encounter to screen for and offer vaccinations. An analysis of NIS-Child data for children born during 2005–2015 found that disparities in coverage with ≥4 doses of diphtheria, tetanus toxoids, and acellular pertussis vaccine (DTaP) for those with Medicaid compared with those with private health insurance could have been reduced by 42% had opportunities for receipt of the fourth DTaP dose not been missed during visits when other vaccinations were received (*5*).

The transition to reporting by birth year rather than by survey year more directly assesses recent changes in vaccination coverage and provides more interpretable estimates and more accurate comparisons to evaluate immunization information systems (*2*,*6*,*7*). With a standard age at assessment (e.g., 24 months), estimates by birth year might be slightly lower for some vaccines than were estimates by survey year, which on average, assessed vaccination by age 27.5 months. Trends in vaccination coverage by birth year and survey year are similar (*8*). Other changes include addition of assessment of ≥2 HepA doses by age 35 months to better reflect current

ACIP recommendations and the addition of vaccination with 2 doses of influenza vaccine by age 24 months.***

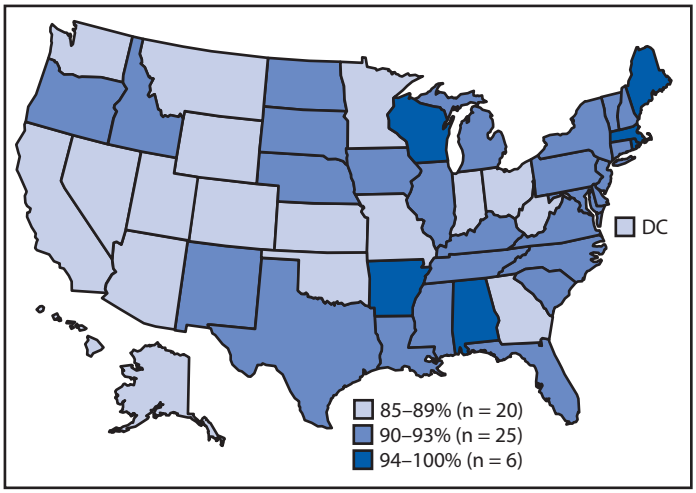
The findings in this report are subject to at least two limitations. First, as with previous NIS-Child estimates by survey year, vaccination coverage estimates by birth year might be biased because of an incomplete sample frame, nonresponse, and underascertainment of vaccination (*6*). No evidence for change in survey accuracy from 2017 to 2018 was detected. Second, starting in 2018, the NIS-Child sample was drawn only from cellular telephone numbers. Vaccination coverage trends should thus be viewed with caution, although the effect of dropping the landline sample is likely small.

Improvements in childhood vaccination coverage will require that parents and other caregivers have access to vaccination providers and believe in the safety and effectiveness of vaccines. Increased opportunity for vaccination can be facilitated through expanded access to health insurance, greater promotion of available vaccines through the Vaccines for Children program, and solutions to logistical challenges such as transportation, child care, and time off from work. Providers can improve vaccination coverage overall and reduce disparities by administering all recommended vaccines during office visits. Compelling and accessible educational materials, combined with effective techniques for providers to use when discussing vaccination, can be used to counter inaccurate claims and communicate the value of vaccines in protecting the health of children (*9*). In addition, actionable data at a local level are needed so that interventions can be targeted to areas at risk for outbreaks of measles and other vaccine-preventable diseases. More immunization information systems will contribute to this effort because they streamline their data collection processes and improve data quality (*10*).††† Given low survey response rates, CDC is working to better assess accuracy of NIS-Child vaccination coverage estimates, evaluate new survey approaches (e.g., switching to an address-based sample frame), and integrate data from immunization information systems and, potentially, other data sources (*7*).

*** This measure of influenza vaccination differs from other estimates from NIS-Flu (see https://www.cdc.gov/flu/fluvaxview/coverage-1718estimates-children.htm): it is based on provider-reported vaccinations instead of relying on parental report; and it reflects vaccinations that might have been received over two influenza seasons, while NIS-Flu estimates are for one season. Receipt of two influenza vaccinations by age 24 months is also a Healthcare Effectiveness Data and Information Set measure (https://www.ncqa.org/hedis/measures/childhood-immunization-status/); this measure can be used to identify commercial and Medicaid health plans within states with lower vaccination coverage.

††† General information about immunization information systems is available at https://www.cdc.gov/vaccines/programs/iis/about.html. Guidance on using immunization information systems to identify geographic areas of populations at risk for outbreaks of vaccine-preventable diseases is available at https://repository.immregistries.org/files/resources/5bae51a16a09c/identifying_immunization_pockets_of_need-_final2.pdf.

FIGURE. Estimated coverage with ≥1 dose of MMR by age 24 months among children born 2015–2016* — National Immunization Survey-Child, United States, 2016–2018



Abbreviations: DC = District of Columbia; MMR = measles, mumps, and rubella vaccine.

* Data for the 2015 birth year are from survey years 2016, 2017, and 2018; data for the 2016 birth year are considered preliminary and come from survey years 2017 and 2018 (data from survey year 2019 are not yet available).

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Update: Interim Guidance for Health Care Providers Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product Use Associated Lung Injury — United States, October 2019

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On October 11, 2019, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

CDC, the Food and Drug Administration (FDA), state and local health departments, and public health and clinical partners are investigating a multistate outbreak of lung injury associated with the use of electronic cigarette (e-cigarette), or vaping, products. In late August, CDC released recommendations for health care providers regarding e-cigarette, or vaping, product use associated lung injury (EVALI) based on limited data from the first reported cases (*1*,*2*). This report summarizes national surveillance data describing clinical features of more recently reported cases and interim recommendations based on these data for U.S. health care providers caring for patients with suspected or known EVALI. It provides interim guidance for 1) initial clinical evaluation; 2) suggested criteria for hospital admission and treatment; 3) patient follow-up; 4) special considerations for groups at high risk; and 5) clinical and public health recommendations. Health care providers evaluating patients suspected to have EVALI should ask about the use of e-cigarette, or vaping, products in a nonjudgmental and thorough manner. Patients suspected to have EVALI should have a chest radiograph (CXR), and hospital admission is recommended for patients who have decreased blood oxygen (O_2) saturation (<95%) on room air or who are in respiratory distress. Health care providers should consider empiric use of a combination of antibiotics, antivirals, or steroids based upon clinical context. Evidence-based tobacco product cessation strategies, including behavioral counseling, are recommended to help patients discontinue use of e-cigarette, or vaping, products. To reduce the risk of recurrence, patients who have been treated for EVALI should not use e-cigarette, or vaping, products. CDC recommends that persons should not use e-cigarette, or vaping, products that contain tetrahydrocannabinol (THC). At present, CDC recommends persons consider refraining from using e-cigarette, or vaping, products that contain nicotine. Irrespective of the ongoing investigation, e-cigarette, or vaping, products should never be used by youths, young adults, or women who are pregnant. Persons who do not currently use tobacco products should not start using e-cigarette, or vaping, products.

As of October 8, 2019, 49 states, the District of Columbia, and one territorial health department have reported 1,299 cases of EVALI to CDC, with 26 deaths reported from 21 states (median age of death = 49 years, range = 17–75 years). Among 1,043 patients with available data on age and sex, 70% were male, and the median age was 24 years (range = 13–75 years); 80% were aged <35 years, and 15% were aged <18 years. Among 573 patients who reported information on substances used in e-cigarette, or vaping, products in the 90 days preceding symptom onset, 76% reported using THC-containing products, and 58% reported using nicotine-containing products; 32% reported exclusive use of THC-containing products, and 13% reported exclusive use of nicotine-containing products.* No single compound or ingredient has emerged as the cause of these injuries to date, and there might be more than one cause. Available data suggest THC-containing products play a role in this outbreak, but the specific chemical or chemicals responsible for EVALI have not yet been identified, and nicotine-containing products have not been excluded as a possible cause.

Ongoing federal and state investigations have provided information about the clinical characteristics of cases and a surveillance case definition for confirmed and probable cases has been developed (*1*); this case definition† is not intended to guide clinical care. To inform CDC's updated interim clinical guidance, on October 2, 2019, CDC obtained individual expert perspectives on the evaluation and treatment of patients with suspected EVALI. Discussions occurred with nine national experts in adult and pediatric pulmonary medicine and critical care who were designated by professional medical societies to participate (Lung Injury Response Clinical Working Group). Evidence supporting CDC's recommendations include data from medical abstractions reported to CDC, previously published case series (*3*–*5*), and the aforementioned individual expert opinions.

* https://www.cdc.gov/lunginjury.
† https://www.cdc.gov/tobacco/basic_information/e-cigarettes/assets/2019-Lung-Injury-Surveillance-Case-Definition-508.pdf.

Clinical Evaluation for Patients with Suspected EVALI

EVALI is considered a diagnosis of exclusion because, at present, no specific test or marker exists for its diagnosis (Box 1). Health care providers should consider multiple etiologies, including the possibility of EVALI and concomitant infection. In addition, health care providers should evaluate alternative diagnoses as suggested by clinical findings and medical history (e.g., cardiac, gastrointestinal, rheumatologic, and neoplastic processes; environmental or occupational exposures; or causes of acute respiratory distress syndrome) (*6*).

Patient history. Based upon medical chart abstraction data submitted to CDC, 95% (323/339) of patients diagnosed with EVALI initially experienced respiratory symptoms (e.g., cough, chest pain, and shortness of breath), and 77% (262/339) had gastrointestinal symptoms (e.g., abdominal pain, nausea, vomiting, and diarrhea). Gastrointestinal symptoms preceded respiratory symptoms in some patients (*1*–*3*). Respiratory or gastrointestinal symptoms were accompanied by constitutional symptoms such as fever, chills, and weight loss among 85% (289/339) of patients (Table).

All health care providers evaluating patients for EVALI should ask about the use of e-cigarette, or vaping, products and ideally should ask about types of substances used (e.g., THC, cannabis [oil, dabs], nicotine, modified products or the addition of substances not intended by the manufacturer); product source, specific product brand and name; duration and frequency of use, time of last use; product delivery system, and method of use (aerosolization, dabbing, or dripping). Empathetic, nonjudgmental, and private questioning of patients regarding sensitive information to assure confidentiality should be employed. Standardized approaches should be used for interviewing adolescents. Resources exist to guide patient interviews, including those of adolescents.[§] In some situations, asking questions over the course of the hospitalization or during follow-up visits might elicit additional information about exposures, especially as trust is established between the patient and clinicians.

Physical examination. For patients who report the use of e-cigarette, or vaping, products, physical examination should include vital signs and pulse-oximetry. Tachycardia was reported in 55% (169/310) of patients and tachypnea in 45% (77/172); O_2 saturation <95% at rest on room air was present for 57% (143/253) of patients reported to CDC (Table), underscoring the need for routine pulse-oximetry. Among patients identified to date, pulmonary findings on auscultation exam have often been unremarkable, even among patients with severe lung injury (personal communication, Lung Injury Response Clinical Working Group, October 2, 2019).

[§] https://www.aafp.org/afp/2017/0101/p29.pdf; https://depts.washington.edu/dbpeds/Screening%20Tools/HEADSS.pdf.

BOX 1. Clinical evaluation for patients with recent history of use of e-cigarette, or vaping, products and suspected lung injury

History
- Ask about respiratory, gastrointestinal, and constitutional symptoms (e.g., cough, chest pain, shortness of breath, abdominal pain, nausea, vomiting, diarrhea, and fever) for patients who report a history of use of e-cigarette, or vaping, products.
- Ask all patients about recent use of e-cigarette, or vaping, products.
  - Types of substances used (e.g., tetrahydrocannabinol [THC], cannabis [oil, dabs], nicotine, modified products or the addition of substances not intended by the manufacturer); product source, specific product brand and name; duration and frequency of use, time of last use; product delivery system, and method of use (aerosolization, dabbing, or dripping).

Physical exam
- Assess vital signs and oxygen saturation via pulse-oximetry.

Laboratory testing
- Infectious disease evaluation might include
  - Respiratory viral panel including influenza testing during flu season, *Streptococcus pneumoniae, Legionella pneumophila, Mycoplasma pneumoniae,* endemic mycoses, and opportunistic infections.
- Initial laboratory evaluation
  - Consider complete blood count with differential, liver transaminases, and inflammatory markers (e.g., erythrocyte sedimentation rate and C-reactive protein).
  - In all patients, consider conducting urine toxicology testing, with informed consent, including testing for THC.

Imaging
- Chest radiograph.
- Consider chest computed tomography for evaluation of severe or worsening disease, complications, other illnesses, or when chest x-ray result does not correlate with clinical findings.

Other considerations
- Further evaluation of patients meeting inpatient admission criteria might include
  - Consultation with pulmonary, critical care, medical toxicology, infectious disease, psychology, psychiatry, and addiction medicine specialists.
  - Additional testing with bronchoalveolar lavage or lung biopsy as clinically indicated, in consultation with pulmonary specialists.

TABLE. Characteristics of patients (N = 342) with e-cigarette use, or vaping, product use associated lung injury (EVALI),* from national EVALI surveillance reports to CDC — United States, 2019†

Characteristic	EVALI patients	
	No. (%)	Total no. used in calculation§
Age, median (range) (yrs)	22 (13–71)	338
Symptoms reported		
Any respiratory	323 (95)	339
Any gastrointestinal	262 (77)	339
Any constitutional¶	289 (85)	339
Vital signs		
Oxygen saturation <95% while breathing room air	143 (57)	253
Tachycardia (heart rate >100 beats/min)	169 (55)	310
Tachypnea (respiratory rate >20 breaths/min)	77 (45)	172
Clinical course		
Admission to intensive care unit	159 (47)	342
Age group (yrs)		
13–17	45 (56)	80
18–24	49 (38)	130
25–50	54 (47)	115
≥51	9 (69)	13
Past cardiac disease**	8 (50)	16
No past cardiac disease	151 (46)	326
Intubation and mechanical ventilation	**74 (22)**	**338**
Age group (yrs)		
13–17	23 (29)	80
18–24	21 (16)	130
25–50	23 (20)	115
≥51	7 (54)	13
Past cardiac disease**	5 (31)	16
No past cardiac disease	70 (21)	326
Corticosteroids	252 (88)	287
Improved after corticosteroids	114 (82)	140
Duration of hospitalization (days)	**Mean (median)**	**Range**
Age group (yrs)		
13–17	6.9 (6)	0–23
18–24	6.2 (5)	0–38
25–50	6.6 (6)	0–40
≥51	14.8 (12)	3–31
Past cardiac disease	8.9 (4)	3–31
No past cardiac disease	6.6 (5)	0–40
Average hospital stay	6.7 (5)	0–40

Abbreviation: E-cigarette = electronic cigarette.

* For cases that had full medical chart abstraction data available.

† Surveillance data through October 3, 2019, from the following 29 U.S states: Alabama, Delaware, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, Nevada, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Texas, Vermont, Washington, West Virginia, and Wisconsin.

§ Patients with missing data were excluded from denominators for selected characteristics.

¶ Self-reported fever, chills, and unexpected weight loss.

** Heart failure, heart attack, or other heart conditions.

Laboratory testing. Laboratory testing should be guided by clinical findings. A respiratory virus panel, including influenza testing during influenza season, should be strongly considered. Additional testing should be based on published guidelines for evaluation of community-acquired pneumonia.¶ Infectious diseases to consider include *Streptococcus pneumoniae, Legionella pneumophila, Mycoplasma pneumoniae*, endemic mycoses, and opportunistic infections; the likelihood of infection by any of these varies by geographic prevalence and patient medical history. Other abnormal laboratory tests reported in patients with EVALI include elevated white blood cell (WBC) count, serum inflammatory markers (C-reactive protein, erythrocyte sedimentation rate [ESR]), and liver transaminases. In a report of initial patients from Illinois and Wisconsin, 87% had a WBC >11,000/mm^3 and 93% had an ESR >30mm/hr; 50% of patients had elevated liver transaminases (aspartate aminotransferase or alanine aminotransferase >35 U/L) (*3*). However, at this time, these tests cannot be used to distinguish EVALI from infectious etiologies. In all patients, providers should consider conducting, with informed consent, urine toxicology testing, including testing for THC.

Imaging. Radiographic findings consistent with EVALI include pulmonary infiltrates on CXR and opacities on chest computed tomography (CT) scan (*1*,*7*). A CXR should be obtained on all patients with a history of e-cigarette, or vaping, product use, who have respiratory or gastrointestinal symptoms, particularly when accompanied by decreased O_2 saturation (<95%). Chest CT might be useful when the CXR result does not correlate with clinical findings or to evaluate severe or worsening disease, complications such as pneumothorax or pneumomediastinum, or other illnesses in the differential diagnosis, such as pneumonia or pulmonary embolism. In some cases, chest CT has demonstrated findings such as bilateral ground glass opacities despite a normal or nondiagnostic CXR (*3*). Among patients with abnormal CXR findings and a clinical picture consistent with EVALI, a chest CT scan might not be necessary for diagnosis. The decision to obtain a chest CT should be made on a case-by-case basis depending on the clinical circumstances.

Consultation with specialists. Consultation with several specialists might be necessary to optimize patient management. For patients being evaluated for possible EVALI, consideration should be given to consultation with a pulmonologist, who can help guide further evaluation, recommend empiric treatment, and review the indications for bronchoscopy. The decision to perform bronchoscopy and bronchoalveolar lavage (BAL) to rule out alternative diagnoses such as pulmonary infection should be made on a case-by-case basis. The value of staining BAL cells or fresh lung biopsy tissue for lipid-laden macrophages (e.g., using oil red O or Sudan Black) in the evaluation of EVALI remains unknown. In addition, there should be

¶ https://www.atsjournals.org/doi/full/10.1164/rccm.201908-1581ST#readcube-epdf; http://academic.oup.com/cid/article/53/7/e25/424286/.

a low threshold for consulting with critical care physicians, because, based upon data submitted to CDC, 47% (159/342) of patients were admitted to an intensive care unit and 22% (74/338) required endotracheal intubation and mechanical ventilation (Table); critical care physicians should be consulted to determine optimal management of respiratory failure. Consultation with medical toxicology, infectious disease, psychology, psychiatry, addiction medicine, and other specialists should be considered as warranted by patient circumstances.

Management of Patients with Suspected EVALI

Admission criteria and outpatient management. Several factors should be considered when deciding whether to admit a patient with potential EVALI to the hospital (Box 2). Among 1,002 cases reported to CDC with available data as of October 8, 96% of patients were hospitalized. Patients with suspected EVALI should be admitted if they have decreased O_2 saturation (<95%) on room air, are in respiratory distress, or have comorbidities that compromise pulmonary reserve. Consider modifying factors such as altitude to guide interpretation of measured O_2 saturation.

Outpatient management of suspected EVALI might be considered on a case-by-case basis for patients who are clinically stable, have less severe injury, and for whom follow-up within 24–48 hours of initial evaluation can be assured. Candidates for outpatient management should have normal O_2 saturation (≥95%), reliable access to care, and strong social support systems. For these patients, empiric use of antimicrobials, including antivirals, if indicated, should be considered. Some patients who initially had mild symptoms experienced a rapid worsening of symptoms within 48 hours. In Illinois and Wisconsin, 72% of patients had either an outpatient or emergency department visit before seeking additional medical care that resulted in hospital admission (*3*). Health care providers should instruct all patients to seek medical care promptly if respiratory symptoms worsen.

Medical treatment. Corticosteroids might be helpful in treating this injury. Several case reports describe improvement with corticosteroids, likely because of a blunting of

BOX 2. Management of patients with suspected e-cigarette, or vaping, product use associated lung injury (EVALI)

Admission criteria and outpatient management
- Strongly consider admitting patients with potential lung injury, especially if respiratory distress present, have comorbidities that compromise pulmonary reserve, or decreased (<95%) O_2 saturation (consider modifying factors such as altitude to guide interpretation).
- Outpatient management for patients with suspected lung injury who have less severe injury might be considered on a case-by-case basis.

Medical treatment
- Consider initiation of corticosteroids.
- Early initiation of antimicrobial coverage for community-acquired pneumonia should be strongly considered in accordance with established guidelines.*
- Consider influenza antivirals in accordance with established guidelines.†

Patients not admitted to hospital
- Recommend follow-up within 24–48 hours to assess and manage possible worsening lung injury.
- Outpatients should have normal oxygen saturation, reliable access to care and social support systems, and be instructed to promptly seek medical care if respiratory symptoms worsen.
- Consider empiric use of antimicrobials and antivirals.

Post-hospital discharge follow-up
- Schedule follow-up visit no later than 1–2 weeks after discharge that includes pulse-oximetry testing. Consider repeating chest radiograph.
- Consider additional follow-up testing including spirometry and diffusion capacity testing, and consider repeat chest radiograph in 1–2 months.
- Consider endocrinology consultation for patients treated with high-dose corticosteroids.

Cessation services and preventive care
- Strongly advise patients to discontinue use of e-cigarette, or vaping, products.
- Provide education and cessation assistance for patients to aid nicotine addiction and treatment or referral for patients with marijuana-use-disorder.§
- Emphasize importance of routine influenza vaccination.¶
- Consider pneumococcal vaccine.**

* https://www.atsjournals.org/doi/full/10.1164/rccm.201908-1581ST#readcube-epdf; http://academic.oup.com/cid/article/53/7/e25/424286/.
† https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm; https://www.idsociety.org/practice-guideline/influenza/.
§ Substance Abuse and Mental Health Services Administrations treatment locator (https://www.samhsa.gov/find-treatment)to find treatment in your area or call 1–800–662-HELP (4357).
¶ https://www.cdc.gov/flu/prevent/vaccinations.htm.
** https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6337a4.htm?s_cid.

the inflammatory response (*3*–*5*). In a series of patients in Illinois and Wisconsin, 92% of 50 patients received corticosteroids; the medical team documented in 65% of 46 patient notes that "respiratory improvement was due to the use of glucocorticoids" (*3*). Among 140 cases reported nationally to CDC that received corticosteroids, 82% of patients improved (Table). However, the natural progression of this injury is not known, and it is possible that patients might recover without corticosteroids or by avoiding use of e-cigarette, or vaping, products. In some circumstances, it would be advisable to withhold corticosteroids while evaluating patients for infectious etiologies, such as fungal pneumonia, that might worsen with corticosteroid treatment. Nevertheless, because the diagnosis remains one of exclusion, aggressive empiric therapy with corticosteroids, antimicrobial, and antiviral therapy might be warranted for patients with severe illness. A range of corticosteroid doses, durations, and taper plans might be considered on a case-by-case basis. Whenever possible, decisions on the use of corticosteroids and dosing regimen should be made in consultation with a pulmonologist.

Early initiation of antimicrobial treatment for community-acquired pneumonia in accordance with established guidelines** should be strongly considered given the overlapping of signs and symptoms in these conditions. During influenza season, health care providers should consider influenza in all patients with suspected EVALI. Antivirals should be considered in accordance with established guidelines.†† Decisions on initiation or discontinuation of treatment should be based on specific clinical features and, when appropriate, in consultation with specialists.

Follow-up from hospital admission. Patients discharged from the hospital after inpatient treatment for EVALI should have a follow-up visit no later than 1–2 weeks after discharge that includes pulse-oximetry, and clinicians should consider repeating the CXR. Additional follow-up testing 1–2 months after discharge that might include spirometry, diffusion capacity testing, and CXR should be considered. Long-term effects and the risk of recurrence of EVALI are not known. Whereas many patients' symptoms resolved, clinicians report that some patients have relapsed during corticosteroid tapers after hospitalization, underscoring the need for close follow-up (personal communication, Lung Injury Response Clinical Working Group, October 2, 2019). Some patients have had persistent hypoxemia (O_2 saturation <95%), requiring home oxygen at discharge and might need ongoing pulmonary follow-up. Patients treated with high-dose corticosteroids might require care from an endocrinologist to monitor adrenal function.

It is unknown if patients with a history of EVALI are at higher risk for severe complications of influenza or other respiratory viral infections if they are infected simultaneously or after recovering from lung injury. Health care providers should emphasize the importance of annual vaccination against influenza for all persons >6 months of age, including patients with a history of EVALI. In addition, administration of pneumococcal vaccine should be considered according to current guidelines.§§

Addressing exposures. Advising patients to discontinue use of e-cigarette, or vaping, products should be an integral part of the care approach during an inpatient admission and should be re-emphasized during outpatient follow-up. Cessation of e-cigarette, or vaping, products might speed recovery from this injury; resuming use of e-cigarette, or vaping, products has the potential to cause recurrence of symptoms or lung injury. Evidence-based tobacco product cessation strategies include behavioral counseling and FDA-approved cessation medications.¶¶ For patients who have addiction to THC-containing or nicotine-containing products, cognitive-behavioral therapy, contingency management, motivational enhancement therapy, and multidimensional family therapy have been shown to help, and consultation with addiction medicine services should be considered (*8*–*10*).

Special considerations for groups at high risk. Patients with certain characteristics or comorbidities, including older age, history of cardiac or lung disease, or pregnancy, might be at higher risk for more severe outcomes. Among reported cases (Table), patients aged >50 years experienced the highest percentage of endotracheal intubation and mechanical ventilation (54%) and the longest mean inpatient stays (15 days). The mean first recorded O_2 saturations among those who did and did not require intubation were 87% and 92%, respectively (data not shown). Among those with and without past cardiac disease, 31% and 21%, respectively, required intubation (Table). Special consideration might need to be given to patients aged >50 years, because these patients might require longer duration of hospitalization and have a higher risk of intubation (Figure). Rapid identification of exposure, a high index of suspicion of EVALI, initiation of corticosteroids, and specialist consultations might be lifesaving in this patient population.

Additional data might identify other groups at high risk, provide important information about disparities in outcomes,

** https://www.atsjournals.org/doi/full/10.1164/rccm.201908-1581ST#readcube-epdf; http://academic.oup.com/cid/article/53/7/e25/424286/.

†† https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm; https://www.idsociety.org/practice-guideline/influenza/.

§§ https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6337a4.htm?s_cid.

¶¶ https://www.cdc.gov/tobacco/campaign/tips/quit-smoking/index.html?s_cid.

and help guide clinical care. Certain patients, such as adolescents and young adults, might benefit from specialized services, such as addiction treatment services and providers who have experience with counseling and behavioral health follow-up.

Clinical Care and Public Health Recommendations

Reporting cases to state, local, territorial, or tribal health departments is critical for accurate surveillance of EVALI. Reporting cases and obtaining and sending products, devices, and clinical and pathologic specimens for testing, can help health departments and CDC determine the cause or causes of these lung injuries.*** CDC is developing *International Classification of Diseases, Tenth Edition, Clinical Modification* coding guidance for health care encounters related to EVALI. Updates, when available, can be found at https://www.cdc.gov/lunginjury (Box 3).

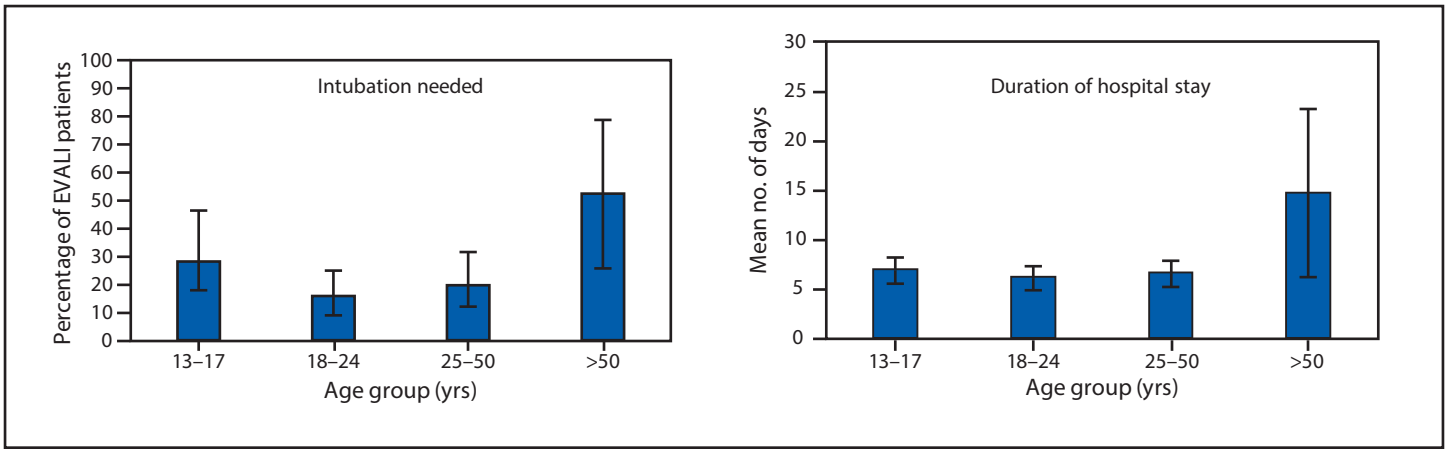
Public health recommendations. At this time, FDA and CDC have not identified the cause or causes of the lung injuries among EVALI cases, and the only commonality among all cases is that patients report the use of e-cigarette, or vaping, products. This outbreak might have more than one cause, and many different substances and product sources are still under investigation. To date, national and state data suggest that products containing THC, particularly those obtained off the street or from other informal sources (e.g., friends, family members, or illicit dealers), are linked to most of the cases and play a major role in the outbreak (*11*,*12*). Therefore, CDC recommends that persons should not use e-cigarette, or vaping, products that contain THC. Persons should not buy any type of e-cigarette, or vaping, products, particularly those containing THC, off the street. Persons should not modify or add any substances to e-cigarette, or vaping, products that are not intended by the manufacturer, including products purchased through retail establishments.

Given that the exclusive use of nicotine-containing products has been reported by a small percentage of persons with EVALI, and that many persons with EVALI report combined use of THC- and nicotine-containing products, the possibility that nicotine-containing products play a role in this outbreak cannot be excluded. Therefore, at present, CDC continues to recommend that persons consider refraining from using e-cigarette, or vaping, products that contain nicotine. If adults are using e-cigarette, or vaping, products to quit cigarette smoking, they should not return to smoking cigarettes; they should use evidence-based treatments, including health care provider counseling and FDA-approved medications.††† If persons continue to use these products, they should carefully monitor themselves for symptoms and see a health care provider immediately if symptoms develop. Irrespective of the ongoing investigation, e-cigarette, or vaping, products should never be used by youths, young adults, or women who are pregnant.

*** https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/health-departments/index.html.

††† https://www.aafp.org/dam/AAFP/documents/patient_care/tobacco/pharmacologic-guide.pdf.

FIGURE. Percentage of persons needing intubation (N = 338) and hospitalization (N = 242) among patients with e-cigarette, or vaping, product use associated lung injury (EVALI), by age of patient — United States, February 1–October 3, 2019*,†



Abbreviation: E-cigarette = electronic cigarette.

* Data reported through October 3, 2019, from the following 29 states: Alabama, Delaware, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, Nevada, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Texas, Vermont, Washington, West Virginia, and Wisconsin.

† 95% confidence intervals indicated by error bars.

BOX 3. Clinical Care and Public Health Reporting of e-cigarette, or vaping, product use associated lung injury (EVALI)

Considerations at points of care

- Examples include emergency departments, urgent care, doctors' offices, etc.
- Consider posting reminders or signage to encourage conversation between patients and providers about use of e-cigarette, or vaping, products.*
- Report cases of lung injury associated with use of e-cigarette, or vaping, products within the past 90 days to state or local health department.
- Determine whether any remaining product, including devices and liquids, is available for testing. Testing can be coordinated with health departments.
- CDC is developing *International Classification of Diseases, Tenth Edition, Clinical Modification* (ICD-10-CM) coding guidance for healthcare encounters related to EVALI. Updates, when available, will be at https://www.cdc.gov/lunginjury.

Clinical specimen testing by CDC†

- Consider submission of any collected specimens, including bronchoalveolar lavage, blood, or urine, to CDC for evaluation.

Testing of pathologic specimens by CDC§

- If a lung biopsy or autopsy is performed on a patient suspected of lung injury related to e-cigarette, or vaping, product use, consider submission of fixed lung biopsy tissues or autopsy tissues to CDC for evaluation.
- Testing can include evaluation for lipids on formalin-fixed (wet) lung tissues that have not undergone routine processing.
- Routine microscopic examination will be performed, as well as infectious disease testing, if indicated, on formalin-fixed (wet) tissues, or formalin-fixed, paraffin-embedded tissue specimens.

* https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/healthcare-providers/index.html.
† https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/health-departments/index.html.
§ https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/health-departments/index.html.

Summary

What is already known about this topic?

Forty-nine states, the District of Columbia, and one U.S. territory have reported 1,299 cases of lung injury associated with the use of electronic cigarette (e-cigarette), or vaping, products. Twenty-six deaths have been reported from 21 states.

What is added by this report?

Based on the most current data, CDC's updated interim guidance provides a framework for health care providers in their initial assessment, evaluation, management, and follow-up of persons with symptoms of e-cigarette, or vaping, product use associated lung injury (EVALI).

What are the implications for public health practice?

Rapid recognition by health care providers of patients with EVALI and an increased understanding of treatment considerations could reduce morbidity and mortality associated with this injury.

There is no safe tobacco product, and the use of any tobacco products, including e-cigarettes, carries a risk. Therefore, persons who do not currently use tobacco products should not start using e-cigarette, or vaping, products.

This investigation is ongoing. CDC will continue to work in collaboration with FDA and state and local partners to investigate cases and to update guidance, as appropriate, as new data emerges from this complex outbreak.

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Conflict of Interest

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Tobacco Use and Tobacco-Related Behaviors — 11 Countries, 2008–2017

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Each year, tobacco use is responsible for approximately 8 million deaths worldwide, including 7 million deaths among persons who use tobacco and 1.2 million deaths among nonsmokers exposed to secondhand smoke (SHS) (*1*). Approximately 80% of the 1.1 billion persons who smoke tobacco worldwide reside in low- and middle-income countries (*2*,*3*). The World Health Organization's (WHO's) Framework Convention on Tobacco Control (FCTC) provides the foundation for countries to implement and manage tobacco control through the MPOWER policy package,* which includes monitoring tobacco use, protecting persons from SHS, warning them about the danger of tobacco, and enforcing bans on tobacco advertising, promotion, or sponsorship (tobacco advertising) (*4*). CDC analyzed data from 11 countries that completed two or more rounds of the Global Adult Tobacco Survey (GATS) during 2008–2017. Tobacco use and tobacco-related behaviors that were assessed included current tobacco use, SHS exposure, thinking about quitting because of warning labels, and exposure to tobacco advertising. Across the assessed countries, the estimated percentage change in tobacco use from the first round to the most recent round ranged from -21.5% in Russia to 1.1% in Turkey. Estimated percentage change in SHS exposure ranged from -71.5% in Turkey to 72.9% in Thailand. Estimated percentage change in thinking about quitting because of warning labels ranged from 77.4% in India to -33.0% in Turkey. Estimated percentage change in exposure to tobacco advertising ranged from -66.1% in Russia to 44.2% in Thailand. Continued implementation and enforcement of proven tobacco control interventions and strategies at the country level, as outlined in MPOWER, can help reduce tobacco-related morbidity and mortality worldwide (*3*,*5*,*6*).

GATS is a nationally representative household survey of noninstitutionalized adults aged ≥15 years that uses a standard core questionnaire, sample design, and data collection methods.† GATS data were analyzed from 11 countries with at least two rounds of data collection during 2008–2017. Sample sizes in the first round ranged from 5,581 (Uruguay) to 69,296 (India) and in the most recent round, from 4,966 (Uruguay) to 74,037 (India).§ Because Turkey is the only country to have conducted three rounds of GATS data collection (2008, 2012, and 2016), 2008 was used as the baseline and 2016 as the follow-up to allow for results to be presented similarly to other countries; however, to assess changes over time in that country, all three rounds of data from Turkey were also analyzed. Response rates in the first round of GATS ranged from 76.2% (Ukraine) to 97.7% (Russia) and in the most recent round, from 64.4% (Ukraine) to 98.2% (Russia). Data were adjusted for nonresponse through weighting to provide nationally representative estimates among persons aged ≥15 years.

The prevalence and weighted population estimates of four tobacco control indicators were calculated: 1) current tobacco use; 2) SHS exposure; 3) thinking about quitting because of warning labels; and 4) exposure to tobacco advertising. Current tobacco use¶ was defined as either currently smoking tobacco, currently using smokeless tobacco, or both on a daily or less than daily basis.** SHS exposure was defined as being exposed to SHS in the past 30 days in any of four public places: restaurants, government buildings, health care facilities, or public transportation.†† Thinking about quitting because of warning labels was defined as currently smoking tobacco and noticing health warnings on a cigarette package leading

* The six components of MPOWER are "monitor" tobacco use and prevention policies; "protect" persons from tobacco smoke; "offer" help to quit tobacco use; "warn" about the dangers of tobacco; "enforce" bans on tobacco advertising, promotion, and sponsorship; and "raise" taxes on tobacco. https://www.who.int/tobacco/mpower/mpower_report_full_2008.pdf.

† https://journals.sagepub.com/doi/full/10.1177/1757975913499800.

§ Second round of GATS data for Brazil were obtained from a national health survey (Pesquisa Nacional Por Amostrade Domicilios), which integrated the entire GATS into the survey, thus producing nationally representative estimates for adults aged ≥18 years. All analyses for Brazil are among adults aged ≥18 years. Turkey has three rounds of GATS data (2008, 2012, and 2016).

¶ In most countries in this analysis, tobacco that is smoked is the predominant type of tobacco used. This is not the case in India and Bangladesh, where smokeless tobacco is the predominant type of tobacco used.

** Operational definition for persons who currently use tobacco can be found in GATS Indicator Definitions, Version 2.1. Current tobacco use is defined as having responded "daily" or "less than daily" to either "Do you currently smoke tobacco on a daily basis, less than daily, or not at all?" and "Do you currently use smokeless tobacco on a daily basis, less than daily, or not at all?" https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DownloadAttachment.aspx?ID=53.

†† Operational definition for secondhand smoke exposure can be found in GATS Indicator Definitions, Version 2.1. Secondhand smoke exposure in a public place is defined as having responded "yes" to any of the four following questions: "Did anyone smoke inside of any government building or government offices that you visited in the past 30 days?," "Did anyone smoke inside of any health care facilities that you visited in the past 30 days?," "Did anyone smoke inside of any restaurants that you visited in the past 30 days?," or "Did anyone smoke inside of any public transportation that you used in the past 30 days?" https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DownloadAttachment.aspx?ID=53.

to thinking about quitting in the past 30 days.[§§] Exposure to tobacco advertising was defined as being aware of cigarette advertising, promotions, or sponsorship in the last 30 days.[¶¶]

Country-specific prevalence and population estimates with corresponding 95% confidence intervals (CIs) were calculated for current tobacco use, SHS exposure, thinking about quitting because of warning labels, and exposure to tobacco advertising. Also, percentage point differences and percentage differences in prevalences and differences in population estimates were calculated. Z-tests were used to assess statistically significant differences ($p<0.05$) between surveys. All statistical analyses were conducted using SAS-callable SUDAAN (version 11.0; RTI International).

Across the 11 countries, the overall population estimate for current tobacco use decreased by approximately 20 million between GATS rounds, with estimated percentage point differences ranging from an 8.5% decline (Russia) to a 0.4% increase (Turkey) (Table). The overall population estimate for SHS exposure decreased by approximately 53.4 million, with estimated percentage point differences ranging from a 24.5% decrease (Russia) to a 13.0% increase (Thailand). The overall population estimate for thinking about quitting because of warning labels increased by approximately 12.4 million, with estimated percentage point differences ranging from a 22.1% increase (India) to an 18.2% decrease (Vietnam). The overall population estimate for exposure to tobacco advertising decreased by approximately 98.8 million, with estimated differences ranging from a 45.0% decline (Russia) to a 7.9% increase (Thailand). Analysis of the three rounds of data from Turkey showed that current tobacco use decreased during 2008–2012 and then increased during 2012–2016; thinking about quitting because of warning labels increased during 2008–2012 and then decreased during 2012–2016; SHS exposure decreased over all three rounds; and exposure to tobacco advertising did not change significantly during 2008–2012 or 2012–2016 (Figure 1). The WHO target for 2030 is a 30% reduction in current tobacco use among persons aged ≥15 years (Figure 2). From 2009 to 2016, Russia had a 21.5% reduction in the number of current tobacco users, and six countries (Bangladesh, Brazil, India, Philippines, Ukraine, and Uruguay) had reductions ranging from 13.1% to 19.9%. Two countries (Thailand and Vietnam) had reductions of <5%; Mexico and Turkey experienced slight increases. The differences in prevalence estimates and population estimates are due to changing population sizes of the countries over time. Prevalence and population estimates were included for all indicators: current tobacco use, secondhand smoke exposure, thinking about quitting because of warning labels, and exposure to tobacco advertisements in any location.

Discussion

The 11 countries included in this assessment of tobacco use and tobacco-related behaviors are home to 70% of the world's tobacco users; approximately 2.3 million annual tobacco-attributable deaths occur in these countries (*1*). Although seven of the 11 countries made measurable progress toward WHO's target of a 30% reduction in tobacco use by 2030, country-level progress varied. As of January 2018, 181 parties had ratified WHO's FCTC, including all 11 countries highlighted in this report. The ratification of FCTC by these 11 countries demonstrates their commitment to implementing, enforcing, and strengthening tobacco-control efforts, as evidenced by changes in current tobacco use and progress toward WHO's 2030 target. Continued implementation of MPOWER strategies could help reduce overall tobacco related morbidity and mortality in these countries and worldwide (*3*,*5*,*6*).

Estimated decreases in SHS exposure occurred in seven of the assessed countries. To protect persons from SHS, Article 8 of FCTC encourages signatories to adopt and implement measures that protect persons from SHS exposures in multiple settings (*4*). For all countries with an estimated decline in SHS exposure, the declines were ≥20%, which might reflect the comprehensiveness and enforcement of smoke-free laws. As of 2019, five of the 11 assessed countries had laws that mandated 100% of public places to be smoke-free or had subnational smoke-free legislation that covered at least 90% of the population (*7*).

[§§] Operational definition for thinking about quitting because of warning labels can be found in GATS Indicator Definitions, Version 2.1. Contemplated quitting because of warning labels is defined as current tobacco smokers, those respondents responding "daily" or "less than daily" to "Do you currently smoke tobacco on a daily basis, less than daily, or not at all?," who responded "yes" to "In the last 30 days, did you notice any health warnings on cigarette packages?" and "In the last 30 days, have warning labels on cigarette packages led you to think about quitting?" https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DownloadAttachment.aspx?ID=53.

[¶¶] Operational definition for awareness of cigarette advertising promotion, and sponsorships can be found in GATS Indicator Definitions, Version 2.1. Being aware of cigarette advertising and promotions is defined as responding "yes" to any of the four following questions: "In the last 30 days, have you noticed any advertisements or signs promoting cigarettes in the following places? A) In stores where cigarettes are sold?; B) On television?; C) On the radio? D) On billboards? E) On posters? F) In newspapers or magazines? G) In cinemas? H) On the internet? I) On public transportation vehicles or stations? J) On public walls? K) Anywhere else?," "In the last 30 days, have you noticed any sport or sporting event that is associated with cigarette brands or cigarette companies?," or "In the last 30 days, have you noticed any of the following types of cigarette promotions? A) Free samples of cigarettes? B) Cigarette at sale prices? C) Coupons for cigarettes? D) Free gifts or special discount offers on other products when buying cigarettes? E) Clothing or other items with a cigarette brand name or logo? F) Cigarette promotions in the mail?" The exact questions asked in the survey varied depending on country circumstances. In India, the definition covers both cigarettes and bidis instead of cigarettes only. https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DownloadAttachment.aspx?ID=53.

TABLE. Estimated prevalence and weighted population estimates* of persons aged ≥15 years of age who currently used tobacco, who were exposed to secondhand smoke, who contemplated quitting because of warning labels on cigarette packages, and who were exposed to tobacco advertisements — 11 countries, Global Adult Tobacco Survey (GATS), 2008–2017

Tobacco use category	Prevalence†				Population (millions)†		
	Baseline round	Most recent round	% Point difference	% Change§	Baseline round	Most recent round	Population difference
Country (yrs)	% (95% CI)				Estimate (95% CI)		
Current tobacco use							
Bangladesh (2009, 2017)	43.3 (41.7–45.0)	35.3 (33.9–36.7)	−8.0¶	−18.5¶	41.3 (38.9–43.6)	37.7 (36.0–39.4)	−3.5¶
Brazil** (2008, 2013)	18.5 (18.0–19.0)	15.0 (14.5–15.5)	−3.5¶	−19.2¶	24.6 (23.3–25.9)	21.9 (21.1–22.7)	−2.7¶
India (2009/10, 2016/17)	34.6 (33.6–35.5)	28.6 (27.9–29.3)	−5.9¶	−17.2¶	274.8 (260.7–289.0)	266.8 (258.1–275.5)	−8.0
Mexico (2009, 2015)	16.5 (15.3–17.8)	16.6 (15.7–17.6)	0.1	0.8	11.0 (9.3–12.7)	14.4 (13.5–15.3)	3.3¶
Philippines (2009, 2015)	29.7 (28.5–31.0)	23.8 (22.8–24.9)	−5.9¶	−19.9¶	18.0 (17.0–19.1)	16.5 (15.5–17.6)	−1.4¶
Russia†† (2009, 2016)	39.4 (38.0–40.8)	30.9 (29.4–32.4)	−8.5¶	−21.5¶	44.1 (41.2–47.0)	34.2 (32.5–36.0)	−9.8¶
Thailand (2009, 2011)	27.2 (26.2–28.3)	26.9 (25.7–28.1)	−0.4	−1.4	14.3 (13.7–14.9)	14.5 (13.8–15.3)	0.2
Turkey§§ (2008, 2016)	31.2 (30.0–32.6)	31.6 (30.2–33.0)	0.4	1.1	15.9 (15.2–16.7)	19.2 (18.2–20.1)	3.2¶
Ukraine†† (2010, 2016)	28.4 (27.2–29.7)	23.0 (21.8–24.3)	−5.4¶	−19.0¶	9.7 (9.2–10.2)	8.2 (7.7–8.7)	−1.4¶
Uruguay (2009, 2017)	25.0 (23.4–26.6)	21.7 (20.4–23.0)	−3.3¶	−13.1¶	0.6 (0.5–0.6)	0.5 (0.5–0.6)	<−0.1
Vietnam (2010, 2015)	25.2 (24.0–26.4)	24.2 (22.9–25.5)	−1.0	−4.1	16.0 (15.2–16.8)	16.3 (15.3–17.3)	0.3
Secondhand smoke exposure							
Bangladesh (2009, 2017)	45.0 (43.4–46.5)	34.1 (32.5–35.7)	−10.9¶	−24.2¶	42.8 (40.1–45.5)	36.2 (34.1–38.3)	−6.5¶
Brazil** (2008, 2013)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
India (2009/10, 2016/17)	29.0 (28.1–29.9)	23.1 (22.4–23.9)	−5.9¶	−20.3¶	228.4 (216.3–240.4)	214.7 (206.5–222.9)	−13.6
Mexico (2009, 2015)	23.3 (21.5–25.1)	24.8 (23.6–26.0)	1.5	6.5	15.9 (13.5–18.3)	21.6 (20.4–22.8)	5.7¶
Philippines (2009, 2015)	55.0 (53.3–56.7)	37.8 (36.0–39.6)	−17.2¶	−31.3¶	33.6 (31.7–35.5)	26.3 (24.5–28.0)	−7.3¶
Russia†† (2009, 2016)	35.1 (33.0–37.3)	10.7 (9.3–12.2)	−24.5¶	−69.7¶	39.2 (35.9–42.6)	11.7 (10.1–13.4)	−27.5¶
Thailand (2009, 2011)	17.8 (16.7–18.9)	30.8 (29.0–32.6)	13.0¶	72.9¶	9.2 (8.5–9.8)	16.4 (15.3–17.5)	7.2¶
Turkey§§ (2008, 2016)	31.5 (29.8–33.3)	9.0 (8.0–10.1)	−22.5¶	−71.5¶	16.0 (15.0–17.0)	5.2 (4.6–5.9)	−10.7¶
Ukraine†† (2010, 2016)	29.0 (27.3–30.8)	12.5 (11.1–14.0)	−16.5¶	−57.0¶	9.9 (9.2–10.6)	4.4 (3.8–5.0)	−5.4¶
Uruguay (2009, 2017)	8.8 (7.8–10.0)	6.5 (5.6–7.6)	−2.3¶	−26.5¶	0.2 (0.1–0.2)	0.1 (0.1–0.2)	<−0.1
Vietnam (2010, 2015)	32.5 (31.2–33.8)	37.3 (35.9–38.8)	4.9¶	15.0¶	20.8 (19.9–21.7)	25.8 (24.6–26.9)	4.9¶
Thinking about quitting because of warnings labels							
Bangladesh (2009, 2017)	58.5 (55.1–61.7)	75.6 (71.9–78.9)	17.1¶	29.3¶	12.5 (11.5–13.5)	14.4 (13.4–15.5)	1.9¶
Brazil** (2008, 2013)	65.0 (63.4–66.5)	54.3 (50.3–54.2)	−10.7¶	−19.6¶	15.7 (14.7–16.6)	11.2 (10.6–11.9)	−4.4¶
India (2009/10, 2016/17)	28.6 (26.8–30.4)	50.7 (48.8–52.7)	22.1¶	77.4¶	31.6 (29.1–34.1)	50.4 (47.4–53.5)	18.8¶
Mexico (2009, 2015)	33.0 (30.1–36.0)	43.2 (39.9–46.5)	10.2¶	31.0¶	3.6 (2.9–4.2)	6.1 (5.5–6.7)	2.5¶
Philippines (2009, 2015)	37.4 (34.8–40.0)	44.6 (41.5–47.7)	7.2¶	19.4¶	6.4 (5.9–6.9)	7.0 (6.3–7.7)	0.5
Russia†† (2009, 2016)	31.7 (28.9–34.6)	36.1 (33.4–38.8)	4.4¶	13.8¶	13.8 (12.3–15.3)	12.2 (11.1–13.3)	−1.6
Thailand (2009, 2011)	67.0 (64.4–69.5)	62.6 (60.0–65.2)	−4.4¶	−6.5¶	8.3 (7.9–8.8)	8.1 (7.5–8.7)	−0.2
Turkey§§ (2008, 2016)	46.3 (43.6–49.1)	31.0 (28.5–33.7)	−15.3¶	−33.0¶	7.4 (6.8–7.9)	5.9 (5.3–6.4)	−1.4¶
Ukraine†† (2010, 2016)	59.7 (56.1–63.2)	54.0 (50.6–57.5)	−5.7¶	−9.5¶	5.7 (5.3–6.2)	4.4 (4.0–4.7)	−1.3¶
Uruguay (2009, 2017)	42.9 (39.4–46.4)	42.9 (39.4–46.6)	0.1	0.2	0.2 (0.2–0.2)	0.2 (0.2–0.2)	<0.1
Vietnam (2010, 2015)	66.7 (63.9–69.4)	48.5 (45.5–51.5)	−18.2¶	−27.2¶	10.1 (9.5–10.7)	7.5 (6.8–8.1)	−2.6¶
Exposure to advertisements, promotions, or sponsorships in any location							
Bangladesh (2009, 2017)	48.7 (46.2–51.2)	39.6 (36.7–42.5)	−9.1¶	−18.8¶	45.8 (42.5–49.1)	28.8 (26.3–31.3)	−16.9¶
Brazil** (2008, 2013)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
India (2009/10, 2016/17)	31.1 (29.9–32.3)	22.3 (21.4–23.1)	−8.8¶	−28.4¶	242.8 (229.6–256.0)	207.4 (198.6–216.1)	−35.4¶
Mexico (2009, 2015)	56.5 (54.5–58.4)	53.1 (51.7–54.4)	−3.4¶	−6.1¶	38.7 (34.0–43.4)	46.4 (44.8–48.0)	7.6¶
Philippines (2009, 2015)	74.3 (72.4–76.1)	58.6 (55.9–61.2)	−15.7¶	−21.1¶	45.5 (43.1–47.8)	40.8 (38.1–43.5)	−4.6¶
Russia†† (2009, 2016)	68.0 (65.8–70.2)	23.1 (20.6–25.7)	−45.0¶	−66.1¶	76.1 (71.1–81.2)	25.4 (22.6–28.1)	−50.7¶
Thailand (2009, 2011)	17.8 (16.5–19.2)	25.7 (23.7–27.8)	7.9¶	44.2¶	9.1 (8.4–9.9)	13.6 (12.5–14.8)	4.5¶
Turkey§§ (2008, 2016)	13.3 (12.0–14.6)	17.5 (15.5–19.7)	4.2¶	31.8¶	6.7 (6.0–7.4)	10.5 (9.2–11.8)	3.7¶
Ukraine†† (2010, 2016)	46.3 (44.2–48.4)	25.0 (23.2–26.8)	−21.3¶	−46.0¶	15.8 (14.9–16.7)	8.9 (8.2–9.7)	−6.8¶
Uruguay (2009, 2017)	44.3 (42.0–46.5)	34.5 (31.6–37.5)	−9.8¶	−22.1¶	1.0 (1.0–1.1)	0.9 (0.8–1.0)	−0.1¶
Vietnam (2010, 2015)	16.9 (15.8–18.1)	16.0 (14.8–17.3)	−0.9	−5.5	10.8 (10.0–11.6)	11.0 (10.1–11.9)	0.1

Abbreviations: CI = confidence interval; N/A = not applicable.

* Population is presented in millions and has been rounded down to the nearest 100,000.

† Both prevalence and population estimates are shown. The estimated differences in population are different from estimated differences in prevalence because of changing population sizes in the 11 countries.

§ Percentage change is calculated as [(t2-t1)/t1] x 100 where t1 is the prevalence reported during the first round of GATS and t2 is the prevalence reported during the most recent round.

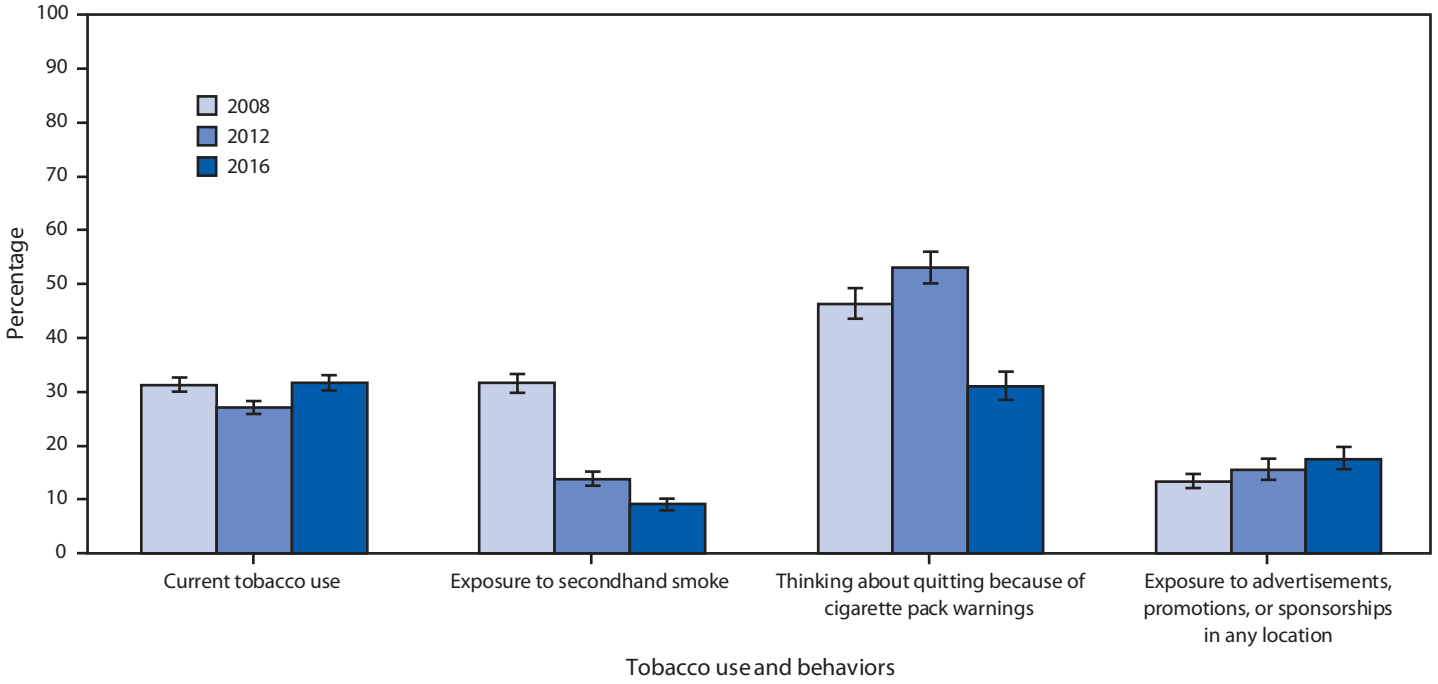
¶ Statistically significant change, p<0.05.

** In 2008, Brazil completed one round of GATS and, in 2013, integrated GATS into its national health survey conducted among adults aged ≥18 years. Thus, Brazil's data across time compares results for adults aged ≥18 years. Brazil's 2013 national health survey did not assess the indicators on exposure to secondhand smoke and exposure to advertisements, promotions, or sponsorships in any location.

†† In the most recent round, Russia and Ukraine did not survey certain geographic areas that were surveyed in the baseline round.

§§ Turkey has completed three rounds of GATS (2008, 2012, and 2016). Data shown are from 2008 as the baseline and 2016 as the latest round.

FIGURE 1. Estimated prevalence of current tobacco use, secondhand smoke exposure, thinking about quitting because of warning labels, and exposure to tobacco advertisements, promotions, or sponsorships among persons aged ≥15 years — Global Adult Tobacco Survey, Turkey, 2008, 2012, and 2016*,†,§



* For current tobacco use, secondhand smoke exposure, and thinking about quitting because of warning labels, between surveys in 2008 and 2012, prevalence estimates with p-values <0.05 were considered statistically significant.

† For current tobacco use, secondhand smoke exposure, and thinking about quitting because of warning labels, between surveys in 2012 and 2016, prevalence estimates with p-values <0.05 were considered statistically significant.

§ For secondhand smoke exposure, thinking about quitting because of warning labels, and exposure to tobacco advertisements, promotions, or sponsorships, between surveys in 2008 and 2016, prevalence estimates with p-values <0.05 were considered statistically significant.

Significant gains were also made in the proportion of persons considering quitting because of warning labels. Article 11 of FCTC encourages parties to adopt and implement effective measures to ensure that tobacco product packaging and labels do not promote a tobacco product and effectively warn about the dangers of tobacco use (*4*). Currently, all 11 assessed countries have large warnings on their cigarette packages (*7*), with the warnings occupying 30%–85% of the largest package surface. In most countries, the pictorial health warnings were enlarged, text was enhanced, or both (*8*). Adoption of more effective health warnings on tobacco packages (e.g., plain packaging or larger pictorial warnings) could help increase quit attempts (*9*,*10*).

Six countries experienced an estimated decrease in exposure to tobacco advertising, suggesting that gains in protecting persons from exposure to tobacco advertising have been made. Article 13 of FCTC calls for countries to undertake comprehensive bans on tobacco advertising (*4*). As of 2019, four of the 11 assessed countries had bans on all forms of direct and

Summary

What is already known about this topic?

Each year, tobacco use is responsible for approximately 8 million deaths worldwide.

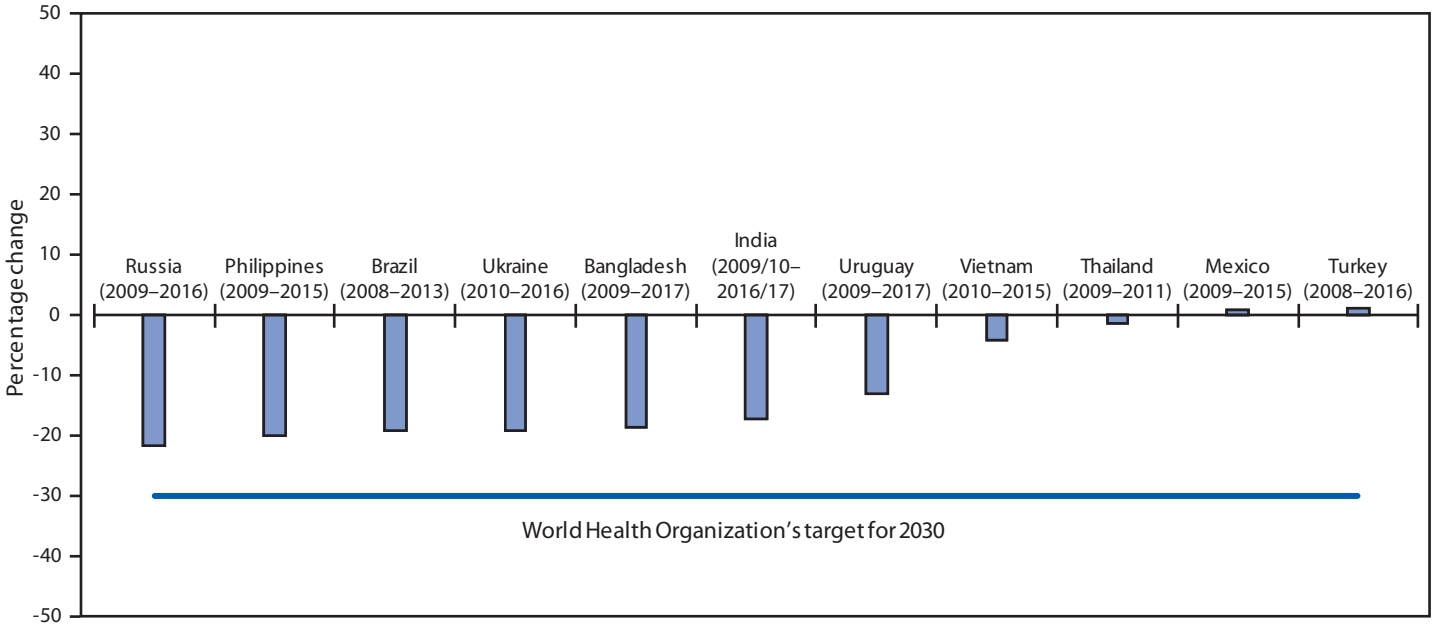
What is added by this report?

Analyses of data from 11 countries that conducted at least two rounds of the Global Adult Tobacco Survey showed progress in tobacco control efforts in terms of tobacco use; exposure to secondhand smoke; contemplated quitting because of cigarette package warning labels; and exposure to tobacco advertising, promotions, and sponsorships.

What are the implications for public health practice?

Continued implementation and enforcement of proven tobacco control interventions and strategies at the country level, as outlined in the World Health Organization's MPOWER strategies, can help reduce tobacco use, which is expected to reduce tobacco-related morbidity and mortality.

FIGURE 2. Estimated change in current tobacco use*,† prevalence among persons aged ≥15 years — Global Adult Tobacco Survey (GATS), 11 countries,§,¶, 2008–2017**



* Current tobacco use is defined as either smoking tobacco or using smokeless tobacco either "every day" or "some days."
† Percentage change is calculated as [(t2-t1)/t1] x 100 where t1 is the prevalence reported during the first round of GATS and t2 is the prevalence reported during the most recent round.
§ Statistically significant change ($p<0.05$) was noted for Bangladesh, Brazil, India, Philippines, Russia, Ukraine, and Uruguay.
¶ In the most recent round of GATS, Russia and Ukraine did not survey certain geographic areas that were surveyed in the baseline round.
** In 2008, Brazil completed one round of GATS and, in 2013, integrated GATS into its national health survey conducted among adults aged ≥18 years. Thus, Brazil's data across time compares results for adults aged ≥18 years.

indirect tobacco advertising, resulting in ≥90% of the population being covered by subnational legislation prohibiting tobacco advertising (*7*).

The findings in this report are subject to at least three limitations. First, data were self-reported, which might be subject to misreporting, recall bias, or social desirability bias. Second, the interval between survey rounds varied from 2 to 8 years, which might affect the magnitude of the change in the indicators assessed, given that some countries had more time to implement programs and policies than did others. Finally, the survey did not assess actual policy implementation or level of enforcement.

Progress in reducing tobacco use and addressing tobacco-related behaviors varies across countries. Opportunities exist for countries to improve tobacco control through the implementation and enforcement of evidence-based strategies, which estimates suggest could save 100 million lives by the end of the century (*5*). Continued surveillance of tobacco use, including new and emerging products, and other tobacco-related measures are also critical for informing tobacco control policy, planning, and practice worldwide.

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Erratum

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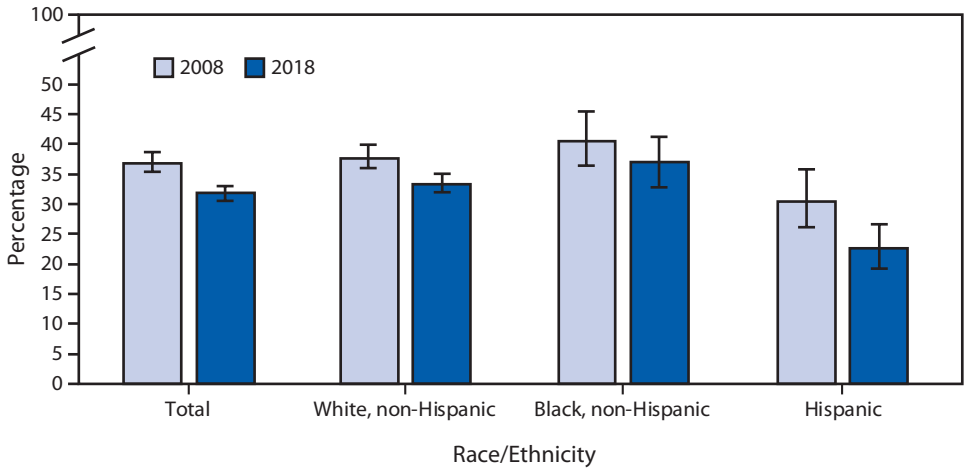
In the *MMWR* Surveillance Summary "Population-Based Active Surveillance for Culture-Confirmed Candidemia — Four Sites, United States, 2012–2016," on page 9, the second and third footnotes († and §) for Table 3 should have read

† Culture positive for *Candida* was obtained <3 days **after** admission for a patient with a recent health care exposure.
§ Culture positive for *Candida* was obtained <3 days **after** admission for a patient without a recent health care exposure.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Women Aged ≥50 Years Who Have Had a Hysterectomy,† by Race/Ethnicity and Year — National Health Interview Survey, United States, 2008 and 2018§



* Percentages shown with 95% confidence intervals.
† Based on the response of "yes" to the survey question "Have you ever had a hysterectomy?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey sample adult component.

The percentage of women aged ≥50 years who have had a hysterectomy decreased from 36.6% in 2008 to 31.7% in 2018. Decreases were also observed among non-Hispanic white women (37.5% to 33.3%) and Hispanic women (30.3% to 22.6%), but there was no significant decrease for non-Hispanic black women (40.4% to 36.8%). For both time points, non-Hispanic black and non-Hispanic white women were more likely than Hispanic women to have had a hysterectomy.

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

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