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Update on Vaccine-Derived Poliovirus Outbreaks — Worldwide, January 2023–June 2024

Apophia Namageyo-Funa, PhD[1]; Sharon A. Greene, PhD[1]; Elizabeth Henderson[2]; Mohamed A. Traoré[3]; Shahzad Shaukat, PhD[3]; John Paul Bigouette, PhD[1]; Jaume Jorba, PhD[2]; Eric Wiesen, DrPH[1]; Omotayo Bolu, PhD[1]; Ousmane M. Diop, PhD[3]; Cara C. Burns, PhD[2]; Steven G.F. Wassilak, MD[1]

Abstract

Circulating vaccine-derived polioviruses (cVDPVs) can emerge and lead to outbreaks of paralytic polio as well as asymptomatic transmission in communities with a high percentage of undervaccinated children. Using data from the World Health Organization Polio Information System and Global Polio Laboratory Network, this report describes global polio outbreaks due to cVDPVs during January 2023–June 2024 and updates previous reports. During the reporting period, 74 cVDPV outbreaks were detected in 39 countries or areas (countries), predominantly in Africa. Among these 74 cVDPV outbreaks, 47 (64%) were new outbreaks, detected in 30 (77%) of the 39 countries. Three countries reported cVDPV type 1 (cVDPV1) outbreaks and 38 countries reported cVDPV type 2 (cVDPV2) outbreaks; two of these countries reported cocirculating cVDPV1 and cVDPV2. In the 38 countries with cVDPV2 transmission, 70 distinct outbreaks were reported. In 15 countries, cVDPV transmission has lasted >1 year into 2024. In Nigeria and Somalia, both countries with security-compromised areas, persistent cVDPV2 transmission has spread to neighboring countries. Delayed implementation of outbreak response campaigns and low-quality campaigns have resulted in further international spread. Countries can control cVDPV outbreaks with timely allocation of resources to implement prompt, high-quality responses after outbreak confirmation. Stopping all cVDPV transmission requires effectively increasing population immunity by overcoming barriers to reaching children.

Introduction

Live, attenuated oral poliovirus vaccine (OPV) induces long-term protection against paralytic disease, and limits virus shedding in vaccinated persons with infection (*1*). Circulating vaccine-derived poliovirus (cVDPVs)* outbreaks occur when OPV-related strains undergo prolonged circulation in communities with very low immunity against polioviruses, and the genetically reverted virus has regained neurovirulence (vaccine-derived poliovirus [VDPV] emergence) (*2*,*3*). After declaration of wild poliovirus type 2 eradication in 2015, and in an effort to lower the risk for cVDPV type 2 (cVDPV2) outbreaks, immunization programs in countries using OPV switched from using trivalent OPV (tOPV) (containing types 1, 2, and 3 Sabin strains) in routine and supplementary immunization activities (SIAs) to bivalent OPV (bOPV) (containing types 1

* By genomic sequence analysis of the region encoding capsid viral protein 1, a poliovirus with >1% divergence from the parent Sabin strain for serotypes 1 and 3, or >0.6% for serotype 2, is classified as a vaccine-derived poliovirus (VDPV). Evidence of circulation (i.e., a cVDPV outbreak) occurs when two or more independent detections of genetically linked VDPVs are identified through acute flaccid paralysis (AFP) surveillance, environmental surveillance (ES), or from healthy community members.

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and 3 Sabin strains) (*4*); bOPV is used for cVDPV type 1 (cVDPV1) outbreak response. After the switch from tOPV to bOPV, monovalent type 2 OPV (mOPV2) (Sabin-strain type 2) was reserved for cVDPV2 outbreak responses. Since 2021, novel oral poliovirus vaccine type 2 (nOPV2), a more genetically stable vaccine with reduced risk for reversion to neurovirulence than Sabin-strain OPV2, has been the recommended vaccine for cVDPV2 outbreak response (*5*). However, nOPV2 supply has been periodically restricted because of manufacturing delays, including during a period in early 2024. Despite the goal of permanent cessation of cVDPV2 transmission by switching from tOPV to bOPV, new cVDPV2 polio outbreaks continue to be reported in multiple countries (*5*,*6*). This report describes global polio outbreaks due to cVDPVs during January 2023–June 2024 and updates previous reports.

Methods

Data Sources

The surveillance and virologic data on cVDPV outbreaks in this report (as of September 18, 2024)† were gathered from the World Health Organization (WHO) Polio Information System§ and the Global Polio Laboratory Network (GPLN).¶ Genomic sequencing and analyses were conducted by WHO-accredited sequencing laboratories within GPLN. A cVDPV outbreak is confirmed when two or more independent detections of genetically linked VDPV emergences are identified through acute flaccid paralysis (AFP) surveillance, environmental surveillance (ES),** or from sampling of healthy community members†† (*2*,*3*). Each unique VDPV emergence group is labeled by the country or area (country) and geographic subnational region of the emergence and the number of emergences in each subnational region.

† To meet standard laboratory timeliness indicators for stool specimen processing, laboratories should report ≥80% of poliovirus isolation results ≤14 days of specimen receipt, ≥80% of intratypic differentiation results ≤7 days of isolate receipt, and ≥80% of sequencing results ≤7 days of identifying isolate intratype. Results for all acute flaccid paralysis (AFP) cases with paralysis onset or environmental surveillance (ES) collected through June 2024 that have been isolated, differentiated, sequenced, and reported by September 18, 2024, were included.

§ The WHO Polio Information System is a centralized database integrating case-based AFP and ES, with SIA data from all WHO regions. https://extranet.who.int/polis (Access is limited to members of GPEI partner organizations).

¶ GLPN consists of 144 WHO-accredited polio laboratories using the WHO-recommended procedures for detecting and characterizing polioviruses from stool and sewage samples collected from AFP patients, their contacts, and the environment. https://polioeradication.org/resource-hub/?rh_policy_and_report_types=global-polio-laboratory-network-reports

** ES is the systematic sampling and testing of sewage for the presence of poliovirus.

†† Cases of VDPV among healthy community members may be established either through 1) AFP contact sampling or 2) targeted stool sampling of healthy children. AFP contact sampling can be conducted when an AFP case has inadequate stool specimens for laboratory confirmation of poliovirus; AFP contact sampling is used to provide laboratory evidence of poliovirus in an AFP case. Targeted stool sampling of healthy children can be conducted following a new VDPV isolation when community transmission has not been confirmed to determine if poliovirus is present in the community.

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Data on outbreak control were also reviewed. Based on WHO's Emergency Committee under the International Health Regulations on the international spread of poliovirus, outbreaks were considered to have been interrupted when no detections were identified ≥13 months since the onset of paralysis or collection of the most recent positive environmental or other sample. Outbreaks were considered to be prolonged when transmission persisted for ≥12 months.

Analysis

VDPV outbreaks were tabulated and mapped by country, serotype, source of detection, emergence group, and other characteristics. cVDPV emergences with ongoing transmission detected outside of the country of first isolation during 2024, either through AFP cases or ES, were also plotted. Descriptive analyses were conducted using R software (version 4.4.1; R Foundation). These activities were reviewed by CDC, deemed not research, and were conducted consistent with applicable federal law and CDC policy.[§§]

Results

cVDPV Outbreaks

During January 2023–June 2024, a total of 74 cVDPV outbreaks were detected in 39 countries, with 672 confirmed AFP cases identified in 27 of the 39 countries (Figure 1) (Table). Twelve countries reported cVDPV circulation detected only through ES or sampling of healthy community members. Cocirculation of cVDPV1 and cVDPV2 was detected in two countries in the WHO African Region (Democratic Republic of the Congo [DRC] and Mozambique). During the reporting period, no new cVDPV3 emergences were detected. Overall, the number of cVDPV AFP cases declined from 881 in 2022 to 672 during January 2023–June 2024 (Supplementary Figure, https://stacks.cdc.gov/view/cdc/164302). Despite the decline in AFP case counts, the number of countries reporting AFP cases remained approximately the same. The number of cVDPV1 AFP cases declined substantially over the reporting period.

cVDPV1 Outbreaks

During January 2023–June 2024, cVDPV1 circulation was detected in three countries (DRC, Madagascar, and Mozambique) from four cVDPV1 emergences (Figure 1) (Table). No new countries or emergences were reported since 2022. A total of 140 AFP cases were confirmed, with 111 reported from DRC, 106 (75%) in 2023, and five (5%) in the first half of 2024. Recent cVDPV1 detections occurred in April 2024 in DRC (RDC-TAN-1) and May 2024 in Mozambique (MOZ-NPL-2). The latest cVDPV1 detection in Madagascar occurred in September 2023.

cVDPV2 Outbreaks

During January 2023–June 2024, a total of 70 cVDPV2 outbreaks from 34 emergences were reported in 38 countries (Figure 1) (Table); 532 AFP cases were confirmed in 26 countries. During the reporting period, five countries reported their first cVDPV2 detection since type 2-containing OPV was removed from OPV-using countries' routine immunization programs in April 2016. Ten (29%) of the 34 emergences spread outside the country of first detection. In Nigeria and Somalia, countries with security-compromised areas, persistent cVDPV2 transmission has spread frequently to neighboring countries. The transmission from Nigeria to its neighbors led to further international spread. The NIE-ZAS-1 emergence, first detected in Nigeria in July 2020, continued to circulate within Nigeria during the reporting period and was detected in 17 other countries in the African Region, particularly in West Africa (Figure 2). SOM-BAN-1, detected in Somalia in October 2017 (*7*), was reported in Kenya, and for the first time, was detected in Uganda during the reporting period. Since the previous reporting period (January 2021–December 2022) (*7*), Indonesia has detected two additional cVDPV2 emergences, with seven AFP cases. The EGY-NOR-1 emergence detected in 11 ES samples collected in Egypt was detected in six ES samples collected in the Palestinian Territories in June 2024 (Table).

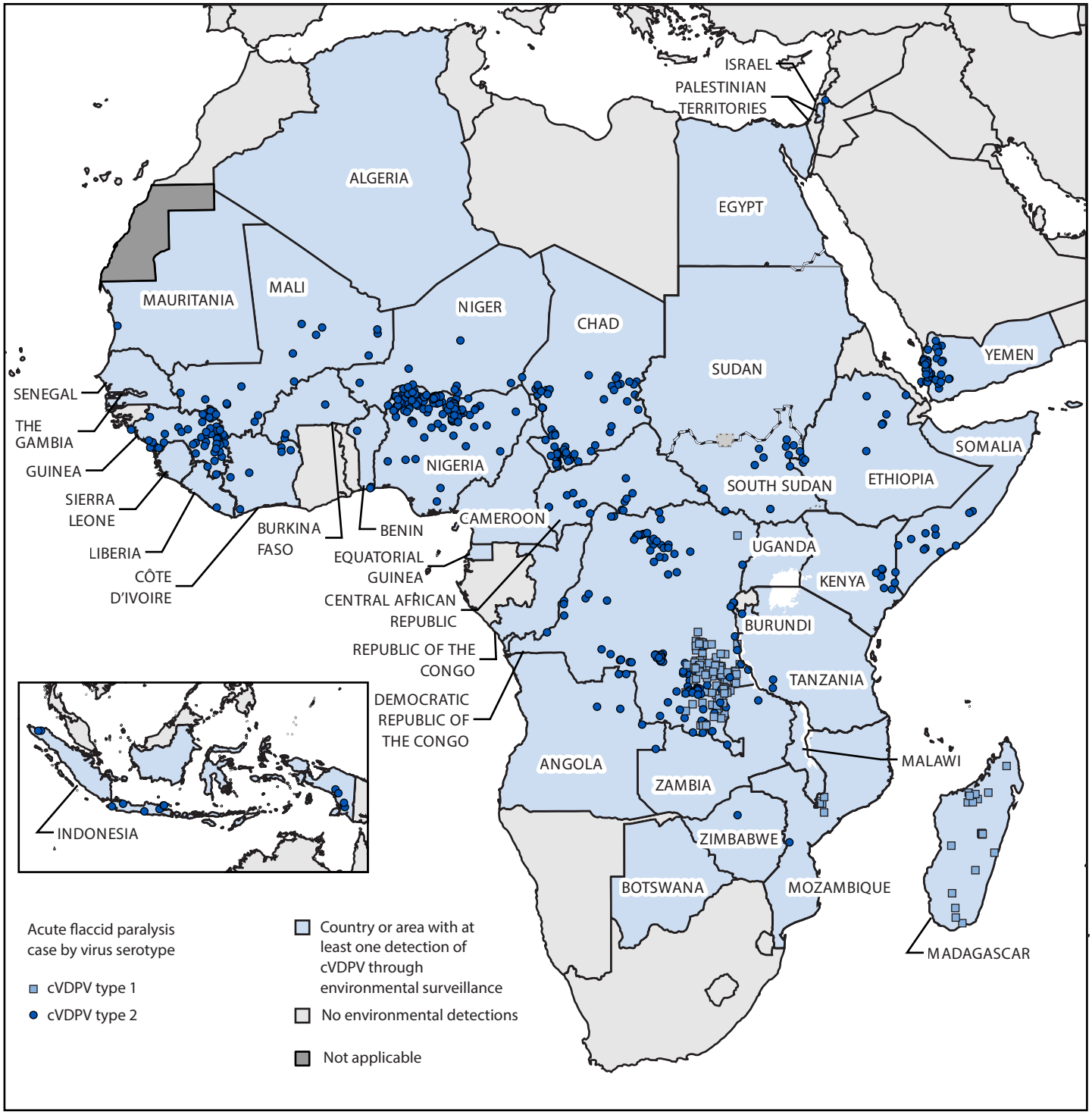
Among the 70 cVDPV2 outbreaks, 29 (comprising 19 VDPV2 emergences) were linked to nOPV2 use in 19 countries. Two of the 19 emergences (RDC-SKV-1 and CAF-KEM-1) were first detected in September 2022 and December 2022, respectively. A total of 113 AFP cases were reported in 14 of the 19 countries with emergences; the highest number (70; 62%) was reported in DRC. Five countries detected outbreaks linked to nOPV2 use through ES only, with no confirmed AFP cases. The RDC-KOR-1 emergence was first detected in DRC in January 2023 and spread to Angola, Mozambique, and Republic of the Congo. The RDC-SKV-1 emergence was first detected in DRC and spread to Angola, Burundi, Côte d'Ivoire, Tanzania, and Zambia, with the most recent detection of an AFP case in Angola on May 11, 2024.

Outbreak Control

Of the 74 cVDPV outbreaks, 47 were new outbreaks detected during the reporting period in 30 of the 39 countries reporting outbreaks (Table). The remaining 27 outbreaks had been detected before the reporting period began and are ongoing (<13 months since most recent case) in 20 of the 39 countries. During January 2023–June 2024, SIAs were conducted to control cVDPV outbreaks in 32 of the 39 outbreak countries.

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

FIGURE 1. Countries and areas* reporting circulating vaccine-derived polio outbreaks (N = 39) — worldwide, January 2023–June 2024†



Abbreviation: cVDPV = circulating vaccine-derived poliovirus.
* Some boundaries might differ under World Health Organization mapping guidelines.
† Data as of September 18, 2024.

Among the 74 cVDPV outbreaks, 11 (in seven countries) were documented to have been interrupted. Prolonged transmission of a cVDPV outbreak (≥12 months from first to most recent detection) was observed in 15 countries: Algeria, Benin, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Indonesia, Madagascar,

TABLE. Ongoing circulating vaccine-derived poliovirus outbreaks (N = 74), by serotype, emergence group, detection source, and other selected characteristics — worldwide, January 2023–June 2024

WHO region/ Country or area	cVDPV emergence designation[†]	Virus origin[§]	Years detected[¶]	No. of detections by source* AFP cases	Other human sources (non-AFP)**	ES	% VP1 genome region divergence from Sabin-strain poliovirus[††]	Outbreak confirmation date	Most recent positive sample[§§]
cVDPV type 1 outbreaks									
African Region									
DRC[¶¶]	RDC-TAN-1	Sabin	2022–2024	111	0	0	15–27	Sep 12, 2022	Apr 27, 2024
Madagascar	MAD-ANO-2	Sabin	2021–2023	24	1	100	45–65	Feb 28, 2022	Sep 16, 2023
	MAD-SUE-1	Sabin	2020–2023	0	6	0	44–54	Apr 26, 2021	Jun 20, 2023
Mozambique[¶¶]	MOZ-NPL-2	Sabin	2020–2024	5	0	0	47–54	Jul 25, 2022	May 17, 2024
cVDPV type 2 outbreaks									
African Region									
Algeria	NIE-ZAS-1	Sabin	2022–2024	0	3	30	34–49	Jul 11, 2022	Feb 27, 2024
Angola	RDC-KOR-1	Novel	2023–2024	3	0	7	18–24	Jan 29, 2024	Jul 7, 2024
	RDC-SKV-1	Novel	2024	1	0	0	20–20	Jul 1, 2024	May 11, 2024
	ANG-LNO-3	Novel	2024	1	1	1	13–15	May 6, 2024	Mar 30, 2024
	NIE-ZAS-1	Sabin	2024	0	0	1	31–31	Mar 11, 2024	Jan 24, 2024
Benin	NIE-ZAS-1	Sabin	2022–2024	4	0	4	37–54	Jun 27, 2022	May 18, 2024
Botswana	BOT-FRA-1	Novel	2023	0	0	3	7–10	Aug 14, 2023	Jul 25, 2023
	RDC-MAN-5	Sabin	2022–2023	0	0	2	17–28	Oct 31, 2022	Jan 24, 2023
Burkina Faso	NIE-ZAS-1	Sabin	2023	3	0	1	38–51	Jul 3, 2023	Dec 12, 2023
Burundi	RDC-SKV-1	Novel	2022–2023	1	0	13	6–14	Mar 13, 2023	Jun 15, 2023
Cameroon	CAE-EST-1	Novel	2024	1	0	0	8–8	Sep 10, 2024	May 15, 2024
	NIE-ZAS-1	Sabin	2021–2023	0	0	12	38–48	Oct 25, 2021	Sep 28, 2023
	CAE-EXT-1	Novel	2023	0	0	1	6–6	Oct 9, 2023	Jun 13, 2023
Central African Republic	CAF-BNG-3	Novel	2023	5	2	1	10–14	Jul 10, 2023	Oct 7, 2023
	NIE-ZAS-1	Sabin	2021–2023	6	10	0	36–51	Nov 29, 2021	Sep 9, 2023
	CAF-MOZ-1	Sabin	2023	3	2	0	16–17	Mar 27, 2023	Apr 26, 2023
	CAF-KEM-1	Novel	2022–2023	0	1	0	7–7	May 29, 2023	Mar 9, 2023
Chad	NIE-ZAS-1	Sabin	2021–2024	61	6	7	31–54	Jan 31, 2022	Jun 29, 2024
	CAE-EXT-1	Novel	2023	1	0	0	7–7	Oct 2, 2023	Jul 26, 2023
Côte d'Ivoire	NIE-ZAS-1	Sabin	2022–2024	6	16	68	24–61	Mar 7, 2022	Apr 23, 2024
	RDC-SKV-1	Novel	2023	0	0	1	13–13	Jan 22, 2024	Dec 5, 2023
DRC[¶¶]	RDC-KOR-1	Novel	2023–2024	49	8	34	8–25	Apr 10, 2023	Jun 12, 2024
	RDC-TSH-2	Novel	2024	2	1	0	12–14	Jul 8, 2024	Apr 7, 2024
	RDC-BUE-1	Sabin	2022–2024	11	0	0	24–37	Sep 5, 2022	Mar 20, 2024
	RDC-TSH-1	Sabin	2022–2023	13	0	0	19–36	Oct 3, 2022	Nov 19, 2023
	RDC-HKA-2	Novel	2023	5	0	2	7–16	Jul 17, 2023	Oct 27, 2023
	CAF-BNG-2	Sabin	2023	2	0	0	21–28	Nov 27, 2023	Sep 5, 2023
	RDC-MAN-3	Sabin	2021–2023	32	1	3	23–38	Dec 20, 2021	Aug 4, 2023
	RDC-SKV-1	Novel	2022–2023	14	0	0	6–14	Jan 13, 2023	Jun 23, 2023
	RDC-MAN-5	Sabin	2021–2023	1	1	0	24–24	Mar 14, 2022	Apr 28, 2023
Equatorial Guinea	NIE-ZAS-1	Sabin	2024	0	0	1	38–38	May 27, 2024	Mar 26, 2024
Ethiopia	ETH-TIG-1	Novel	2023–2024	7	0	1	9–22	May 20, 2024	Jun 13, 2024
	RSS-UNL-1	Sabin	2024	5	2	0	12–15	May 20, 2024	May 19, 2024
The Gambia	NIE-ZAS-1	Sabin	2024	0	0	1	45–45	Jun 3, 2024	Feb 15, 2024
Guinea	NIE-ZAS-1	Sabin	2021–2024	52	11	33	40–51	Dec 13, 2021	Jun 12, 2024
Kenya	SOM-BAN-1	Sabin	2018–2024	8	8	9	65–80	Apr 16, 2018	Jun 12, 2024
Liberia	NIE-ZAS-1	Sabin	2023–2024	1	12	18	42–53	Feb 26, 2024	Jun 19, 2024
Malawi	RDC-MAN-5	Sabin	2023	0	0	1	18–18	Feb 27, 2023	Jan 2, 2023
Mali	NIE-ZAS-1	Sabin	2022–2024	16	0	6	37–48	Feb 6, 2023	Jan 2, 2024
Mauritania	NIE-ZAS-1	Sabin	2023	1	0	3	42–47	Dec 4, 2023	Dec 13, 2023
Mozambique[¶¶]	RDC-KOR-1	Novel	2024	0	0	1	19–19	May 6, 2024	Mar 5, 2024
	MOZ-MAN-1	Novel	2023	1	3	0	10–15	Jan 8, 2024	Dec 8, 2023
Niger	NIE-ZAS-1	Sabin	2021–2024	7	0	10	35–66	Nov 1, 2021	Jun 17, 2024
Nigeria	NIE-ZAS-1	Sabin	2020–2024	121	55	100	35–58	Sep 18, 2020	Jun 26, 2024
	NIE-KTS-1	Novel	2023–2024	7	8	1	12–22	Jan 15, 2024	Jun 10, 2024
Republic of the Congo	RDC-KOR-1	Novel	2023	0	0	1	20–20	Jan 22, 2024	Dec 7, 2023
	RDC-MAN-3	Sabin	2023	0	0	1	27–27	Jul 17, 2023	Apr 11, 2023
Senegal	NIE-ZAS-1	Sabin	2023–2024	0	0	6	42–61	Jan 29, 2024	May 2, 2024
Sierra Leone	NIE-ZAS-1	Sabin	2024	0	0	15	43–52	Mar 11, 2024	May 28, 2024
South Sudan	RSS-JON-1	Novel	2024	1	0	3	8–9	Jun 17, 2024	Jun 25, 2024
	RSS-UNL-1	Sabin	2023–2024	6	4	0	13–16	Mar 25, 2024	Jun 28, 2024
	RSS-WEQ-1	Novel	2023–2024	4	3	0	12–18	Jan 1, 2024	Feb 23, 2024

See table footnotes on the next page.

TABLE. (*Continued*) Ongoing circulating vaccine-derived poliovirus outbreaks (N = 74), by serotype, emergence group, detection source, and other selected characteristics — worldwide, January 2023–June 2024

WHO region/ Country or area	cVDPV emergence designation†	Virus origin§	Years detected¶	No. of detections by source*			% VP1 genome region divergence from Sabin-strain poliovirus††	Outbreak confirmation date	Most recent positive sample§§
				AFP cases	Other human sources (non-AFP)**	ES			
Uganda	SOM-BAN-1	Sabin	2024	0	0	1	68–68	Jun 3, 2024	May 7, 2024
Tanzania	RDC-SKV-1	Novel	2023	2	6	6	13–22	Jul 17, 2023	Nov 20, 2023
Zambia	RDC-SKV-1	Novel	2023	1	4	2	7–13	Jun 5, 2023	Jun 6, 2023
Zimbabwe	ZIM-HRE-2	Novel	2024	0	0	2	7 – 8	Sept 12, 2024	Jun 25, 2024
	ZIM-HRE-1	Novel	2023–2024	1	2	25	8–17	Oct 23, 2023	May 28, 2024
Eastern Mediterranean Region									
Egypt	SUD-RED-1	Sabin	2024	0	0	1	12–12	Feb 19, 2024	Jan 31, 2024
	EGY-NOR-1	Novel	2023	0	0	11	9–15	Sep 18, 2023	Dec 30, 2023
Palestinian Territories	EGY-NOR-1	Novel	2024	0	0	6	13–18	Jul 29, 2024	Jun 23, 2024
Somalia	SOM-BAN-1	Sabin	2017–2024	8	6	11	63–77	Feb 12, 2018	Jun 5, 2024
	SOM-BAY-1	Sabin	2023–2024	3	0	1	16–23	Mar 4, 2024	May 14, 2024
Sudan	RSS-UNL-1	Sabin	2024	0	0	1	12–12	Sep 2, 2024	Jan 24, 2024
	SUD-RED-1	Sabin	2023–2024	0	0	6	6–11	Jan 22, 2024	Jan 11, 2024
Yemen	YEM-TAI-1	Sabin	2021–2024	35	2	22	20–45	Nov 22, 2021	May 19, 2024
	SUD-RED-1	Sabin	2023–2024	6	0	1	7–19	Mar 11, 2024	May 13, 2024
European Region									
Israel	IUUC-2022	Sabin	2022–2023	1	0	0	12–12	Mar 6, 2023	Feb 13, 2023
South-East Asia Region									
Indonesia	cVDPV2	Sabin	2024	1	1	0	13–42	Sep 2, 2024	Jun 15, 2024
	INO-cVDPV2	Novel	2024	6	12	0	8–15	Jul 1, 2024	Jun 27, 2024
	INO-ACE-1	Sabin	2022–2023	6	7	1	27–43	Nov 28, 2022	Dec 7, 2023

Abbreviations: AFP = acute flaccid paralysis; cVDPV = circulating vaccine-derived poliovirus; DRC = Democratic Republic of the Congo; ES = environmental surveillance; VDPV = vaccine-derived poliovirus; VP1 = viral protein 1; WHO = World Health Organization.

* During January 2023–June 2024 with data as of September 18, 2024. For AFP cases, the number of patients with a VDPV-positive specimen or for whom a direct contact had a VDPV-positive specimen when the patient did not. For other human sources, the number of contacts of the patient or healthy children in the community with a VDPV-positive specimen. For detections from ES, the total number of samples with VDPVs detected from environmental (sewage) collections.

† Emergences indicate detection of cVDPV strains that have unique genetic reversion compared with other VDPVs, and the names of emergences generally designate the country and geographic subnational region of the emergence's first detection and the number of emergences in each subnational region.

§ Novel refers to the virus strain contained in novel oral poliovirus type 2, a more genetically stable vaccine available since 2021, with lower risk for reversion to neurovirulence than Sabin-strain oral poliovirus type 2.

¶ Range of total years detected for previously reported cVDPV outbreaks. Data as of September 18, 2024.

** Contacts and healthy child specimen sampling during January 2023–June 2023 with data as of September 18, 2024, for all emergences.

†† Percentage of divergence is estimated from the number of nucleotide differences in the genome region encoding VP1 from the corresponding parental Sabin strain.

§§ For AFP cases, dates refer to the date of paralysis onset. For contacts, healthy children, and environmental (sewage) samples, dates refer to the date of collection during January 2023–June 2024 with data as of September 18, 2024. Table is restricted to outbreaks with at least one reported detection during the current reporting period.

¶¶ cVDPV type 1 and cVDPV type 2 co-circulated in these countries.

Mali, Mozambique, Niger, Nigeria, Somalia, and Yemen. In seven of the 74 outbreaks across six countries, no cVDPV was detected ≥13 months since the most recent positive sample.

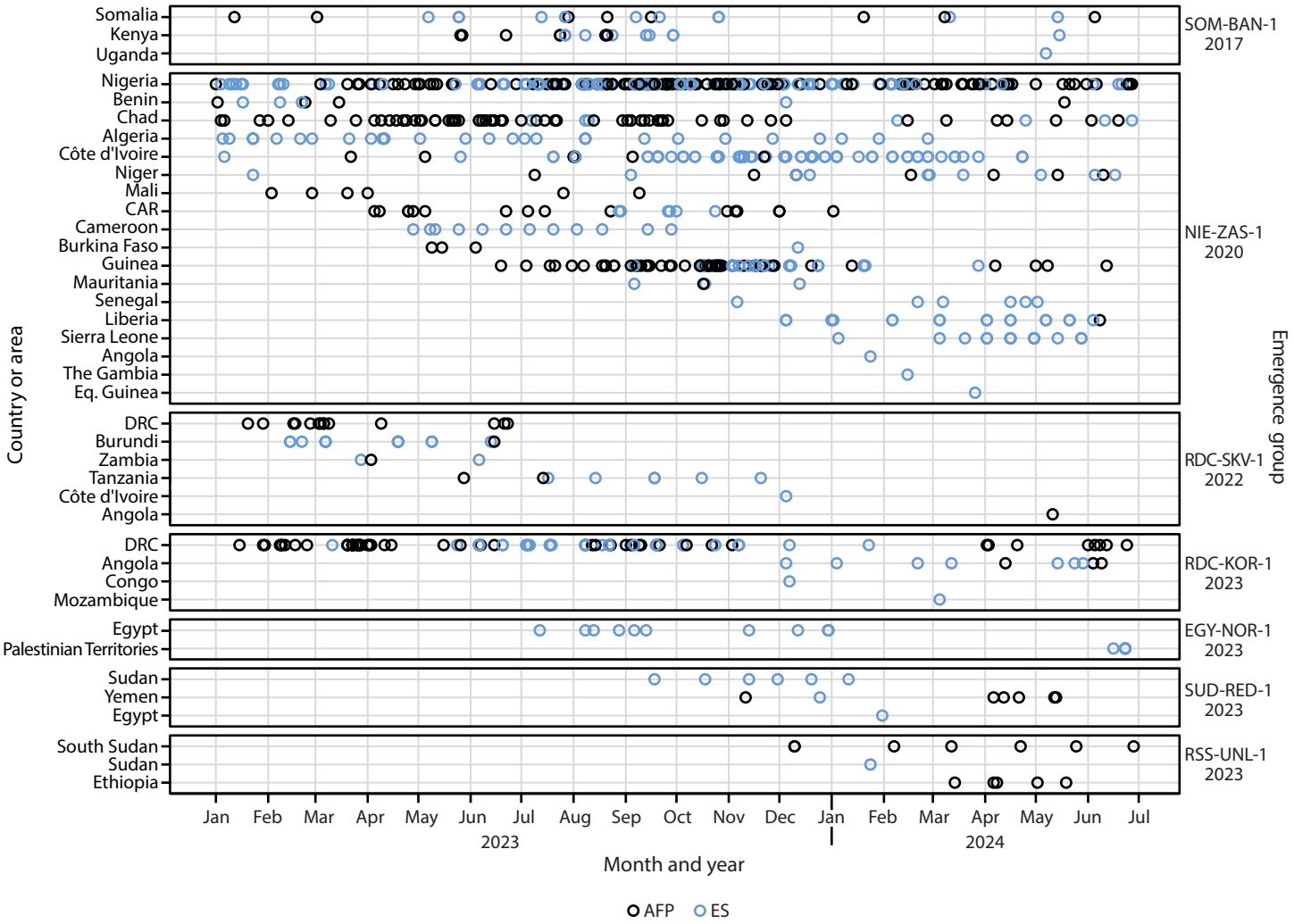
Discussion

Continuing cVDPV outbreaks impede attainment of the Global Polio Eradication Initiative (GPEI) 2022–2026 Strategic Plan goal of eradicating polio, particularly that of interrupting all cVDPV transmission in 2024 (*2*). During January 2023–June 2024, cVDPV2 outbreaks remained as prevalent as those during previous reporting periods (*7*,*8*). Although the number of countries reporting outbreaks is approximately the same during each of the most recent years, as some countries interrupt transmission, newly infected or reinfected countries are reporting confirmed outbreaks.

Since 2022, no new countries have reported cVDPV1 emergences or outbreaks. Although cVDPV1 detections were reported in Mozambique and DRC in early 2024, no detections have been reported in Madagascar since September 2023, following multiyear transmission in each of these countries. This development reflects the ultimate success of outbreak response efforts and highlights the possibility of controlling all cVDPV1 outbreaks in 2024. The decline in routine childhood immunization coverage during the early years of the COVID-19 pandemic (*9*) has resulted in an accumulation of undervaccinated, susceptible children in many African countries with weak essential health services, increasing the risk for new cVDPV1 emergences.

The spread of cVDPV2 emergence groups such as NIE-ZAS-1 and SOM-BAN-1 outside the country of first detection, often with further international spread, reveals gaps in the effectiveness and timeliness of outbreak responses. In light of the many social, economic, and political challenges, promptly interrupting transmission of cVDPV2 requires sufficient resources, including those

FIGURE 2. Circulating type 2 vaccine-derived polioviruses* associated with outbreaks ongoing in 2024 that involved international spread since emergence, by outbreak and country or area — worldwide, January 2023–June 2024†



Abbreviations: AFP = acute flaccid paralysis; CAR = Central African Republic; DRC = Democratic Republic of the Congo; ES = environmental surveillance; Eq. Guinea = Equatorial Guinea.

* No international spread was reported from emergence groups in circulating vaccine-derived poliovirus type 1.

† For AFP cases, dates refer to the date of paralysis onset. For environmental surveillance samples, dates refer to the date of collection. For samples collected on the same dates, symbols will overlap; thus, not all isolates are visible. Data as of September 18, 2024, for all emergences.

mobilized within countries, to implement intensive response efforts with cross-border collaborations.

Low supplies of nOPV2, compounded with logistical challenges and insufficient access, have led to delays in implementation of outbreak responses, impeding efforts to achieve the high population immunity required to stop cVDPV2 transmission. During January 2023–June 2024, cVDPV2 outbreaks were linked to nOPV2 use in 19 countries. Whereas nOPV2 is genetically more stable than Sabin strain OPV2 in community circulation, these findings highlight that cVDPVs can develop with nOPV2 use when the timing and quality of vaccination responses are suboptimal (*10*). Prolonged community circulation of the vaccine strain leads to reversion to neurovirulence, seeding new emergences.

Gaps in poliovirus surveillance can delay outbreak response activities and provide a longer opportunity for virus to spread. Efforts are underway to strengthen surveillance systems and improve the capacity to confirm cVDPV outbreaks by increasing the number of laboratories accredited by GPLN to perform genomic sequencing.

The current GPEI target is to stop all cVDPV transmission by the end of 2026. Continued circulation of cVDPVs highlights the need for 1) increased urgency to implement prompt, high-quality SIAs upon detection of new cVDPV outbreaks and 2) enhanced efforts, such as more engagement with humanitarian nongovernmental organizations, to vaccinate children in security-compromised areas and in hard-to-reach communities.

Summary

What is already known about this topic?

Circulating vaccine-derived polioviruses (cVDPVs) can emerge and cause paralysis in areas with low population poliovirus immunity. Since 2017, large cVDPV type 2 (cVDPV2) outbreaks have occurred, primarily in Africa.

What is added by this report?

During January 2023–June 2024, 74 cVDPV outbreaks (672 confirmed polio cases) were detected in 39 countries or areas. Annual cVDPV type 1 case counts declined markedly compared with those during 2022. Despite a small decline in reported cVDPV2 cases compared with those reported during 2022, the number of countries or areas reporting outbreaks remained high.

What are the implications for public health practice?

To achieve the Global Polio Eradication Initiative's goal of interrupting cVDPV transmission by 2026, outbreak responses must be timely and overcome barriers to reaching children who are missed by routine and supplementary immunization activities.

Limitations

The findings in this report are subject to at least two limitations. First, existing gaps in polio surveillance systems might lead to the underestimation of cases and transmission levels and inaccuracies in the geographic spread of cVDPVs. Second, delays in the transportation of polio samples and testing by reference laboratories might result in underreporting of cases, outbreaks, and emergences during January–June 2024.

Implications for Public Health Practice

GPEI currently aims to eradicate polio by 2026; the key challenges are ending transmission in security-compromised areas and hard-to-reach communities and preventing any further international spread. Ending transmission by 2026 will require a focus on implementing intensive efforts to vaccinate children in security-compromised and hard-to-reach communities to achieve the goal of sustained cVDPV2 interruption. Countries can control cVDPV outbreaks with timely allocation of resources to implement prompt, high-quality responses after outbreak confirmation. Stopping all cVDPV transmission requires effectively increasing population immunity by overcoming the barriers to reaching children.

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Corresponding author: Apophia Namageyo-Funa, aen5@cdc.gov.

[1]Global Immunization Division, Center for Global Health, CDC; [2]Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, CDC; [3]Polio Eradication Department, World Health Organization, Geneva, Switzerland.

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Tobacco Product Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2024

Ahmed Jamal, MBBS[1], Eunice Park-Lee, PhD[2]; Jan Birdsey, MPH[1]; Andrenita West, PhD[1]; Monica Cornelius, PhD[1]; Maria R. Cooper, PhD[2]; Hannah Cowan, MPH[2]; Jia Wang, MPH[2]; Michael D. Sawdey, PhD[2]; Karen A. Cullen, PhD[2]; Livia Navon, MS[1]

Abstract

Use of tobacco products in any form is unsafe, and nearly all tobacco product use begins during adolescence. CDC and the Food and Drug Administration (FDA) analyzed data from the 2024 National Youth Tobacco Survey to determine tobacco product use among U.S. middle school (grades 6–8) and high school (grades 9–12) students. In 2024, current (previous 30-day) use of any tobacco product was reported by 10.1% of high school students (representing 1.58 million students) and 5.4% of middle school students (representing 640,000 students). Among all students, e-cigarettes were the most commonly reported tobacco product currently used (5.9%), followed by nicotine pouches (1.8%), cigarettes (1.4%), cigars (1.2%), smokeless tobacco (1.2%), other oral nicotine products (1.2%), heated tobacco products (0.8%), hookahs (0.7%), and pipe tobacco (0.5%). During 2023–2024, among all students, the estimated number who reported current use of any tobacco product decreased from 2.80 to 2.25 million students; e-cigarette use decreased (from 2.13 to 1.63 million students); and hookah use decreased (from 290,000 to 190,000 students). Among high school students, current use of any tobacco product decreased from 12.6% to 10.1% of students, and e-cigarette use decreased from 10.0% to 7.8%. Among middle school students, no statistically significant changes occurred. Evidence-based strategies can help prevent initiation and promote cessation of tobacco product use among U.S. youths.

Introduction

Use of tobacco* products in any form is unsafe, and nearly all tobacco product use begins during adolescence (*1*). This report presents findings from the 2024 National Youth Tobacco Survey (NYTS) and describes ever use and current use of nine tobacco product types and changes in use among U.S. middle and high school students (youths) from 2023 to 2024. Detailed NYTS estimates of e-cigarette and nicotine pouch use were recently published (*2*); this report provides information on use of all forms of tobacco products and includes estimates by school level, sex, and race and ethnicity.

* The term "tobacco" as used in this report refers to commercial tobacco products and not to the sacred and traditional use of tobacco by some American Indian communities; however, NYTS does not distinguish between use of ceremonial and commercial use.

Methods

Data Source and Collection

NYTS is a cross-sectional, voluntary, school-based, self-administered, Internet survey of U.S. middle school (grades 6–8) and high school (grades 9–12) students. A stratified, three-stage cluster sampling procedure was used to generate a nationally representative sample of U.S. students attending private or public middle and high schools. Data were collected during January 22–May 22, 2024; 29,861 students from 283 schools participated, with an overall response rate of 33.4%.

Data Analysis

National weighted prevalence estimates, 95% CIs, and population totals† were calculated for ever use (i.e., ever having used, even once or twice) and current use (i.e., use on ≥1 day during the previous 30 days) of nine tobacco products§ (e-cigarettes, nicotine pouches,¶ cigarettes, cigars, smokeless tobacco, other oral nicotine products, heated tobacco products,** hookahs, and pipe tobacco) by student characteristics. Three composite use measures were also reported: 1) any tobacco product use,†† 2) any combustible tobacco product use,§§ and 3) multiple tobacco product

† Data were weighted to account for complex survey design and to adjust for nonresponse. The weighted proportions of students in each grade matched national population proportions for U.S. public and private schools using combined data from the National Center for Education Statistics (the 2021–2022 Common Core of Data and the 2019–2020 Private School Universe Survey) and spring 2023 data from Market Data Retrieval Inc. Population total estimates were rounded down to the nearest 10,000 persons.

§ Products include e-cigarettes, nicotine pouches, cigarettes, cigars (cigars, cigarillos, or little cigars), smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products (lozenges, discs, tablets, gums, dissolvable tobacco products, and other products), heated tobacco products, hookahs, and pipe tobacco. Consistent with 2023 NYTS reporting analyses, dissolvable tobacco products were classified as other oral nicotine products.

¶ Small, flavored pouches that contain nicotine. Users place them in their mouth between the lip and gum. Unlike other smokeless tobacco products such as snus, dip, or chewing tobacco, nicotine pouches do not contain any tobacco leaf.

** Heated tobacco products include heat-processed tobacco leaf in the form of sticks ("heatsticks"), plugs, or capsules that produce a vapor the user inhales. This is different from e-cigarettes, which heat a liquid to produce a vapor.

†† Any tobacco product use was defined as the use of one or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis (small, brown cigarettes wrapped in a leaf).

§§ Any combustible tobacco product use was defined as the use of one or more of the following tobacco products: cigarettes, cigars, hookahs, pipe tobacco, or bidis.

use.¶¶ Changes in current use prevalence since 2023 were assessed for statistical significance using *t*-tests; 2023 NYTS methods and estimates have been published previously (*3*). P-values <0.05 were considered statistically significant. Analyses were conducted using SAS-callable SUDAAN software (version 11.0.4; Research Triangle Institute). Estimates with an unweighted denominator <50 or a relative SE >30% were suppressed. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.***

Results

Characteristics of Students Who Have Ever Used or Currently Use Tobacco Products

In 2024, 19.0% of U.S. middle and high school students (representing 5.28 million students) reported ever having used any tobacco product (Table 1); 8.1% (representing 2.25 million students) reported current use of any tobacco product (Table 2). Current use of any tobacco product was reported by 8.5% of male, 7.7% of female, 16.3% of non-Hispanic American Indian or Alaska Native (AI/AN), 10.0% of non-Hispanic Black or African American (Black), 9.0% of non-Hispanic multiracial (multiracial), 8.4% of Hispanic or Latino (Hispanic), 7.8% of non-Hispanic White (White), and 3.3% of non-Hispanic Asian (Asian) students.††† Current use of any combustible tobacco product was reported by 6.3% of AI/AN, 4.1% of Black, 3.9% of multiracial, 2.9% of Hispanic, and 2.4% of White students. Multiple tobacco product use was reported by 6.9% of AI/AN, 3.8% of multiracial, 3.3% of Black, 3.1% of Hispanic, 3.0% of White, and 1.1% of Asian students. Among students who had ever used a tobacco product, 42.9% reported current use.

Types of Tobacco Products Used

E-cigarettes were the most commonly reported currently used tobacco product (5.9%) among all students, followed by nicotine pouches (1.8%), cigarettes (1.4%), cigars (1.2%), smokeless tobacco (1.2%), other oral nicotine products (1.2%), heated tobacco products (0.8%), hookahs (0.7%), and pipe tobacco (0.5%). Among students who had ever used e-cigarettes, 43.6% reported current e-cigarette use.

¶¶ Multiple tobacco product use was defined as the use of two or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis.

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

††† Estimates for non-Hispanic Native Hawaiian or Pacific Islander students, overall and by school level, were statistically unreliable for all current use measures and are not reported.

High School Student Tobacco Product Use

Among high school students, 10.1% reported current use of any tobacco product, 3.3% reported current use of any combustible tobacco product (32.7% of those who reported current use of any tobacco product), and 3.7% reported current use of multiple tobacco products (36.6% of those who reported any tobacco product use). E-cigarettes were the most commonly used product (7.8%), followed by nicotine pouches (2.4%), cigarettes (1.7%), cigars (1.5%), smokeless tobacco (1.5%), other oral nicotine products (1.4%), heated tobacco products (0.9%), hookahs (0.8%), and pipe tobacco (0.5%).

Middle School Student Tobacco Product Use

Among middle school students, 5.4% reported current use of any tobacco product, 2.1% reported current use of any combustible tobacco product (38.9% of those who reported current use of any tobacco product), and 2.1% reported current use of multiple tobacco products (38.9% of those who reported any tobacco product use). E-cigarettes were the most commonly used product (3.5%), followed by cigarettes (1.1%), nicotine pouches (1.0%), other oral nicotine products (0.9%), cigars (0.8%), smokeless tobacco (0.8%), heated tobacco products (0.7%), hookahs (0.6%), and pipe tobacco (0.5%).

Trends in Tobacco Product Use Prevalence Among Middle and High School Students

From 2023 (*3*) to 2024, statistically significant declines occurred among all students in current use of any tobacco product (from 10.0% to 8.1%), e-cigarettes (from 7.7% to 5.9%) (*2*), and hookahs (from 1.1% to 0.7%) (Figure). Among high school students, declines occurred in current use of any tobacco product (from 12.6% to 10.1%) and e-cigarettes (from 10.0% to 7.8%). Among middle school students, no significant change in current use of any individual tobacco product or composite tobacco product use measure was observed. During 2023–2024, whereas any tobacco product use prevalence declined among female students (from 11.2% to 7.7%) and Hispanic students (from 11.7% to 8.4%), use increased among AI/AN students (from 8.0% to 16.3%). By product type, from 2023 to 2024, declines occurred among female students in current use of e-cigarettes (from 9.3% to 6.1%) and multiple tobacco products (from 3.4% to 2.5%) and among Hispanic students in current use of e-cigarettes (from 8.5% to 6.1%), cigars (from 2.2% to 1.4%), hookahs (from 1.3% to 0.9%), and multiple tobacco products (from 3.9% to 3.1%). In contrast, increases occurred among White students in current use of nicotine pouches (from 1.4% to 2.2%) and among AI/AN students in current use of e-cigarettes (from

TABLE 1. Percentage of middle and high school students who reported ever using tobacco products,* overall and by school level, product, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2024

	% (95% CI)										
	Sex		Race and ethnicity†								
Tobacco product	Female	Male	AI/AN	Asian	Black or African American	NH/PI	White	Hispanic or Latino	Multiracial	Total	Total estimated no.§
Overall											
Any tobacco product¶	19.0 (17.5–20.7)	19.0 (17.6–20.6)	31.7 (26.7–37.1)	9.3 (7.2–12.0)	21.6 (19.0–24.6)	17.8 (11.4–26.8)	18.6 (16.7–20.7)	19.7 (18.2–21.3)	22.2 (19.2–25.6)	**19.0 (17.7–20.5)**	**5,280,000**
E-cigarettes	14.8 (13.6–16.2)	13.2 (12.0–14.6)	22.5 (18.0–27.7)	5.7 (4.2–7.8)	14.3 (12.3–16.7)	13.8 (8.0–22.8)	14.1 (12.4–16.0)	15.0 (13.7–16.3)	16.2 (13.7–19.1)	**14.0 (12.9–15.2)**	**3,870,000**
Cigarettes	5.3 (4.6–6.0)	6.3 (5.5–7.2)	11.2 (8.2–15.0)	2.6 (1.9–3.6)	4.4 (3.7–5.3)	—**	6.5 (5.5–7.6)	5.7 (5.0–6.5)	7.5 (5.6–9.8)	**5.8 (5.1–6.5)**	**1,570,000**
Cigars††	2.6 (2.2–3.0)	5.1 (4.4–5.8)	6.1 (4.2–8.9)	—	4.6 (3.5–6.1)	—	4.1 (3.5–4.8)	3.7 (3.1–4.3)	4.4 (2.9–6.7)	**3.9 (3.5–4.3)**	**1,050,000**
Nicotine pouches	1.9 (1.6–2.2)	5.0 (4.3–5.9)	9.1 (6.5–12.5)	1.2 (0.7–2.0)	1.7 (1.2–2.4)	—	4.4 (3.7–5.3)	3.0 (2.5–3.5)	3.8 (2.7–5.4)	**3.5 (3.0–4.0)**	**890,000**
Other oral nicotine products††	2.6 (2.3–2.9)	3.7 (3.2–4.2)	6.0 (3.8–9.4)	1.3 (0.8–2.2)	2.1 (1.5–3.0)	—	3.4 (2.8–4.1)	3.4 (3.0–3.8)	3.5 (2.6–4.8)	**3.1 (2.8–3.5)**	**840,000**
Smokeless tobacco††	1.8 (1.5–2.2)	4.0 (3.3–4.7)	7.7 (5.5–10.7)	1.1 (0.7–1.8)	1.7 (1.2–2.4)	—	3.6 (2.9–4.4)	2.6 (2.2–3.0)	3.4 (2.4–4.9)	**2.9 (2.5–3.4)**	**790,000**
Hookahs	2.6 (2.1–3.1)	2.3 (1.9–2.8)	4.4 (2.7–7.3)	1.5 (1.0–2.5)	4.5 (3.7–5.6)	—	1.5 (1.2–2.0)	2.8 (2.2–3.6)	2.8 (1.9–4.2)	**2.4 (2.1–2.8)**	**650,000**
Heated tobacco products	1.4 (1.1–1.7)	1.7 (1.4–2.1)	3.9 (2.4–6.4)	—	1.9 (1.3–2.7)	—	1.2 (0.9–1.6)	2.1 (1.8–2.4)	1.1 (0.7–1.9)	**1.6 (1.3–1.8)**	**390,000**
Pipe tobacco	1.2 (1.0–1.5)	1.6 (1.4–2.0)	4.8 (3.0–7.5)	—	1.3 (0.9–1.9)	—	1.4 (1.1–1.6)	1.7 (1.4–2.0)	2.0 (1.3–2.9)	**1.5 (1.3–1.7)**	**390,000**
Any combustible tobacco product§§	8.5 (7.5–9.5)	10.4 (9.4–11.4)	16.4 (13.0–20.4)	4.1 (3.1–5.5)	11.6 (10.0–13.4)	8.0 (4.5–14.0)	9.3 (8.1–10.7)	9.2 (8.2–10.4)	12.1 (9.8–14.8)	**9.4 (8.6–10.3)**	**2,580,000**
Multiple tobacco products¶¶	7.6 (6.8–8.5)	9.5 (8.5–10.7)	17.2 (13.6–21.5)	3.2 (2.3–4.3)	8.3 (6.9–9.9)	—	8.9 (7.7–10.4)	8.8 (7.8–9.9)	10.0 (8.2–12.2)	**8.6 (7.8–9.5)**	**2,380,000**
High school students (grades 9–12)											
Any tobacco product¶	23.2 (21.2–25.3)	23.9 (21.6–26.4)	37.1 (30.3–44.6)	10.8 (8.1–14.1)	24.2 (20.4–28.5)	25.7 (15.0–40.3)	24.6 (22.2–27.2)	23.5 (21.1–26.0)	25.8 (21.5–30.5)	**23.6 (21.6–25.6)**	**3,700,000**
E-cigarettes	18.8 (17.0–20.8)	17.4 (15.3–19.6)	27.0 (20.8–34.2)	7.0 (5.0–9.7)	17.0 (14.0–20.4)	21.7 (12.1–35.8)	19.3 (16.9–21.9)	18.4 (16.5–20.5)	20.1 (16.1–24.8)	**18.1 (16.3–20.0)**	**2,840,000**
Cigarettes	6.4 (5.5–7.5)	8.3 (7.1–9.6)	15.7 (10.9–22.1)	2.9 (2.0–4.1)	4.3 (3.4–5.6)	—	8.9 (7.5–10.5)	6.8 (5.8–8.0)	9.2 (6.5–12.9)	**7.4 (6.4–8.4)**	**1,130,000**
Cigars††	3.1 (2.6–3.7)	7.3 (6.3–8.5)	7.2 (4.4–11.6)	—	5.6 (3.9–8.0)	—	6.1 (5.2–7.2)	4.4 (3.6–5.5)	6.4 (4.0–10.1)	**5.3 (4.6–6.0)**	**800,000**
Nicotine pouches	2.2 (1.8–2.7)	7.2 (5.9–8.6)	12.3 (8.6–17.3)	—	1.9 (1.2–2.8)	—	6.5 (5.4–7.8)	3.6 (2.9–4.5)	4.9 (3.2–7.5)	**4.7 (4.0–5.6)**	**680,000**
Other oral nicotine products††	2.8 (2.4–3.3)	4.8 (4.0–5.6)	8.5 (5.1–14.0)	—	2.3 (1.4–3.6)	—	4.5 (3.8–5.5)	3.7 (3.1–4.5)	3.8 (2.4–5.8)	**3.8 (3.3–4.4)**	**570,000**
Smokeless tobacco††	1.7 (1.3–2.2)	4.9 (4.0–6.1)	9.4 (6.1–14.3)	—	1.6 (1.0–2.8)	—	4.5 (3.5–5.6)	2.7 (2.1–3.4)	3.7 (2.3–5.9)	**3.4 (2.8–4.1)**	**510,000**
Hookahs	3.2 (2.5–4.0)	3.1 (2.4–3.9)	—	—	5.4 (4.1–7.0)	—	2.1 (1.6–2.9)	3.5 (2.5–4.9)	3.7 (2.3–5.8)	**3.1 (2.6–3.8)**	**470,000**
Heated tobacco products	1.5 (1.2–1.9)	1.9 (1.5–2.5)	—	—	2.0 (1.2–3.4)	—	1.5 (1.1–2.1)	2.3 (1.8–2.8)	—	**1.7 (1.4–2.1)**	**240,000**
Pipe tobacco	1.4 (1.1–1.7)	2.0 (1.6–2.6)	5.9 (3.3–10.5)	—	1.6 (1.0–2.5)	—	1.6 (1.3–2.1)	2.0 (1.6–2.6)	2.2 (1.4–3.4)	**1.7 (1.5–2.0)**	**260,000**
Any combustible tobacco product§§	10.4 (9.0–11.9)	13.6 (12.1–15.3)	20.9 (15.4–27.7)	4.4 (3.3–5.9)	13.0 (10.6–15.9)	—	12.7 (11.1–14.6)	11.2 (9.5–13.1)	15.3 (12.2–19.0)	**12.1 (10.8–13.4)**	**1,860,000**
Multiple tobacco products¶¶	9.3 (8.1–10.6)	12.4 (10.8–14.3)	22.6 (16.8–29.7)	3.0 (2.1–4.1)	9.4 (7.3–12.1)	—	12.1 (10.2–14.1)	10.6 (8.9–12.5)	12.9 (10.3–16.1)	**10.9 (9.6–12.3)**	**1,710,000**

See table footnotes on the next page.

TABLE 1. (*Continued*) Percentage of middle and high school students who reported ever using tobacco products,* overall and by school level, product, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2024

	% (95% CI)										
	Sex		Race and ethnicity†								
Tobacco product	Female	Male	AI/AN	Asian	Black or African American	NH/PI	White	Hispanic or Latino	Multiracial	Total	Total estimated no.§
Middle school students (grades 6–8)											
Any tobacco product¶	13.5 (11.4–15.9)	12.4 (10.9–14.0)	23.6 (18.1–30.1)	7.0 (4.4–10.9)	17.8 (15.2–20.7)	—	10.5 (8.4–13.1)	14.6 (13.0–16.3)	17.5 (13.4–22.6)	**12.9 (11.2–14.8)**	**1,530,000**
E-cigarettes	9.4 (7.8–11.2)	7.6 (6.6–8.8)	15.7 (11.0–21.8)	—	10.4 (8.5–12.7)	—	7.1 (5.6–9.0)	10.3 (9.1–11.6)	11.0 (8.1–14.8)	**8.5 (7.3–9.8)**	**1,000,000**
Cigarettes	3.7 (2.9–4.7)	3.6 (2.8–4.6)	5.5 (3.0–9.9)	—	4.5 (3.6–5.6)	—	3.2 (2.2–4.7)	4.1 (3.3–5.2)	5.2 (3.3–7.9)	**3.6 (2.9–4.5)**	**420,000**
Cigars††	1.9 (1.4–2.5)	2.1 (1.5–2.8)	4.8 (2.7–8.3)	—	3.2 (2.1–4.8)	—	1.4 (1.0–2.0)	2.5 (2.0–3.2)	—	**2.0 (1.6–2.5)**	**230,000**
Nicotine pouches	1.4 (1.1–1.9)	2.1 (1.7–2.7)	—	—	1.3 (0.8–2.2)	—	1.7 (1.2–2.3)	2.0 (1.5–2.6)	2.3 (1.5–3.7)	**1.8 (1.4–2.2)**	**190,000**
Other oral nicotine products††	2.2 (1.8–2.7)	2.2 (1.8–2.7)	—	—	1.9 (1.2–2.8)	—	1.8 (1.4–2.4)	2.9 (2.4–3.5)	3.1 (2.0–4.7)	**2.2 (1.8–2.6)**	**250,000**
Smokeless tobacco††	1.9 (1.4–2.6)	2.7 (2.1–3.5)	5.7 (3.7–8.7)	—	1.8 (1.1–2.7)	—	2.4 (1.7–3.5)	2.3 (1.7–2.9)	3.0 (1.8–4.9)	**2.3 (1.8–3.0)**	**260,000**
Hookahs	1.7 (1.3–2.2)	1.2 (0.9–1.6)	—	—	3.2 (2.4–4.4)	—	0.7 (0.4–1.0)	1.9 (1.4–2.5)	—	**1.4 (1.1–1.8)**	**160,000**
Heated tobacco products	1.2 (0.9–1.6)	1.4 (1.0–1.8)	—	—	1.6 (1.1–2.3)	—	0.8 (0.5–1.3)	1.8 (1.4–2.3)	—	**1.3 (1.0–1.6)**	**130,000**
Pipe tobacco	1.0 (0.8–1.4)	1.1 (0.8–1.5)	—	—	0.9 (0.5–1.5)	—	1.0 (0.7–1.3)	1.2 (0.9–1.7)	—	**1.1 (0.8–1.4)**	**120,000**
Any combustible tobacco product§§	5.9 (4.8–7.2)	5.9 (4.9–7.2)	10.9 (7.5–15.8)	3.6 (2.1–6.1)	9.3 (7.8–11.2)	—	4.7 (3.5–6.3)	6.5 (5.4–7.8)	8.0 (5.5–11.5)	**5.9 (4.9–7.1)**	**690,000**
Multiple tobacco products¶¶	5.3 (4.3–6.4)	5.6 (4.6–6.8)	10.6 (7.1–15.5)	3.4 (1.9–5.7)	6.5 (5.4–8.0)	—	4.7 (3.5–6.3)	6.3 (5.3–7.4)	6.4 (4.5–9.0)	**5.4 (4.5–6.5)**	**640,000**

Abbreviations: AI/AN = American Indian or Alaska Native; NH/PI = Native Hawaiian or Pacific Islander.

* Ever use is defined as ever having used the product, even once or twice. Because of missing data on the ever use questions, denominators for each tobacco product might differ. For each question, response options were "yes" or "no."

† Hispanic or Latino (Hispanic) persons might be of any race; all races listed are non-Hispanic.

§ Estimated weighted total number of students who reported ever use of tobacco product was rounded down to the nearest 10,000 persons. Overall estimates were reported based on 29,861 U.S. middle and high school students. School level was determined by reported grade level: high school = grades 9–12 (15,124) and middle school = grades 6–8 (14,554). The subgroup estimates might not sum to the overall population estimates because of rounding or exclusion of students who did not report sex, race and ethnicity, or grade level.

¶ Any tobacco product use is defined as ever use of one or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis (small, brown cigarettes wrapped in a leaf).

** Dashes indicate that data were statistically unreliable because of an unweighted denominator <50 or a relative SE >30%.

†† Cigars were defined as cigars, cigarillos, or little cigars. Smokeless tobacco was defined as chewing tobacco, snuff, dip, or snus. Other oral nicotine products were defined as lozenges, discs, tablets, gums, dissolvable tobacco products, and other products.

§§ Any combustible tobacco product use was defined as ever use of one or more of the following tobacco products: cigarettes, cigars, hookahs, pipe tobacco, or bidis.

¶¶ Multiple tobacco product use was defined as ever use of two or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis.

5.9% to 11.5%), other oral nicotine products (from 0.5% to 2.8%), any combustible tobacco product (from 2.7% to 6.3%), and multiple tobacco products (from 2.0% to 6.9%). No significant changes occurred in current use of cigarettes, smokeless tobacco, heated tobacco products, or pipe tobacco among all racial and ethnic groups.

Discussion

During 2023–2024, among all middle school and high school students, current use of any tobacco product declined by an estimated 550,000 students, largely driven by the decline in high school e-cigarette use (from 1.56 million to 1.21 million) (*3*), and reaching the lowest level ever measured by NYTS. Despite these declines, approximately one in 12 middle and high school students reported current use of any tobacco product during 2024, including approximately one in 10 high school students and approximately 1 in 20 middle school students. Approximately two in five students who had ever used a tobacco product currently used them.

Since 2014, e-cigarettes have been the most used tobacco product among U.S. youths (*4*). From 2023 (*3*) to 2024,

TABLE 2. Percentage of middle and high school students who reported current (previous 30-day) tobacco product use,* overall and by school level, product, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2024

	% (95% CI)									
	Sex		Race and ethnicity†							
Tobacco product	Female	Male	AI/AN	Asian	Black or African American	White	Hispanic or Latino	Multiracial	Total	Total estimated no.§
Overall										
Any tobacco product¶	7.7 (6.9–8.6)	8.5 (7.6–9.5)	16.3 (12.8–20.5)	3.3 (2.3–4.6)	10.0 (8.4–11.9)	7.8 (6.6–9.3)	8.4 (7.5–9.3)	9.0 (7.4–11.0)	**8.1 (7.4–8.9)**	**2,250,000**
E-cigarettes	6.1 (5.4–6.9)	5.8 (5.1–6.5)	11.5 (8.4–15.5)	2.3 (1.5–3.7)	7.0 (5.7–8.6)	5.9 (4.8–7.1)	6.1 (5.5–6.9)	6.6 (5.2–8.3)	**5.9 (5.3–6.6)**	**1,630,000**
Nicotine pouches	0.9 (0.7–1.1)	2.7 (2.2–3.2)	4.4 (2.8–7.0)	—**	1.0 (0.6–1.4)	2.2 (1.8–2.8)	1.7 (1.4–2.1)	1.4 (0.8–2.4)	**1.8 (1.5–2.1)**	**480,000**
Cigarettes	1.2 (1.0–1.5)	1.6 (1.3–2.0)	3.5 (2.1–5.6)	—	0.9 (0.6–1.4)	1.4 (1.2–1.8)	1.6 (1.3–2.0)	2.1 (1.3–3.5)	**1.4 (1.2–1.6)**	**380,000**
Cigars††	0.9 (0.7–1.2)	1.5 (1.2–1.9)	—	—	2.2 (1.5–3.1)	0.9 (0.7–1.2)	1.4 (1.1–1.8)	—	**1.2 (1.0–1.5)**	**330,000**
Smokeless tobacco††	0.7 (0.5–0.8)	1.7 (1.4–2.1)	3.6 (2.0–6.4)	—	0.8 (0.5–1.3)	1.3 (1.1–1.7)	1.3 (1.0–1.6)	1.3 (0.7–2.2)	**1.2 (1.0–1.4)**	**330,000**
Other oral nicotine products††	0.9 (0.7–1.1)	1.5 (1.2–1.8)	2.8 (1.6–5.0)	—	1.1 (0.7–1.6)	1.3 (1.0–1.6)	1.4 (1.1–1.6)	1.0 (0.6–1.6)	**1.2 (1.0–1.4)**	**320,000**
Heated tobacco products	0.7 (0.6–0.9)	0.9 (0.7–1.1)	—	—	0.9 (0.6–1.4)	0.6 (0.4–0.8)	1.2 (1.0–1.5)	0.8 (0.4–1.4)	**0.8 (0.7–1.0)**	**220,000**
Hookahs	0.8 (0.6–1.0)	0.7 (0.6–0.9)	—	—	1.5 (1.0–2.2)	0.4 (0.3–0.6)	0.9 (0.7–1.1)	0.8 (0.4–1.3)	**0.7 (0.6–0.9)**	**190,000**
Pipe tobacco	0.4 (0.3–0.6)	0.6 (0.4–0.7)	—	—	0.6 (0.3–1.0)	0.4 (0.3–0.5)	0.7 (0.5–0.9)	—	**0.5 (0.4–0.6)**	**130,000**
Any combustible tobacco product§§	2.4 (2.0–2.9)	3.1 (2.7–3.6)	6.3 (4.1–9.5)	—	4.1 (3.2–5.2)	2.4 (2.0–2.9)	2.9 (2.5–3.5)	3.9 (2.8–5.4)	**2.8 (2.5–3.2)**	**760,000**
Multiple tobacco products¶¶	2.5 (2.1–2.9)	3.6 (3.1–4.1)	6.9 (4.5–10.4)	1.1 (0.6–2.0)	3.3 (2.5–4.4)	3.0 (2.5–3.7)	3.1 (2.7–3.5)	3.8 (2.7–5.2)	**3.0 (2.7–3.4)**	**840,000**
High school students (grades 9–12)										
Any tobacco product¶	9.3 (8.2–10.5)	10.9 (9.5–12.5)	21.1 (15.7–27.8)	3.6 (2.5–5.2)	11.1 (8.8–13.9)	10.5 (8.6–12.6)	9.8 (8.4–11.3)	11.3 (8.9–14.3)	**10.1 (9.0–11.3)**	**1,580,000**
E-cigarettes	7.7 (6.7–8.9)	7.8 (6.7–9.0)	15.5 (10.5–22.1)	3.1 (2.0–4.9)	8.4 (6.6–10.7)	8.1 (6.6–10.0)	7.4 (6.4–8.5)	8.7 (6.6–11.4)	**7.8 (6.9–8.8)**	**1,210,000**
Nicotine pouches	0.8 (0.6–1.1)	3.9 (3.1–4.8)	5.6 (3.3–9.5)	—	0.9 (0.5–1.7)	3.3 (2.7–4.1)	2.0 (1.6–2.5)	—	**2.4 (2.0–2.9)**	**360,000**
Cigarettes	1.1 (0.9–1.5)	2.2 (1.8–2.7)	5.2 (3.0–8.7)	—	—	1.9 (1.4–2.4)	1.7 (1.4–2.2)	—	**1.7 (1.4–2.0)**	**250,000**
Cigars††	1.0 (0.7–1.4)	2.1 (1.6–2.7)	—	—	2.7 (1.7–4.2)	1.3 (0.9–1.7)	1.6 (1.2–2.2)	—	**1.5 (1.2–1.9)**	**230,000**
Smokeless tobacco††	0.6 (0.5–0.8)	2.3 (1.8–2.9)	—	—	—	1.8 (1.5–2.3)	1.4 (1.1–1.8)	—	**1.5 (1.2–1.8)**	**220,000**
Other oral nicotine products††	0.9 (0.7–1.2)	2.0 (1.6–2.4)	—	—	—	1.7 (1.3–2.2)	1.5 (1.2–1.8)	—	**1.4 (1.2–1.7)**	**210,000**
Heated tobacco products	0.7 (0.6–1.0)	1.0 (0.7–1.3)	—	—	—	0.7 (0.5–1.0)	1.3 (1.0–1.7)	—	**0.9 (0.7–1.1)**	**120,000**
Hookahs	0.7 (0.5–1.1)	0.9 (0.7–1.2)	—	—	1.6 (0.9–2.7)	0.4 (0.3–0.6)	1.0 (0.7–1.4)	—	**0.8 (0.6–1.1)**	**120,000**
Pipe tobacco	0.4 (0.2–0.6)	0.6 (0.4–0.8)	—	—	—	0.4 (0.2–0.6)	0.7 (0.5–1.0)	—	**0.5 (0.4–0.6)**	**70,000**
Any combustible tobacco product§§	2.6 (2.0–3.3)	4.0 (3.4–4.7)	8.0 (4.9–12.7)	—	4.4 (3.1–6.2)	3.0 (2.4–3.7)	3.3 (2.6–4.1)	5.0 (3.3–7.4)	**3.3 (2.9–3.9)**	**510,000**
Multiple tobacco products¶¶	2.7 (2.2–3.3)	4.7 (3.9–5.6)	9.3 (5.9–14.4)	—	3.6 (2.4–5.5)	4.1 (3.3–5.1)	3.2 (2.7–3.8)	4.6 (3.0–7.0)	**3.7 (3.2–4.3)**	**580,000**

See table footnotes on the next page.

current use of e-cigarettes declined significantly among high school students. The decline in high school student e-cigarette use is likely attributable to multiple factors, including ongoing activities at the national, state, and local levels to implement tobacco control strategies. A similar decline in e-cigarette use among high school students occurred from 2022 to 2023 (*3*). E-cigarette use did not change among middle school students from 2023 to 2024, similar to use from 2022 to 2023 (*3*).

In 2024, 1.7% of high school students and 1.1% of middle school students reported current cigarette smoking, the lowest prevalence ever recorded by NYTS. However, youths continue to use other tobacco products, including e-cigarettes and

TABLE 2. (*Continued*) Percentage of middle and high school students who reported current (previous 30-day) tobacco product use,* overall and by school level, product, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2024

	% (95% CI)									
	Sex		Race and ethnicity†							
Tobacco product	Female	Male	AI/AN	Asian	Black or African American	White	Hispanic or Latino	Multiracial	Total	Total estimated no.§
Middle school students (grades 6–8)										
Any tobacco product¶	5.5 (4.5–6.7)	5.3 (4.5–6.3)	10.3 (6.9–15.2)	—	8.4 (6.8–10.3)	4.3 (3.2–5.6)	6.3 (5.4–7.3)	6.3 (4.6–8.6)	**5.4 (4.6–6.3)**	**640,000**
E-cigarettes	3.9 (3.1–4.9)	3.1 (2.5–3.8)	6.5 (3.7–11.1)	—	4.9 (3.8–6.4)	2.8 (2.0–3.9)	4.4 (3.7–5.3)	4.0 (2.6–6.1)	**3.5 (2.9–4.2)**	**410,000**
Nicotine pouches	0.9 (0.6–1.2)	1.1 (0.8–1.4)	—	—	0.9 (0.5–1.6)	0.8 (0.5–1.2)	1.2 (0.9–1.6)	—	**1.0 (0.8–1.2)**	**110,000**
Cigarettes	1.2 (0.9–1.6)	0.9 (0.6–1.4)	—	—	1.1 (0.6–1.8)	0.9 (0.6–1.4)	1.3 (1.0–1.8)	—	**1.1 (0.8–1.3)**	**120,000**
Cigars††	0.8 (0.5–1.1)	0.7 (0.4–1.2)	—	—	1.5 (0.9–2.4)	0.4 (0.3–0.8)	1.0 (0.7–1.3)	—	**0.8 (0.6–1.0)**	**80,000**
Smokeless tobacco††	0.7 (0.5–0.9)	1.0 (0.7–1.3)	—	—	_	0.7 (0.4–1.0)	1.0 (0.7–1.5)	—	**0.8 (0.6–1.1)**	**90,000**
Other oral nicotine products††	0.9 (0.7–1.2)	0.8 (0.6–1.1)	—	—	1.0 (0.6–1.7)	0.7 (0.4–1.0)	1.2 (0.9–1.7)	—	**0.9 (0.7–1.1)**	**100,000**
Heated tobacco products	0.7 (0.4–1.0)	0.8 (0.6–1.1)	—	—	0.9 (0.6–1.5)	—	1.1 (0.8–1.5)	—	**0.7 (0.6–1.0)**	**80,000**
Hookahs	0.7 (0.5–1.1)	0.4 (0.2–0.7)	—	—	1.3 (0.8–2.0)	—	0.6 (0.4–0.9)	—	**0.6 (0.4–0.8)**	**60,000**
Pipe tobacco	0.4 (0.3–0.7)	0.5 (0.3–0.8)	—	—	—	0.4 (0.2–0.6)	0.6 (0.4–1.0)	—	**0.5 (0.3–0.7)**	**50,000**
Any combustible tobacco product§§	2.1 (1.7–2.7)	2.0 (1.4–2.7)	—	—	3.5 (2.6–4.8)	1.5 (1.0–2.2)	2.3 (1.8–2.9)	2.5 (1.5–4.3)	**2.1 (1.6–2.6)**	**240,000**
Multiple tobacco products¶¶	2.1 (1.6–2.7)	2.0 (1.6–2.5)	—	—	2.7 (1.9–3.7)	1.6 (1.1–2.3)	2.6 (2.1–3.2)	2.7 (1.7–4.2)	**2.1 (1.7–2.5)**	**240,000**

Abbreviation: AI/AN = American Indian or Alaska Native.

* Current use is defined as use on ≥1 day during the previous 30 days for each product. Because of missing data on previous 30-day use questions, denominators for each tobacco product might differ.

† Hispanic or Latino (Hispanic) persons might be of any race; all races listed are non-Hispanic. Estimates among non-Hispanic Native Hawaiian or Pacific Islander students, overall and by school level, were statistically unreliable for all measures and are not presented in this table.

§ Estimated weighted total number of students who reported current tobacco product use was rounded down to the nearest 10,000 persons. Overall estimates were reported based on 29,861 U.S. middle and high school students. School level was determined by reported grade level: high school = grades 9–12 (15,124) and middle school = grades 6–8 (14,554). The subgroup estimates might not sum to the overall population estimates because of rounding or exclusion of students who did not report sex, race and ethnicity, or grade level.

¶ Any tobacco product use is defined as current use of one or more of the following tobacco products on ≥1 day during the previous 30 days: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis (small, brown cigarettes wrapped in a leaf).

** Dashes indicate that data were statistically unreliable because of an unweighted denominator <50 or a relative SE >30%.

†† Cigars were defined as cigars, cigarillos, or little cigars. Smokeless tobacco was defined as chewing tobacco, snuff, dip, or snus. Other oral nicotine products were defined as lozenges, discs, tablets, gums, dissolvable tobacco products, and other products.

§§ Any combustible tobacco product use was defined as current use of one or more of the following tobacco products: cigarettes, cigars, hookahs, pipe tobacco, or bidis.

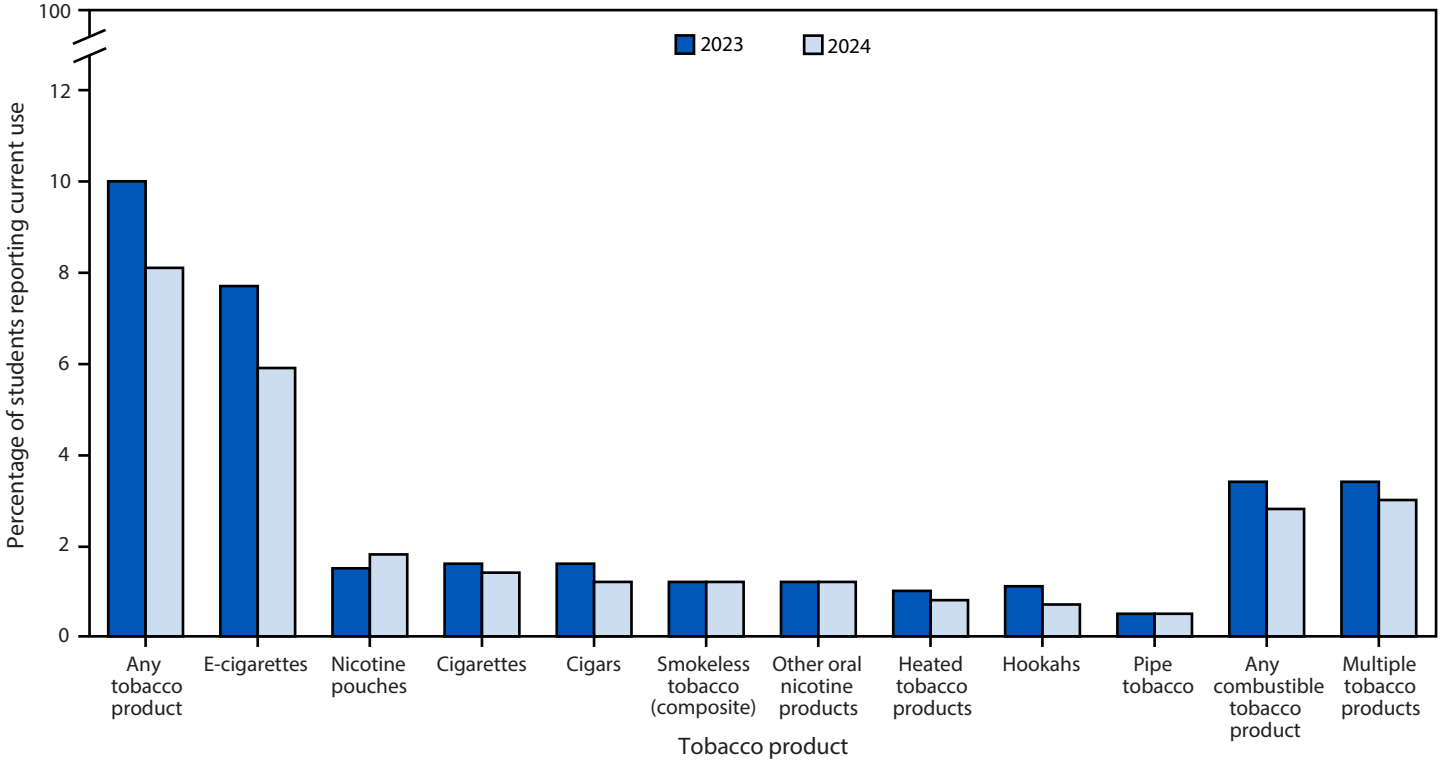
¶¶ Multiple tobacco product use was defined as current use of two or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, or snus), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis.

nicotine pouches (*2*). As the tobacco product market continues to evolve, vigilant monitoring of emerging tobacco product trends among youths is important. Nicotine pouch sales have substantially increased nationwide since 2016[§§§] (*5*); although sales data do not indicate which age groups are using the products, NYTS data indicate use of nicotine pouches among youths remains relatively low (*2*). However, for the first time, nicotine pouches were the second most common currently used tobacco product (1.8%); nearly one million (890,000) students reported ever using nicotine pouches in 2024. CDC and FDA will continue monitoring tobacco product use among youths, especially e-cigarette and nicotine pouches, and address any potential increase in use of these products (*2*,*5*).

Current use of any tobacco product was similar among male and female students; however, males were more likely to report current use of multiple tobacco products. Consistent with previous reports (*6*), among all racial and ethnic groups, AI/AN students reported the highest prevalence of current use of any tobacco product, of e-cigarettes, and of multiple tobacco products. Further, during 2023–2024, whereas any tobacco product use declined for Hispanic students and remained stable for all other racial and ethnic groups, it increased among

§§§ The questions about nicotine pouch use were first added to NYTS in 2021.

FIGURE. Current use of selected tobacco products,* any tobacco product,† any combustible tobacco product,§ and multiple tobacco products¶ by middle and high school students — National Youth Tobacco Survey, United States, 2023 and 2024**



* Current use is defined as use on ≥1 day during the past 30 days for each product.
† Any tobacco product use is defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, nicotine pouches, cigarettes, cigars (cigars, cigarillos, or little cigars), smokeless tobacco (composite [chewing tobacco, snuff, dip, or snus]), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis (small, brown cigarettes wrapped in a leaf).
§ Any combustible tobacco product use was defined as current use of one or more of the following tobacco products: cigarettes, cigars, hookah, pipe tobacco, or bidis.
¶ Multiple tobacco product use was defined as current use of two or more of the following tobacco products: e-cigarettes, nicotine pouches, cigarettes, cigars, smokeless tobacco (composite [chewing tobacco, snuff, dip, or snus]), other oral nicotine products, heated tobacco products, hookahs, pipe tobacco, or bidis.
** During 2023–2024, statistically significant declines in the use of any tobacco product, e-cigarettes, and hookahs were observed. No statistically significant change in use of nicotine pouches, cigarettes, cigars, smokeless tobacco, other oral nicotine products, heated tobacco products, pipe tobacco, any combustible tobacco, or multiple tobacco products occurred.

Summary

What is already known about this topic?

Use of tobacco products in any form is unsafe; most tobacco product use begins in adolescence.

What is added by this report?

From 2023 to 2024, current (previous 30-day) use of any tobacco product declined among high school students from 12.6% to 10.1%, largely driven by the decline in high school e-cigarette use (from 10.0% to 7.8%). During 2024, e-cigarettes remained the most commonly used tobacco product among U.S. youths; nicotine pouches were the second most commonly used tobacco product.

What are the implications for public health?

Tobacco use among youths has continued to decline; however, comprehensive and sustained implementation of evidence-based tobacco control strategies, including tobacco product regulation and enforcement, is needed to prevent and reduce all forms of youth tobacco product use.

AI/AN students, highlighting disparities in tobacco product use. Activities aimed at reducing disparities are a critical part of tobacco prevention and control measures (*3*).

Limitations

The findings in this report are subject to at least five limitations. First, data were obtained by self-report, which is subject to social desirability and recall biases, although previous research suggests that self-reported measures of tobacco use among persons aged 12–21 years correlate with tobacco use biomarkers (*7*). Second, these findings might not be generalizable to youths who are home-schooled, have dropped out of school, are in detention centers, or are enrolled in alternative schools. Third, the 2023 estimate for nicotine pouch use among middle school students was suppressed; therefore, it could not be compared with the 2024 estimate. Fourth, some AI/AN populations use traditional tobacco in cultural ceremonies of medicinal and spiritual importance (*8*). NYTS

does not distinguish between use of ceremonial and commercial tobacco use; therefore, estimates among AI/AN youth might also include ceremonial tobacco use. Finally, because of small sample sizes, many estimates for racial and ethnic population groups were not reliable, particularly for less prevalent tobacco products and among the Non-Hispanic Native Hawaiian or Pacific Islander population.

Implications for Public Health Practice

In 2024, 8.1% (2.25 million) of U.S. middle and high school students reported current tobacco product use. From 2023 to 2024, substantial declines in current use of any tobacco product and e-cigarettes among high school students occurred; however, no change was observed among middle school students. Multiple factors continue to influence tobacco product use and initiation among adolescents including availability of youth-appealing flavored products, marketing, harm misperceptions, the emergence of new flavor types (e.g., ice flavors [flavors that combine cooling and fruit or sweet flavors, such as blueberry ice or strawberry ice]), and product features (*3*). Given the negative health consequences of tobacco use (*9*) and the unique harms associated with adolescent nicotine exposure (*1*), prevention of youth tobacco product use is crucial. Preventing initiation and promoting cessation require a comprehensive approach at the local, state, and national levels. Evidence-based tobacco prevention strategies include price increases, mass media campaigns to educate youths about the harmful effects of all tobacco products, and implementation of comprehensive smoke-free policies that include e-cigarettes (*1*).

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Corresponding author: Ahmed Jamal, AJamal@cdc.gov.

[1]Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Center for Tobacco Products, Food and Drug Administration, Silver Spring, Maryland.

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Please note: This report has been corrected. An erratum has been published.

Coverage with Selected Vaccines and Exemption Rates Among Children in Kindergarten — United States, 2023–24 School Year

Ranee Seither, MPH[1]; Oyindamola Bidemi Yusuf, PhD[1,2]; Devon Dramann, MPH[1,3]; Kayla Calhoun, MS[1]; Agnes Mugerwa-Kasujja, MD[1,2]; Cynthia L. Knighton[1]; Jennifer L. Kriss, PhD[1]; Rebecca Miller, MPH[1]; Georgina Peacock, MD[1]

Abstract

In the United States, states and local jurisdictions set vaccination requirements for school attendance, conditions and procedures for exemptions from these requirements, grace periods for submitting documentation, and provisional enrollment for students who need more time to be vaccinated. States annually report data to CDC on the number of children in kindergarten who meet, are exempt from, or are in the process of meeting requirements. Data reported by 49 states and the District of Columbia (DC) for the 2023–24 school year were used for national- and state-level estimates of the following measures: complete vaccination with required doses of measles, mumps, and rubella vaccine (MMR), diphtheria, tetanus, and acellular pertussis vaccine (DTaP), poliovirus vaccine (polio), and varicella vaccine (VAR); exemptions from vaccination; and school attendance while meeting requirements. The 2023–24 kindergarten class became age-eligible to complete most state-required vaccinations during the COVID-19 pandemic, after schools had returned to routine in-person learning. Compared with approximated national coverage levels across all reported vaccines for the 2019–20 (95%) and 2022–23 (93%) school years, coverage dropped below 93% for the 2023–24 school year, ranging from 92.3% for DTaP to 92.7% for MMR. Exemptions increased to 3.3%, compared with those during the 2022–23 (3.0%) and 2021–22 school years (2.6%). Coverage with MMR, DTaP, polio, and VAR decreased in 35, 32, 33, and 36 jurisdictions, respectively, compared with the 2022–23 school year. Exemptions increased in 41 jurisdictions, with 14 reporting that >5% of kindergartners had an exemption from one or more vaccine. Efforts by health departments, schools, and providers are needed to ensure that students begin school fully vaccinated.

Introduction

School vaccination requirements set by state and local jurisdictions promote vaccination to reduce the risk for vaccine-preventable diseases (*1*). After 10 years of near 95% nationwide vaccination coverage, coverage with measles, mumps, and rubella vaccine (MMR)*; diphtheria, tetanus, and acellular pertussis vaccine (DTaP)†; poliovirus vaccine (polio)§; and varicella vaccine (VAR)¶ declined to approximately 93% over the 2020–21 and 2021–22 school years and remained essentially unchanged during the 2022–23 school year (*2*). These declines persisted after impacts of the COVID-19 pandemic diminished. This analysis summarizes state and local immunization program** data on vaccination coverage and exemptions from vaccination among kindergartners as reported to CDC by 49 states†† and the District of Columbia (DC), and provisional enrollment or grace period status for kindergartners reported by 31 states§§ for the 2023–24 school year.

Methods

Data Collection and Reporting

In compliance with state and local school entry requirements, parents provide children's vaccination or exemption documents

* Jurisdictions reported coverage with all doses of MMR required by the jurisdiction. All states except Wyoming require 2 doses of a measles-containing vaccine. Seven states (Alaska, Georgia, New Jersey, New York, North Carolina, Oregon, and Virginia) require only 1 dose of rubella vaccine. Alaska, New Jersey, and Oregon require only 1 dose of mumps vaccine; mumps vaccine is not required in Iowa. Wyoming requires 1 dose of MMR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose.

† Jurisdictions reported coverage with all doses of DTaP required by the jurisdiction. Nebraska requires 3 doses of DTaP; Maryland and Wisconsin require 4 doses; Wyoming requires 4 doses of DTaP for kindergarten entry, allowing students until the day before their seventh birthday to receive their fifth dose; all other states require 5 doses, unless dose 4 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 requires 5 doses of DTaP by age 5 years but reported 4-dose coverage for kindergartners.

§ Jurisdictions reported coverage with all doses of polio required by the jurisdiction. Two states (Maryland and Nebraska) require only 3 doses of polio; Wyoming requires 3 doses of polio for kindergarten entry, allowing students until the day before their seventh birthday to receive their fourth dose; all other states require 4 doses unless the last dose was given on or after the fourth birthday. The reported coverage estimates represent the percentage of kindergartners with the state-required number of polio doses, except for Kentucky, which requires ≥4 doses but reported ≥3 doses of polio.

¶ Jurisdictions reported coverage with all doses of VAR required by the jurisdiction. Five states require 1 dose of VAR; 44 states and DC require 2 doses. Wyoming requires 1 dose of VAR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose.

** Federally funded immunization programs are in 50 states and DC, five cities, and eight U.S. territories and freely associated states. Two cities (Houston, and New York City) reported data to CDC, which were also included in data submitted by their state. State-level data were used to calculate national estimates and medians. Immunization programs in U.S. territories reported vaccination coverage and exemptions, reported in the Table and Supplementary Table; however, these data were not included in national estimates calculations.

†† Montana did not report school vaccination data.

§§ Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Iowa, Maine, Michigan, Mississippi, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming reported data on the number of students within a grace period or provisionally enrolled at the time of assessment.

to schools, or schools obtain records from the state immunization information system (IIS). Federally funded immunization programs work with departments of education, local health departments, and school personnel to assess the vaccination and exemption status of children enrolled in public and private kindergartens. Programs report unweighted counts, aggregated by school type, to CDC via a questionnaire in the Secure Access Management System, a federal, web-based platform that provides authorized personnel access to public health applications operated by CDC. CDC uses these data to produce state- and national-level estimates of vaccination coverage among children in kindergarten. During the 2023–24 school year, 49 states and DC reported coverage with all state-required vaccinations and exemption data for public school kindergartners; 48 states and DC reported data for private school kindergartners.¶¶ Data from cities were included with their state data. State-level, national, and median coverage with the state-required number of DTaP, MMR, polio, and VAR doses are reported. Hepatitis B vaccination coverage is not included in this report and is available at SchoolVaxView (*2*). Thirty-one states reported the number of kindergartners attending school under a grace period (attendance without proof of complete vaccination or exemption during a set number of days) or provisional enrollment (attendance while completing a catch-up vaccination schedule). All counts were current at the time of the assessment by the immunization program.***

Data Analyses

National estimates, medians, and summary measures include only 49 U.S. states and DC. Coverage and exemption estimates were adjusted based on survey type and response rate.††† Results for U.S. territories and freely associated states are reported separately. National estimates measure coverage and exemptions among all kindergartners, whereas medians indicate the midpoint of state-level estimates. During the 2023–24 school year, immunization programs reported 3,823,506 children enrolled in kindergarten. Reported estimates are based on 3,560,047 (93.1%) children who were surveyed for vaccination coverage, 3,709,489 (97.0%) for exemptions, and 2,748,308 (71.9%) for grace period and provisional enrollment.§§§ Potentially achievable coverage with MMR (the sum of the percentage of children who were up to date with 2 MMR doses and those not up to date but nonexempt) was calculated for each jurisdiction. Students who were not up to date and did not have medical or nonmedical exemptions included those who were provisionally enrolled in kindergarten, in a grace period, or otherwise without documentation of complete vaccination. Required vaccines and required numbers of doses, methods and timing of data collection, and data reported varied by jurisdiction. Kindergartners were considered up to date with a given vaccine if they received all doses of that vaccine required for school entry, except in nine states¶¶¶ that reported kindergartners as up to date for any vaccine only if they had received all doses of all vaccines required for school entry. All but four states**** reported the number of kindergartners with an exemption from one or more vaccine. SAS software (version 9.4; SAS Institute) was used for all analyses. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.††††

Results

Vaccination Coverage

Nationally, 2-dose MMR coverage was 92.7% (range = 79.6% [Idaho] to 98.3% [West Virginia]), with coverage ≥95% reported by 11 jurisdictions and <90% by 14 jurisdictions (Table). Five-dose DTaP coverage was 92.3% (range = 79.5% [Idaho] to 98.4% [West Virginia]); with coverage ≥95% reported by 12 jurisdictions and <90% by 15. Four-dose polio vaccination coverage was 92.6% (range = 80.1% [Idaho] to 98.4% [West Virginia]), with coverage ≥95% reported by 12 jurisdictions and <90% by 13. Two-dose VAR vaccination coverage was 92.4% (range = 79.1% [Idaho] to 99.7% [West Virginia]), with 10 jurisdictions reporting coverage ≥95% and 15 reporting <90% coverage. During the 2023–24 school year,

¶¶ Thirteen states reported coverage and exemption data for at least some homeschooled kindergartners, either separately, or included with data from public or private schools.

*** Assessment date varied by state and area. Three states assessed schools on the first day of school; eight states assessed schools by December 31; 17 states and DC assessed schools by some other date, ranging from October 1, 2023, to June 2, 2024; and 21 states assessed schools on a rolling basis.

††† Immunization programs that used census or voluntary response provided CDC with data aggregated at the state or local (city or territory) level. Estimates based on these data 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 data aggregated at the school or county level for weighted analyses. Weights were calculated to account for sample design and adjusted for nonresponse.

§§§ These totals are the sums of the kindergartners surveyed among programs reporting data for coverage, exemptions, grace periods, and provisional enrollment.

¶¶¶ Alabama, Delaware, 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. In Kentucky, public schools reported numbers of children up to date with specific vaccines, and most private schools reported numbers of children who received all doses of all vaccines required for school entry.

**** Colorado, Illinois, Minnesota, and Missouri did not report the number of kindergartners with an exemption but instead reported the number of exemptions for each vaccine, which could have counted some children more than once. For these states, the percentage of kindergartners exempt from the vaccine with the highest number of exemptions by exemption type (the lower bound of the potential range of exemptions) was included in the national and median exemption rates.

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

TABLE. Estimated* coverage† with measles, mumps, and rubella; diphtheria, tetanus, and acellular pertussis; poliovirus; and varicella vaccines; grace period or provisional enrollment§; and any exemption¶, among kindergartners, by jurisdiction — United States,†† 2023–24 school year**

Jurisdiction	Kindergarten population§§	Percentage							PP change in any exemption from last year to this year	Potentially achievable coverage****
		Surveyed¶¶	2 MMR doses***	5 DTaP doses†††	4 Polio doses§§§	2 VAR doses¶¶¶	Grace period or provisional enrollment	Any exemption		
National estimate††††	3,823,506	93.1	92.7	92.3	92.6	92.4	2.6	3.3	0.3	96.8
Median††††	—	—	92.0	91.3	91.7	91.8	2.0	3.7	0.4	96.4
U.S. states and the District of Columbia										
Alabama§§§§,¶¶¶¶	54,565	100.0	≥93.8	≥93.8	≥93.8	≥93.8	NP	2.2	0.2	97.8
Alaska¶¶¶¶,*****	8,644	88.9	84.3	83.8	84.4	82.6	NR	9.5	3.8	90.8
Arizona†††††	74,834	99.6	89.3	89.4	90.0	94.1	NR	8.5	1.1	92.8
Arkansas	37,535	95.4	92.5	91.4	91.4	92.0	8.0	3.5	0.4	96.6
California§§§§,¶¶¶¶,†††††,§§§§§	569,680	100.0	96.2	95.4	96.1	95.7	2.0	0.1	−0.1	99.9
Colorado§§§§	61,662	100.0	88.3	87.9	87.9	87.3	≥0.7	≥4.2	−0.1	96.0
Connecticut§§§§,¶¶¶¶,†††††	36,184	100.0	97.7	97.6	97.8	97.5	2.0	0.5	−0.3	99.5
Delaware¶¶¶¶, §§§§§	11,043	12.1	≥93.8	≥93.8	≥93.8	≥93.8	0.3	2.5	0.4	97.5
District of Columbia§§§§,¶¶¶¶	7,874	100.0	92.0	92.0	89.4	91.3	NR	2.3	1.0	97.9
Florida§§§§,¶¶¶¶	228,213	100.0	≥88.1	≥88.1	≥88.1	≥88.1	5.0	4.8	0.3	95.2
Georgia§§§§,¶¶¶¶	136,943	100.0	≥88.4	≥88.4	≥88.4	≥88.4	0.5	3.6	−0.2	96.4
Hawaii¶¶¶¶	13,995	8.2	89.8	89.4	90.2	89.1	5.6	5.3	−1.1	94.7
Idaho§§§§	22,376	100.0	79.6	79.5	80.1	79.1	1.4	14.3	2.2	86.5
Illinois§§§§,¶¶¶¶	133,578	100.0	91.6	91.2	91.5	91.1	NR	≥2.5	0.4	97.5
Indiana¶¶¶¶,¶¶¶¶¶	80,639	88.5	90.8	81.8	81.8	90.3	NR	2.4	−0.4	97.6
Iowa§§§§,¶¶¶¶	38,611	100.0	≥89.1	≥89.1	≥89.1	≥89.1	5.9	3.4	0.4	96.6
Kansas¶¶¶¶,§§§§§,¶¶¶¶¶,******	34,178	37.1	90.4	90.1	91.6	89.5	NP	3.0	0.1	97.0
Kentucky§§§§,¶¶¶¶,§§§§§,¶¶¶¶¶	52,609	100.0	≥90.0	≥91.0	≥91.7	≥89.4	NR	2.3	0.6	97.7
Louisiana§§§§	51,839	100.0	92.4	90.5	95.0	90.9	NP	2.8	0.5	97.2
Maine	12,087	93.0	97.5	96.9	97.4	97.1	1.1	1.0	0.1	99.4
Maryland§§§§,¶¶¶¶,§§§§§	63,224	100.0	≥96.6	≥96.8	≥97.0	≥96.2	NR	2.2	0.3	97.8
Massachusetts§§§§,¶¶¶¶,§§§§§	65,424	100.0	96.3	96.0	96.2	95.7	NP	1.4	0.0	98.7
Michigan§§§§	110,156	100.0	92.1	92.1	92.7	91.7	1.0	5.6	0.2	93.6
Minnesota	66,032	99.1	87.0	87.4	88.1	87.2	NR	≥5.4	0.9	94.6
Mississippi§§§§,¶¶¶¶	36,105	100.0	≥97.5	≥97.5	≥97.5	≥97.5	1.4	0.7	0.5	99.3
Missouri§§§§,¶¶¶¶	69,014	100.0	90.4	90.5	91.0	89.9	NR	≥4.7	0.9	95.3
Montana	NR	NR	NR	NR	NR	NR	NR	NR	NA	NA
Nebraska§§§§,¶¶¶¶,§§§§§	23,118	100.0	93.9	95.2	95.7	91.2	2.6	3.5	0.9	96.7
Nevada¶¶¶¶	31,261	91.3	91.9	91.1	91.5	91.2	2.9	6.7	1.1	94.0
New Hampshire§§§§,¶¶¶¶,¶¶¶¶¶	11,871	100.0	≥89.2	≥89.2	≥89.2	≥89.2	4.3	4.1	0.7	95.9
New Jersey§§§§,¶¶¶¶,¶¶¶¶¶	105,408	100.0	≥93.2	≥93.2	≥93.2	≥93.2	1.0	3.9	0.7	96.1
New Mexico§§§§,¶¶¶¶	20,699	100.0	95.0	94.8	95.0	94.4	2.0	1.6	0.1	98.4
New York (including NYC)¶¶¶¶,†††††	200,894	98.8	97.7	96.8	97.1	97.1	2.2	0.1	0.0	99.9
NYC¶¶¶¶,†††††	85,360	99.3	96.7	95.3	95.7	95.9	2.4	0.1	0.0	100.0
North Carolina¶¶¶¶,§§§§§,¶¶¶¶¶	125,964	90.8	93.8	93.5	93.8	93.3	1.4	2.9	0.5	97.3
North Dakota	9,708	97.5	90.9	90.5	91.0	90.7	NR	6.5	1.4	93.5
Ohio	133,716	94.0	89.2	89.3	89.6	88.5	6.5	4.2	0.4	96.2
Oklahoma§§§§§	49,979	93.8	88.3	89.0	91.4	93.7	NR	5.7	1.0	94.6
Oregon§§§§, §§§§§	39,568	100.0	91.2	90.5	91.1	93.9	NR	8.9	0.7	92.4
Pennsylvania	137,593	96.5	93.5	93.8	93.4	93.2	2.0	5.0	0.9	95.0
Rhode Island¶¶¶¶,§§§§§,¶¶¶¶¶	10,539	97.8	97.1	96.9	96.7	96.6	0.7	1.7	0.2	98.5
South Carolina ¶¶¶¶,******	58,069	26.7	92.1	92.3	92.6	91.8	4.5	4.4	0.3	95.6
South Dakota¶¶¶¶,¶¶¶¶¶	11,744	99.8	90.8	90.6	91.0	90.3	NR	5.7	1.6	94.3
Tennessee¶¶¶¶,¶¶¶¶¶	79,323	95.8	95.1	94.6	94.6	94.6	2.0	3.6	0.4	96.4
Texas (including Houston)§§§§§,¶¶¶¶¶	381,421	92.4	94.3	94.0	94.2	93.7	1.8	3.9	0.4	96.4
Houston§§§§§,¶¶¶¶¶	37,882	67.7	93.6	93.4	93.6	92.8	0.8	2.7	0.4	97.6
Utah§§§§	46,228	100.0	88.8	88.5	88.2	88.2	4.2	9.3	1.2	91.4
Vermont§§§§,¶¶¶¶	5,630	100.0	92.9	92.7	92.6	92.5	5.6	4.0	0.4	96.0
Virginia¶¶¶¶,******	92,633	1.9	94.2	96.2	93.0	93.1	NR	2.4	0.2	97.6
Washington¶¶¶¶¶	84,053	97.2	91.3	90.2	90.4	90.0	1.3	4.8	0.8	96.0
West Virginia¶¶¶¶,†††††,§§§§§,¶¶¶¶¶	18,261	82.8	98.3	98.4	98.4	99.7	NR	<0.1	0.0	99.9
Wisconsin§§§§§,¶¶¶¶¶	62,028	98.2	84.8	85.7	86.3	84.3	6.4	8.0	0.8	93.2
Wyoming§§§§,¶¶¶¶	6,754	100.0	93.5	92.2	92.5	95.1	2.0	5.6	0.8	94.6

See table footnotes on the next page.

TABLE. (*Continued*) Estimated* coverage† with measles, mumps, and rubella; diphtheria, tetanus, and acellular pertussis; poliovirus; and varicella vaccines; grace period or provisional enrollment§; and any exemption¶, among kindergartners, by jurisdiction — United States,†† 2023–24 school year**

Jurisdiction	Kindergarten population§§	Percentage							PP change in any exemption from last year to this year	Potentially achievable coverage****
		Surveyed¶¶	2 MMR doses***	5 DTaP doses†††	4 Polio doses§§§	2 VAR doses¶¶¶	Grace period or provisional enrollment	Any exemption		
Territories and freely associated states										
American Samoa§§§§,¶¶¶¶,†††††	758	100.0	78.0	76.8	75.3	76.4	NR	0	NA	100.0
Federated States of Micronesia§§§§,¶¶¶¶,†††††,§§§§§	1,578	100.0	91.3	77.7	79.7	Nreq	NR	0	NA	100.0
Guam¶¶¶¶,¶¶¶¶¶	1,936	97.8	93.0	89.7	92.1	Nreq	NR	0.2	NA	99.8
Marshall Islands§§§§,¶¶¶¶,†††††	947	100.0	99.5	93.6	92.9	Nreq	NR	NR	NA	NA
Northern Mariana Islands§§§§,¶¶¶¶	665	100.0	97.3	94.7	95.8	95.5	NR	0.2	0.2	99.8
Palau§§§§,¶¶¶¶,§§§§§	187	100.0	100.0	100.0	100.0	Nreq	NR	0	0	100.0
Puerto Rico¶¶¶¶	20,967	8.8	94.3	98.4	98.4	94.3	NR	2.9	1.8	97.1
U.S. Virgin Islands¶¶¶¶,§§§§§	977	97.7	92.1	71.8	77.3	82.6	NR	4.8	NA	99.9

Abbreviations: DTP = diphtheria and tetanus toxoids and pertussis vaccine; DTaP = diphtheria, tetanus, and acellular pertussis vaccine; MMR = measles, mumps, and rubella vaccine; NA = not available; NP = no grace period or provisional policy; NR = not reported to CDC; Nreq = not required; NYC = New York City; polio = poliovirus vaccine; PP = percentage point; VAR = varicella vaccine.

* Estimates adjusted for nonresponse and weighted for sampling where appropriate.

† Estimates based on a completed vaccination series (i.e., not vaccine specific) use the "≥" symbol. In Maryland, undervaccinated children might have been counted more than once by some schools; therefore coverage estimates use the "≥" symbol. Coverage might include history of disease or laboratory evidence of immunity. In Kentucky, public schools reported numbers of children up to date with specific vaccines, and most private schools reported numbers of children who received all doses of all vaccines required for school entry.

§ 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 who were within a grace period, were provisionally enrolled, or were in a combination of these categories.

¶ Some jurisdictions 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. Estimates based on vaccine-specific exemptions use the "≥" symbol.

** Exemptions, grace period or 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, and children with exempt from one or more vaccines, and children with exemptions might be fully vaccinated with one or more required vaccine.

†† Includes five territories and three freely associated states.

§§ The kindergarten population is an approximation provided by each program.

¶¶ The number surveyed represents the number surveyed for coverage. Exemption estimates are based on 28,678 kindergartners for Kansas, 58,069 for South Carolina, and 92,606 for Virginia.

*** 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, NYC, North Carolina, and Virginia require 2 doses of measles and mumps vaccines and 1 dose of rubella vaccine. Iowa requires 2 doses of measles vaccine and 2 doses of rubella vaccine. Wyoming requires 1 dose of MMR.

††† Pertussis vaccination coverage might include some DTP doses if administered in another country. Most states require 5 doses of DTaP for school entry, or 4 doses if the fourth dose was received on or after age 4 years; Maryland 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 but reports ≥4 doses of DTaP. Wyoming requires 4 doses of DTaP.

§§§ Most states require 4 doses of polio for school entry, or 3 doses if the fourth dose was received on or after age 4 years; Maryland, Nebraska, and Wyoming require 3 doses. The reported coverage estimates represent the percentage of kindergartners with the state-required number of polio doses, except for Kentucky, which requires ≥4 but reports ≥3 doses of polio.

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

**** 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 documented vaccine exemption. The exemptions used to calculate the potential increase in MMR coverage for Alaska, Arizona, Arkansas, Colorado, District of Columbia, Idaho, Illinois, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, North Carolina, Oklahoma, Oregon, Rhode Island, Texas, Utah, Washington, Wisconsin, and Wyoming are the number of children with exemptions specifically for MMR. For all other jurisdictions, numbers are based on an exemption from any vaccine.

†††† National coverage, exemption estimates, and medians were calculated using data from 49 states and the District of Columbia (Montana, American Samoa, Guam, Marshall Islands, Federated States of Micronesia, Northern Mariana Islands, Palau, Puerto Rico, and the U.S. Virgin Islands were not included). Data from cities were included with their state data. National grace period or provisional enrollment estimates and median were calculated using data from the 31 states that have either a grace period or provisional enrollment policy and reported relevant data to CDC. Data reported from 3,560,047 kindergartners were assessed for coverage, 3,709,489 for exemptions, and 2,748,308 for grace period or provisional enrollment. Estimates represent rates for populations of coverage and exemptions (3,823,506) and grace period or provisional enrollment (2,839,159).

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

¶¶¶¶ Philosophical exemptions were not allowed.

***** Reported public school data only.

††††† 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.

¶¶¶¶¶ Did not include certain types of schools, such as kindergartens in child care facilities, online schools, correctional facilities, or those located on military bases or tribal lands.

****** Vaccination coverage data were collected from a sample of kindergartners; exemption data were collected from a census of kindergartners.

coverage with each of the vaccines decreased in most states compared with that during the 2022–23 school year (Supplementary Figure 1, https://stacks.cdc.gov/view/cdc/164303).

Vaccination Exemptions, Grace Period, and Provisional Enrollment

Nationwide, 3.3% of kindergartners had an exemption (0.2% medical and 3.1% nonmedical[§§§§]) from ≥1 required vaccine (i.e., not limited to MMR, DTaP, polio, and VAR) in 2023–24 (range = <0.1% [West Virginia] to 14.3% [Idaho]) (Supplementary Table, https://stacks.cdc.gov/view/cdc/164305), compared with 3.0% during the 2022–23 school year (*2*). Nonmedical exemptions account for >93% of reported exemptions, and for almost 100% of the increase in the national exemptions (*2*). Exemptions from ≥1 vaccine were higher than the national exemption estimate of 3.3% in 30 states, and exemptions exceeded 5% in 14 states (Figure 1). States with increases in exemptions were distributed across all U.S. Department of Health and Human Services regions (Supplementary Figure 2, https://stacks.cdc.gov/view/cdc/164304). Nationwide, 4.0% of kindergarten students were neither fully vaccinated with MMR nor exempt, and the potentially achievable coverage nationally was 96.8%. Compared with previous years, fewer jurisdictions can potentially achieve 95% MMR coverage because of increasing exemptions: during 2020–21, two jurisdictions could not potentially achieve ≥95% MMR coverage compared with 13 jurisdictions during 2023–24 (Figure 2). Provisional kindergarten enrollment or grace period attendance was 2.6% among 31 states reporting these data (range = 0.3% [Delaware] to 8.0% [Arkansas]) (Table).

Discussion

Nationwide, vaccination coverage among children in kindergarten decreased to <93% during the 2023–24 school year, remaining below the Healthy People 2030 MMR target of 95% (*3*) for the fourth consecutive year. As recently as the 2019–20 school year, coverage with each measured vaccine was 95% (*2*). Coverage with all four vaccines declined in 80% of jurisdictions. CDC's Let's RISE initiative (https://www.cdc.gov/vaccines/partners/routine-immunizations-lets-rise.html) supports jurisdictions with the largest declines in coverage with communication and programmatic efforts to improve coverage.

The percentage of U.S. kindergartners with an exemption from ≥1 vaccine increased to 3.3% (the highest percentage ever reported) (*2*), increased in 41 jurisdictions, and exceeded 5% in 14. The decreases in coverage, combined with increases in exemptions, jeopardize reaching the Healthy People 2030 95% coverage of kindergartners with MMR target. The number of jurisdictions with >5% of kindergartners exempt from any vaccine increased from two in 2020–21 to 14 in 2023–24. The number with >5% of kindergartners exempt specifically from MMR, making those jurisdictions unable to achieve ≥95% MMR coverage even if every nonexempt kindergartner were vaccinated, increased from two to 13. Approximately 280,000 (7.3%) kindergartners did not have documentation of 2 MMR doses and were potentially at risk for measles infection.

Limitations

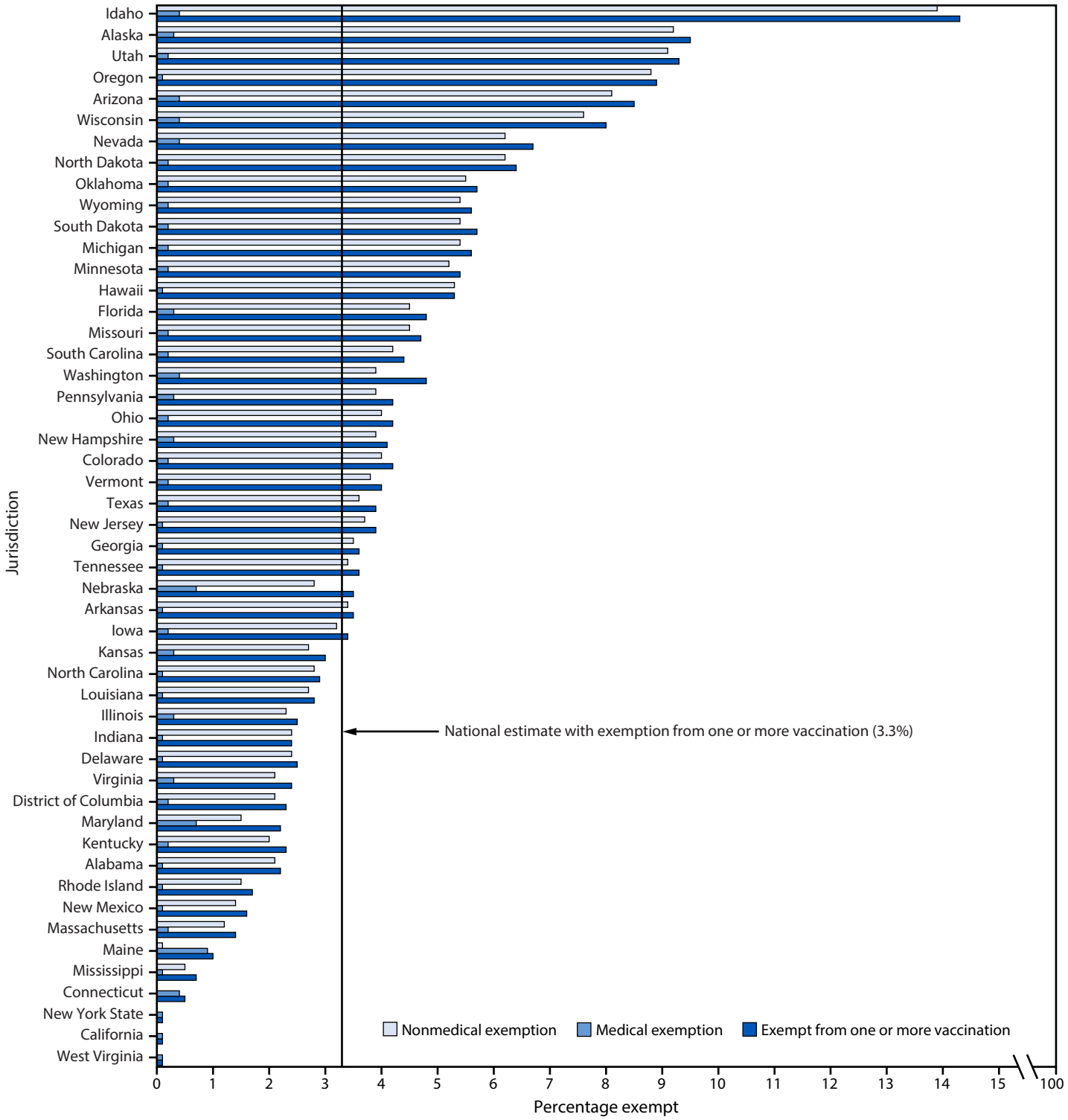
The findings in this report are subject to at least four limitations. First, conditions that include the vaccines and number of doses required, assessment date, acceptable documentation, data collection methods, allowable types of exemptions, and grace period and provisional enrollment policies vary, limiting comparisons among jurisdictions. Second, representativeness might be negatively affected by data collection methods that assess vaccination status at different times, or miss some schools or students (e.g., homeschooled students). Third, inaccurate, incomplete, or missing documentation could result in under- or overestimation of coverage, exemption rates, grace periods, or provisional enrollment. Finally, national coverage estimates for the 2023–24 school year include only 49 of 50 states and DC, 10 of which report lower bound estimates; exemption estimates include 49 states and DC, four of which report lower bound estimates.

Implications for Public Health Practice

Among kindergarten students, vaccination coverage continues to decline as exemptions increase, setting the stage for accumulation of clusters of undervaccinated children, which can lead to outbreaks (*4–6*). These shifts underscore the importance of immunization programs, schools, and providers in ensuring that children are fully vaccinated before school entry. The Vaccines for Children program (https://www.cdc.gov/vaccines-for-children/about/index.html) helps to maintain vaccination coverage among children who are uninsured, have public insurance, or are American Indian or Alaska Native. In previous years, nearly all states had the potential to achieve ≥95% coverage if all nonexempt students were vaccinated, but increases in the percentage of students with exemptions have reduced that number to 36 (72%) in 2023–24. In a 2024 survey of U.S. parents, 8.3% disagreed with the statement that school and child care "vaccination requirements for children are important and necessary," similar to the percentage of children not fully vaccinated; another 15.2% of parents had no opinion (*7*). These results could indicate changes in attitudes toward routine vaccination transferring from hesitancy about COVID-19 vaccination, or

§§§§ Washington was unable to deduplicate data for students with both religious and philosophical exemptions; therefore, the nonmedical exemption type with the highest number of kindergartners (the lower bound of the potential range of nonmedical exemptions) was included in the national and median exemption rates for nonmedical exemptions.

FIGURE 1. Estimated percentage*,† of kindergartners with medical or nonmedical exemptions from one or more vaccination, by jurisdiction§ — United States, 2023–24 school year

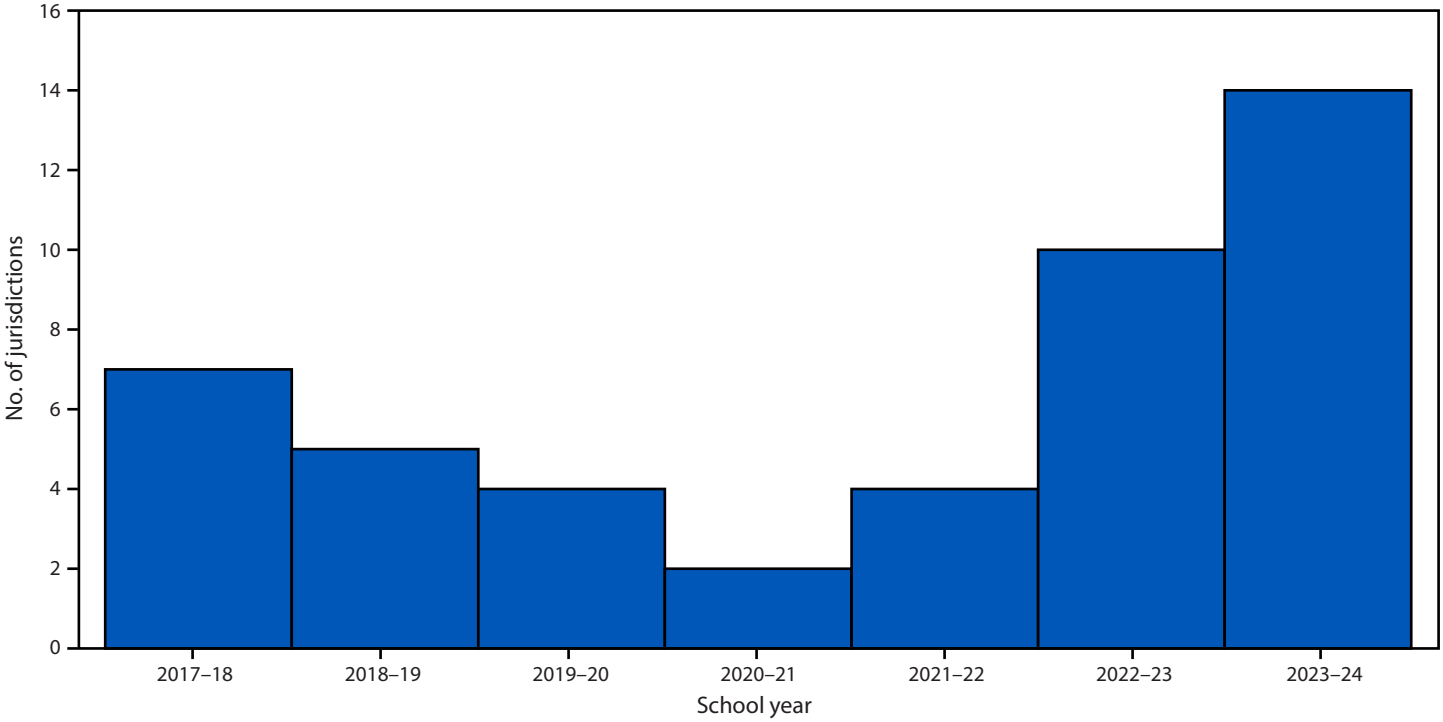


* Colorado, Illinois, Minnesota, and Missouri did not report the number of kindergartners with an exemption but instead reported the number of exemptions for each vaccine, which could have counted some children more than once. For these states, the percentage of kindergartners exempt from the vaccine with the highest number of exemptions by exemption type (the lower bound of the potential range of exemptions) was included in the national and median exemption rates.

† Washington was unable to deduplicate data for students with both religious and philosophical exemptions; therefore, the nonmedical exemption type with the highest number of kindergartners (the lower bound of the potential range of nonmedical exemptions) was included in the national and median exemption rates for nonmedical exemptions. The percentage of kindergartners exempt from one or more vaccination is greater than the sum of the number of students with a medical exemption and the lower bound estimate of the number with a nonmedical exemption.

§ Montana did not report data for the 2023–24 school year.

FIGURE 2. Number of jurisdictions that could not potentially achieve ≥95% coverage*,† with measles, mumps, and rubella vaccine among kindergartners — United States, 2017–18 to 2023–24 school years



Abbreviations: MMR = measles, mumps, and rubella vaccine; UTD = up to date.

* Potentially achievable coverage is estimated as the sum of the percentage of students with UTD MMR and the percentage of students without UTD MMR and without a documented vaccine exemption. Montana did not report kindergarten vaccination coverage for 2021–22 through 2023–24 school years and is excluded from this analysis.

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

Summary

What is already known about this topic?

From the 2019–20 to the 2022–23 school year, national kindergarten coverage with state-required vaccinations declined from 95% to approximately 93%.

What is added by this report?

During the 2023–24 school year, coverage declined to <93% for all reported vaccines (range = 92.3% [diphtheria, tetanus, and acellular pertussis vaccine] to 92.7% [measles, mumps, and rubella vaccine]). The exemption rate increased to 3.3% from 3.0% the year before and increased in 41 jurisdictions, exceeding 5% in 14.

What are the implications for public health practice?

Decreasing vaccination coverage and increasing exemptions increase the risk for vaccine-preventable disease outbreaks. Efforts by health departments, schools, and providers are needed to ensure that students begin school fully vaccinated.

toward any vaccine requirements arising from objections to COVID-19 vaccine mandates, as well as a potential for larger decreases in coverage or increases in exemptions.

States have applied various approaches to increase vaccination or decrease exemptions, including reducing the types of exemptions available (e.g., medical only), requiring that exemption forms be notarized (*8*), and assuring consistency of school practices with state laws (*9*). Approaches known to increase vaccination coverage include enforcement of school vaccination requirements, school-based vaccination clinics, reminder and recall systems, strong provider recommendations, and follow-up of undervaccinated students (*10*). Schools can also work with parents to avoid exemptions because of difficulty meeting vaccination requirements deadlines and share vaccination and exemption data as part of school vaccination assessments by state and local health departments, in accordance with state requirements and as allowed by federal law, to monitor annual vaccination and exemption rates. While following evidence-based practices to improve vaccination coverage, providers could educate parents specifically about the safety and effectiveness of vaccinations required for school entry, and the risks of delayed or incomplete vaccination or nonvaccination to children, family members, classmates, and the community.

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Isabel Ramos, Association of Schools and Programs of Public Health, Washington, DC; Immunization Services Division, National Center for Immunization and Respiratory Diseases, CDC.

Corresponding author: Ranee Seither, rseither@cdc.gov.

[1]Immunization Services Division, National Center for Immunization and Respiratory Diseases, CDC; [2]Certified Technical Experts, Inc., Montgomery, Alabama; [3]Association of Schools and Programs of Public Health, Washington, DC.

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Notes from the Field

Enhanced Surveillance for Raccoon Rabies Virus Variant and Vaccination of Wildlife for Management — Omaha, Nebraska, October 2023–July 2024

Sydney R. Stein, DVM[1,2]; Andrew J. Beron, PhD[1,3]; Kathleen M. Nelson[4]; Emma Price, VMD[1]; Sergio E. Rodriguez, PhD[3,5]; Victoria Shelus, PhD[1,3]; Ann Carpenter, DVM[1,3]; Amy R. Hess, MS[4]; Cassandra Boutelle, MPH[3]; Clint N. Morgan, MS[3]; Crystal M. Gigante, PhD[3]; Christina L. Hutson, PhD[3]; John D. Loy, DVM, PhD[6]; Duan S. Loy, DVM, PhD[6]; Chad Wetzel, MPH[7]; Justin Frederick, MPH[7]; Lindsay Huse, DNP[7]; Lillian Orciari, MS[3]; Richard B. Chipman, MS, MBA[4]; Ryan M. Wallace, DVM[3]; Matthew Donahue, MD[2,*]; Bryan F. Buss, DVM[2,8,*]

On September 28, 2023, a kitten aged approximately 6 weeks found in Omaha, Nebraska, had test results positive for rabies at the Nebraska Veterinary Diagnostic Center (NVDC) after dying with neurologic signs and having bitten and scratched its caretakers. Preliminary investigation identified 10 exposed persons for whom postexposure prophylaxis (PEP)[†] was recommended. Subsequent variant-typing by NVDC yielded a presumptive positive result for the Eastern raccoon rabies virus variant (RRVV), which CDC confirmed on October 6.

Rabies is a fatal, yet preventable, viral disease primarily transmitted through the bite of infected animals; after exposure, the incubation period can last from weeks to months. Globally, dogs are associated with 95% of the annual estimated 70,000 human deaths from rabies. However, in the United States, because of robust rabies control efforts that eliminated canine rabies virus variant and the widespread availability of PEP, fewer than 10 persons die from rabies each year. Rabies is enzootic in bats across the continental United States as well as in geographically distinct non-bat mammal reservoirs, including raccoons, skunks, and foxes (*1*). Initially found only in the southeastern United States, RRVV was introduced into mid-Atlantic states in 1977, after the translocation of wild raccoons from Florida (*2*), resulting in one of North America's most important documented wildlife epizootics[§] (*3*,*4*). As RRVV spread along the east coast, the number of human rabies exposures rose substantially, resulting in increased demand for PEP. Because this kitten of unknown origin was found approximately 850 miles (1,368 km) west of the known range of RRVV, and transmission to local wildlife in Nebraska could not be excluded, a coordinated multiagency response was initiated to determine if local transmission of RRVV was occurring and to implement a wildlife vaccination program.

Investigation and Outcomes

Beginning October 14, 2023, the Nebraska Department of Health and Human Services, Douglas County Health Department, CDC, and U.S. Department of Agriculture (USDA) initiated field activities. Steps included simultaneously attempting to identify the kitten's origin, identifying additional exposures to the kitten, implementing an enhanced rabies surveillance program, and mitigating further spread through wildlife vaccination. Investigators interviewed community members, examined social media platforms for reports of animals exhibiting behavior suggestive of neurologic disease,[¶] and disseminated public messaging through neighborhood flyers, social media accounts, and press conferences. Despite the expansive outreach, no further exposures or information regarding the origin of the kitten were identified.

Investigators established a field laboratory, with a focus on testing animals identified within a 6.2-mile (10-km) radius of the index RRVV case that were found dead or were exhibiting behavior suggestive of neurologic disease. A commercially available point-of-care test[**] was used to conduct rapid field testing for rabies. Brainstem specimens that yielded a presumptive positive test result and a subset of negative samples underwent confirmatory testing[††] at CDC. Among specimens tested from 515 animals through July 31, 2024, none were positive for rabies virus, including those from 350 (68.0%) raccoons, 46 (8.9%) skunks, 63 (12.2%) feral cats, and 56 (10.9%) animals of other species. This activity was reviewed by CDC,

[*] These senior authors contributed equally to this report.

[†] For persons who have never been vaccinated against rabies, PEP comprises a combination of human rabies immune globulin and a first rabies vaccine dose administered following a potential or confirmed rabies exposure; subsequent rabies vaccine doses are administered on days 3, 7, and 14. For immunocompromised persons, an additional vaccine dose is given on day 28. For persons previously vaccinated against rabies, PEP consists of rabies vaccination on days 0 and 3. https://www.cdc.gov/rabies/hcp/prevention-recommendations/post-exposure-prophylaxis.html

[§] In New York, an approximately 100-fold increase in annual rabies PEP administrations occurred within 5 years of RRVV detection. To aid in preventing the westward expansion of RRVV, Congress has appropriated approximately $500 million to USDA for implementation of wildlife rabies management strategies.

[¶] Behavior in wildlife suggestive of neurologic disease, which might be indicative of rabies virus infection, includes but is not limited to hypersalivation, paralysis, lethargy, abnormal aggression, abnormal vocalizations, and diurnal activity of nocturnal species.

[**] Antigen Rapid Rabies Ag Test Kit (BioNote).

[††] The BioNote lateral flow assay (LFA) was chosen as a screening test for this response because of its suitability for use in the field for rabies testing. Because LFA is not yet a recognized rabies diagnostic test in the United States, all samples with a presumptive positive result and ≥20% of randomly selected samples with negative test results underwent confirmatory testing by direct fluorescent antibody or LN34 pan-lyssavirus real-time polymerase chain reaction testing by CDC.

Summary

What is already known about this topic?

Movement of wildlife has facilitated the spread of non-bat rabies virus variants into new geographic areas of the United States, with major implications for human health.

What is added by this report?

A stray kitten died of raccoon rabies virus variant 850 miles west of this variant's known range. Rabies virus variant typing led to prompt surveillance and mitigation efforts, which prevented a potential rabies outbreak in the Midwestern United States.

What are the implications for public health practice?

Routine vaccination of domestic animals and rabies virus variant typing are crucial to preventing, identifying, and mitigating future translocation events.

deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§§]

During October 23–November 2, USDA initiated a trap-vaccinate-release campaign[¶¶] intended for raccoons and striped skunks across a 37-mi^2 (96-km^2) area, followed by a more intense placement of oral rabies vaccine (ORV) baits[***] across a 65-mi^2 (162-km^2) area of Omaha during November 1–4. In total, 757 raccoons, 42 skunks, four feral cats, and one red fox were vaccinated through the trap-vaccinate-release campaign, and 18,000 ORV vaccine baits were placed.

Preliminary Conclusions and Actions

This case represents the westernmost detection of RRVV in a stray or wild animal in the United States. In 2017, an RRVV-infected cat was detected in Ohio (*5*); however, that cat was owned and documented to come from an enzootic area and had no potential contact with wildlife or stray animals. Unlike the response to the 2017 detection, this response required robust rabies surveillance and implementation of a multifaceted wildlife vaccination campaign to address potential introduction of RRVV into local wildlife populations. No further detection of RRVV over a 10-month surveillance period, accompanied by concurrent intensive and focal wildlife vaccination efforts, suggests lack of establishment of RRVV in wildlife in Nebraska. Timely variant typing of the rabies virus infecting this kitten prompted a large-scale response to prevent RRVV establishment in Nebraska wildlife. Maintaining high levels of rabies vaccination for domestic animals and increasing variant typing for rabies virus–positive specimens, particularly those from domestic animals and non-reservoir wildlife species, are crucial to preventing, identifying, and mitigating future translocation events.

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

[¶¶] Healthy animals within an approximately 3-mi (5-km) radius of the index case received a 1-mL intramuscular dose of IMRAB 3 inactivated rabies vaccine (Boehringer Ingelheim Animal Health USA Inc.).

[***] RABORAL V-RG (Boehringer Ingelheim Animal Health USA Inc.) baits were distributed within an approximately 6-mi (10-km) radius of the index case location, stopping at the eastern border with Iowa and the Missouri River.

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Corresponding author: Sydney R. Stein, ohw9@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]Nebraska Department of Health and Human Services; [3]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [4]Wildlife Services, Animal and Plant Health Inspection Service, U.S. Department of Agriculture; [5]Laboratory Leadership Service, CDC; [6]University of Nebraska-Lincoln, Veterinary Diagnostic Center, Lincoln, Nebraska; [7]Douglas County Health Department, Omaha, Nebraska; [8]Career Epidemiology Field Officer Program, CDC.

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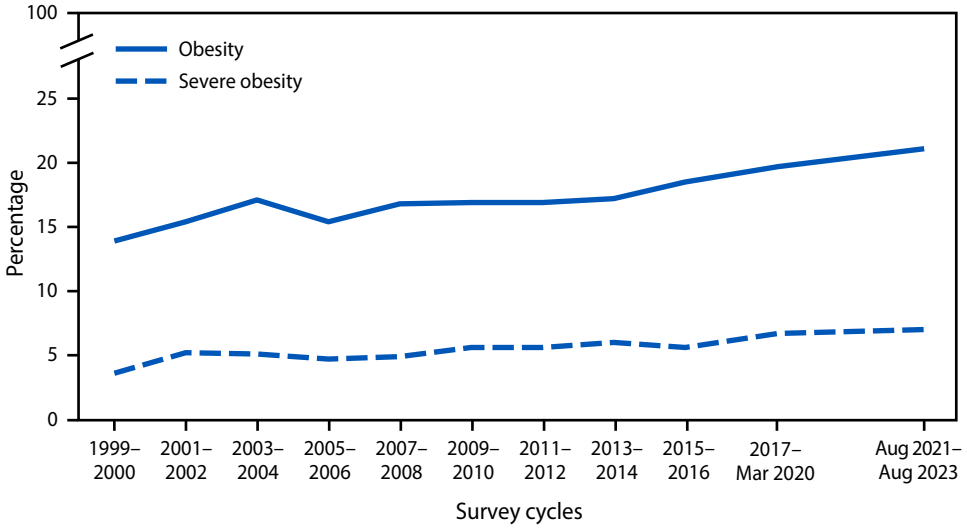
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Prevalence of Obesity* and Severe Obesity† Among Persons Aged 2–19 Years — United States, 1999–2000 Through 2021–2023§



Abbreviation: BMI = body mass index.

* Obesity was defined as BMI ≥95th percentile for age and sex on CDC growth charts (https://www.cdc.gov/growthcharts/cdc_charts.htm). BMI is calculated as weight in kilograms divided by height in meters squared.

† Severe obesity was defined as BMI ≥120% of the 95th percentile for age and sex on CDC growth charts.

§ After National Health and Nutrition Examination Survey operations were suspended in March 2020 because of the COVID-19 pandemic, field operations resumed from August 2021 until August 2023.

From 1999–2000 through August 2021–August 2023, the prevalence of obesity among persons in the United States aged 2–19 years increased from 13.9% to 21.1%, and the prevalence of severe obesity increased from 3.6% to 7.0%.

Supplementary Table: https://stacks.cdc.gov/view/cdc/164014

Source: National Center for Health Statistics, National Health and Nutrition Examination Survey, 1999–2000 through August 2021–August 2023. https://www.cdc.gov/nchs/nhanes/index.htm

Reported by: Samuel D. Emmerich, DVM, semmerich@cdc.gov; Cynthia L. Ogden, PhD.

For more information on this topic, CDC recommends the following link: https://www.cdc.gov/obesity/family-action/index.html.

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