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Progress Toward Regional Measles Elimination — Worldwide, 2000–2018

Minal K. Patel, MD[1]; Laure Dumolard, PhD[1]; Yoann Nedelec, MPH[1]; Samir V. Sodha, MD[1]; Claudia Steulet[1]; Marta Gacic-Dobo, MSc[1]; Katrina Kretsinger, MD[1]; Jeffrey McFarland, MD[2]; Paul A. Rota, PhD[3]; James L. Goodson, MPH[2]

In 2010, the World Health Assembly (WHA) set the following three milestones for measles control to be achieved by 2015: 1) increase routine coverage with the first dose of measles-containing vaccine (MCV1) among children aged 1 year to ≥90% at the national level and to ≥80% in every district, 2) reduce global annual measles incidence to less than five cases per 1 million population, and 3) reduce global measles mortality by 95% from the 2000 estimate* (*1*). In 2012, WHA endorsed the Global Vaccine Action Plan,† with the objective of eliminating measles§ in five of the six World Health Organization (WHO) regions by 2020. This report updates a previous report (*2*) and describes progress toward WHA milestones and regional measles elimination during 2000–2018. During 2000–2018, estimated MCV1 coverage increased globally from 72% to 86%; annual reported measles incidence decreased 66%, from 145 to 49 cases per 1 million population; and annual estimated measles deaths decreased 73%, from 535,600 to 142,300. During 2000–2018, measles vaccination averted an estimated 23.2 million deaths. However, the number of measles cases in 2018 increased 167% globally compared with 2016, and estimated global measles mortality has increased since 2017. To continue progress toward the regional measles elimination targets, resource commitments are needed to strengthen routine immunization systems, close historical immunity gaps, and improve surveillance. To achieve measles elimination, all communities and countries need coordinated efforts aiming to reach ≥95% coverage with 2 doses of measles vaccine (*3*).

Immunization Activities

WHO and the United Nations Children's Fund (UNICEF) use data from administrative records and vaccination coverage surveys reported annually to estimate MCV1 and second dose (MCV2) coverage through routine immunization services.¶ During 2000–2018, estimated MCV1 coverage increased globally from 72% to 86% (Table), although coverage has remained at 84%–86% since 2010, with considerable regional variation. Since 2016, MCV1 coverage has remained relatively constant in the African Region (AFR) (74%–75%), the Eastern Mediterranean Region (EMR) (82%–83%), and the South-East Asia Region (SEAR) (88%–89%); and it

* The coverage milestone is to be met by every country, whereas the incidence and mortality reduction milestones are to be met globally.

† The Global Vaccine Action Plan is the implementation plan of the Decade of Vaccines, a collaboration between WHO; UNICEF; the Bill and Melinda Gates Foundation; the National Institute of Allergy and Infectious Diseases; the African Leaders Malaria Alliance; Gavi, the Vaccine Alliance; and others to extend the full benefit of immunization to all persons by 2020 and beyond. In addition to 2015 targets, it also set a target for measles and rubella elimination in five of the six WHO regions by 2020. https://www.who.int/immunization/global_vaccine_action_plan/en; https://apps.who.int/gb/ebwha/pdf_files/wha65/a65_22-en.pdf.

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

¶ For MCV1, among children aged 1 year or, if MCV1 is given at age ≥1 year, among children aged 24 months. For MCV2, among children at the recommended age for administration of MCV2, per the national immunization schedule. WHO/UNICEF estimates of national immunization coverage are available at https://www.who.int/immunization/monitoring_surveillance/data/en.

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has remained constant since 2008 in the European Region (EUR) (93%–95%) and in the Western Pacific Region (WPR) (95%–97%). Estimated MCV1 coverage in the Region of the Americas (AMR) decreased from 92% in 2016 to 88% in 2017 and increased to 90% in 2018.

Globally, 118 (61%) countries achieved ≥90% MCV1 coverage in 2018, an increase from 86 (45%) countries in 2000, but a decrease from 126 (65%) countries during 2012–2013. In 2018, MCV1 coverage was ≥95% nationally in 78 (40%) countries and ≥80% in all districts in 57 (29%) countries.** In 2018, 19.2 million infants worldwide did not receive MCV1 through routine immunization services. The six countries with the most unvaccinated infants were Nigeria (2.4 million), India (2.3 million), Pakistan (1.4 million), Ethiopia (1.3 million), Indonesia (1.2 million), and the Philippines (0.7 million).

Estimated MCV2 coverage increased globally from 18% in 2000 to 69% in 2018, largely because of an increase in the number of countries providing MCV2 from 98 (51%) in 2000 to 171 (88%) in 2018 (Table). Four countries (Bolivia, the Dominican Republic, Honduras, and the Solomon Islands) introduced MCV2 in 2018.

** In 2000, 191 countries were requested to report to WHO; by 2018, 194 member states were requested to report because of the creation of new countries. For district level coverage, only countries that reported data are in the numerator, whereas the denominator is all WHO countries in that year (191–194) regardless of whether they reported data.

In 2018, approximately 346 million persons received measles vaccination during 45 supplementary immunization activities (SIAs)†† in 37 countries; India's 2018 SIA accounted for 47% of all persons vaccinated in SIAs worldwide. An additional 13 million persons were vaccinated during measles outbreak response activities.

Reported Measles Incidence

In 2018, all 194 WHO member countries conducted measles surveillance, and 191 (98%) had access to standardized quality-controlled laboratory testing through the WHO Global Measles and Rubella Laboratory Network. However, surveillance remains weak in many countries, and only 84 (55%) of 152 countries that reported surveillance indicators achieved the sensitivity indicator target of ≥2 discarded measles and rubella§§ cases per 100,000 population.

†† Supplementary immunization activities (SIAs) generally are carried out using two target age ranges. An initial, nationwide catch-up SIA focuses on all children aged 9 months–14 years, with the goal of eliminating susceptibility to measles in the general population. Periodic follow-up SIAs then focus on all children born since the last SIA. Follow-up SIAs generally are conducted nationwide every 2–4 years and focus on children aged 9–59 months; their goal is to eliminate any measles susceptibility that has developed in recent birth cohorts due to low MCV coverage and to protect children who did not respond to MCV1. Data on SIAs by country are available at https://www.who.int/immunization/monitoring_surveillance/data/Summary_Measles_SIAs.xls?ua.

§§ A discarded case is defined as a suspected case that has been investigated and determined not to be measles or rubella using 1) laboratory testing in a proficient laboratory or 2) epidemiological linkage to a laboratory-confirmed outbreak of a communicable disease that is not measles or rubella. The discarded case rate is used to measure the sensitivity of measles surveillance.

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TABLE. Estimates of coverage with the first and second doses of measles-containing vaccine administered through routine immunization services, reported measles cases and incidence, and estimated measles cases and deaths,* by World Health Organization (WHO) region — worldwide, 2000 and 2018

WHO region/ Year (no. of countries in region)	% MCV1† coverage	% countries with ≥90% MCV1 coverage	% MCV2† coverage	% of reporting countries with <5 measles cases per 1 million	No. of reported measles cases§	Measles incidence per 1 million§,¶	Estimated no. of measles cases (95% CI)	Estimated no. of measles deaths (95% CI)	Estimated % measles mortality reduction, 2000–2018	Cumulative no. of measles deaths averted by vaccination, 2000–2018
African										
2000 (46)	53	9	5	8	520,102	836	10,723,800 (7,718,000–17,119,100)	345,600 (236,300–562,100)	85	12,146,900
2018 (47)	74	30	26	47	125,426	118	1,759,000 (1,141,200–6,002,100)	52,600 (32,000–173,400)		
Americas										
2000 (35)	93	63	65	89	1,754	2	8,770 (4,400–35,100)	NA**	NA	97,100
2018 (35)	90	57	82	91	16,327	24	83,500 (41,800–334,200)	NA		
Eastern Mediterranean										
2000 (21)	71	57	28	17	38,592	90	2,427,900 (1,503,800–3,892,900)	37,900 (21,700–64,000)	–29	2,820,600
2018 (21)	82	57	74	35	64,722	93	2,852,700 (2,293,700–4,265,200)	49,000 (36,700–72,500)		
European										
2000 (52)	91	62	48	45	37,421	50	860,176 (227,200–6,668,300)	400 (100–2,200)	50	95,600
2018 (53)	95	89	91	34	82,523	98	861,800 (71,100–6,480,300)	200 (0–1,800)		
South-East Asia										
2000 (10)	63	30	3	0	78,558	51	11,411,900 (8,764,600–15,572,100)	141,700 (100,100–199,600)	72	6,825,400
2018 (11)	89	82	80	36	34,741	18	3,803,800 (2,856,700–6,702,900)	39,100 (24,800–76,000)		
Western Pacific										
2000 (27)	85	48	2	30	177,052	105	2,786,500 (1,923,900–22,167,600)	10,000 (5,200–74,200)	87	1,213,200
2018 (27)	95	59	91	77	29,497	15	408,400 (42,500–16,753,800)	1,300 (100–2,786,500)		
Total										
2000 (191)	**72**	**45**	**18**	**38**	**853,479**	**145**	**28,219,100 (20,141,900–65,455,000)**	**535,600 (363,400–901,700)**	**73**	**23,198,800**
2018 (194)	**86**	**61**	**69**	**54**	**353,236**	**49**	**9,769,400 (6,446,900–40,538,500)**	**142,300 (93,600–387,900)**		

Abbreviations: CI = confidence interval; MCV1 = first dose of measles-containing vaccine; MCV2 = second dose of measles-containing vaccine; NA = not applicable; UNICEF = United Nations Children's Fund.

* Mortality estimates for 2000 might be different from previous reports. When the model used to generate estimated measles deaths is rerun each year using new WHO/UINICEF estimates of national immunization coverage (WUENIC) data, as well as updated surveillance data, adjusted results for each year, including the baseline year, are also produced and updated.

† Coverage data: WUENIC. Geneva, Switzerland, World Health Organization; 2019. https://www.who.int/immunization/monitoring_surveillance/data/en.

§ Reported measles cases (2018) from World Health Organization. Geneva, Switzerland, World Health Organization; 2019. https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html.

¶ Cases per 1 million population; population data from United Nations, Department of Economic and Social Affairs, Population Division, 2019. Any country not reporting data on measles cases for that year was removed from both the numerator and denominator.

** Estimated measles mortality was too low to allow reliable measurement of mortality reduction.

Countries report the number of incident measles cases¶¶ to WHO and UNICEF annually using the Joint Reporting Form.*** During 2000–2018, the number of reported cases decreased 59%, from 853,479 in 2000 to 353,236 in 2018, and measles incidence decreased 66%, from 145 to 49 cases per million population (Table). However, compared with the reported number of cases (132,413) and incidence (19 cases per million) in 2016, both cases and incidence increased in 2018, the highest levels since 2011 (Figure 1). Compared with 2016, the number of measles cases increased 167% globally, including increases of 246% in AFR, 16,732% in AMR, 931% in EMR,

¶¶ https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html; data reported here as of July 15, 2019. Only countries that reported data are in the numerator, whereas the denominator is all WHO countries in that year (191–194) regardless of whether they reported data.

*** https://www.who.int/immunization/monitoring_surveillance/routine/reporting/en/.

1,791% in EUR, and 26% in SEAR.††† In WPR, the number of measles cases decreased 49%, primarily because of decreased cases in China. In 2018, five (3%) of 179 reporting countries (Democratic Republic of the Congo, Liberia, Madagascar, Somalia, and Ukraine) had measles incidences >600 per million and accounted for 45% (157,239 cases) of all reported cases worldwide. The percentage of reporting countries with annual measles incidence of <5 cases per million population increased from 38% (64 of 169) in 2000 to 70% (125 of 178) in 2016, then decreased to 54% (96 of 179) in 2018 (Table) (Figure 1).

Genotypes of viruses isolated from measles cases were reported by 95 (73%) of 131 countries reporting at least one measles case in 2018. Among the 24 recognized measles virus genotypes, 11 were detected during 2005–2008, eight during 2009–2014, six in 2016, five in 2017, and four in 2018 (*4*). In 2018, among 7,155 reported virus sequences, 3,011 (42%) were genotype B3; 20 (0.3%) were D4; 3,774 (53%) were D8; and 350 (5%) were H1.

Measles Case and Mortality Estimates

A previously described model for estimating measles cases and deaths was updated with new measles vaccination coverage data, case data, and United Nations population estimates for all countries during 2000–2018, enabling derivation of a new series of disease and mortality estimates (*5*). For countries with anomalous estimates in previous iterations, the model was modified slightly to generate mortality estimates consistent with observed case data. Based on the updated data, the estimated number of measles cases decreased 65%, from 28,219,100 (95% confidence interval [CI] = 20,141,900–65,455,000) in 2000 to 9,769,400 (95% CI = 6,446,900–40,538,500) in 2018. During this period, estimated measles deaths decreased 73%, from 535,600 (95% CI = 363,400–901,700) to 142,300 (95% CI = 93,600–387,900) (Table) (Figure 2). During 2000–2018, compared with no measles vaccination, measles vaccination prevented an estimated 23.2 million deaths globally.

Regional Verification of Measles Elimination

By the end of 2018, 82 (42%) countries had been verified as having eliminated measles. Austria, Bahrain, North Korea, Oman, Singapore, Switzerland, and Timor-Leste were verified as having achieved elimination during 2018. No AFR country had yet been verified as having eliminated measles. In the AMR, a region that had achieved verification of measles elimination in 2016, endemic measles transmission was reestablished in Venezuela in 2018 and in Brazil in 2019. In EUR, endemic measles transmission was reestablished during 2018 in Albania, Czechia, Greece, and the United Kingdom.

Discussion

During 2000–2018, increased coverage with MCV1 and MCV2, widespread SIAs, and other elimination efforts contributed to a 66% decrease in reported measles incidence, a 73% reduction in estimated measles mortality, and a reduction in the number of circulating measles virus genotypes worldwide. Despite this progress, the 2015 global milestones were not met: MCV1 coverage has stagnated for nearly a decade, MCV2 coverage is only 69%, and suboptimal surveillance limits data-driven actions. Reported measles incidence has increased in five regions since 2016 and estimated global measles mortality has increased since 2017. Increased measles cases and outbreaks occurred mostly among unvaccinated persons, including school-aged children and young adults.

The causes of the measles resurgence during 2017–2018 are multifactorial and vary by country. Large sustained outbreaks in a few countries with weak immunization systems accounted for most reported measles cases during this time. In addition, unidentified or unaddressed immunity gaps in older children and adults, because of historically weak routine immunization programs and inadequate SIA coverage, led to sustained transmission in some countries that previously had low incidence or had eliminated measles (*6*). As well, international travel by infected persons, including both unimmunized foreign visitors and unimmunized residents traveling abroad and returning home, facilitated international spread of measles. For example, in 2018, Israel experienced nearly 100 measles importations from multiple countries including Philippines, Ukraine, and the United Kingdom; and importations from Israel and Ukraine led to outbreaks in the United States (*7*). Sustaining elimination in the face of frequent importations and gaps in vaccination coverage presents challenges. For example, after having experienced >100 importations in 2018 as a consequence of inadequate vaccination coverage, endemic measles virus transmission has been reestablished in the United Kingdom. Countries such as Cambodia, which, through sustained efforts, identified and closed immunity gaps to achieve elimination, but which border countries with ongoing endemic transmission, must remain vigilant to identify and stop measles outbreaks rapidly. Before international travel, travelers from all countries should ensure they have

††† Twenty-five countries did not report case data in 2000: Algeria, Austria, Belgium, Comoros, Equatorial Guinea, Fiji, Finland, Germany, Guinea-Bissau, Ireland, Libya, Mauritania, Monaco, Montenegro, North Korea, Samoa, Saudi Arabia, Seychelles, Slovenia. Solomon Islands, South Sudan. Switzerland, Timor-Leste, Tuvalu, and Yemen. Sixteen countries did not report case data in 2016: Belgium, Cabo Verde, Cook Islands, Haiti, Ireland, Italy, Kiribati, Marshall Islands, Monaco, Morocco, Mozambique, Niue, Samoa, Singapore, Tuvalu, and Vanuatu. Fifteen countries did not report case data in 2018: Belarus, France, Israel, Kuwait, Luxembourg, Marshall Islands, Mauritius, Montenegro, Nauru, Niue, North Macedonia, Palau, Seychelles, Tuvalu, and United States. Countries do not provide WHO with their reasons for not reporting case data.

FIGURE 1. Reported measles incidence per 1 million persons — worldwide, 2000, 2016, and 2018

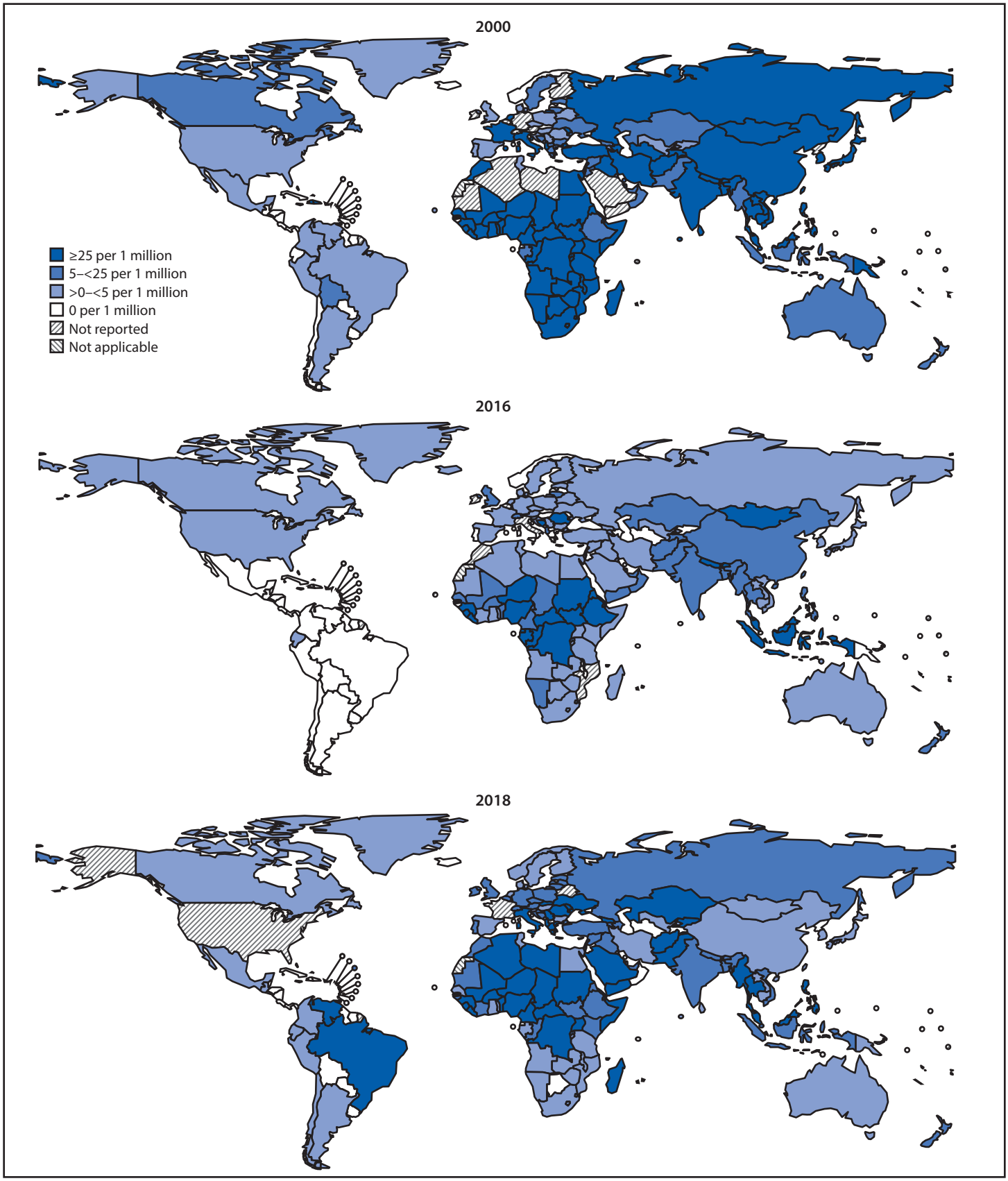
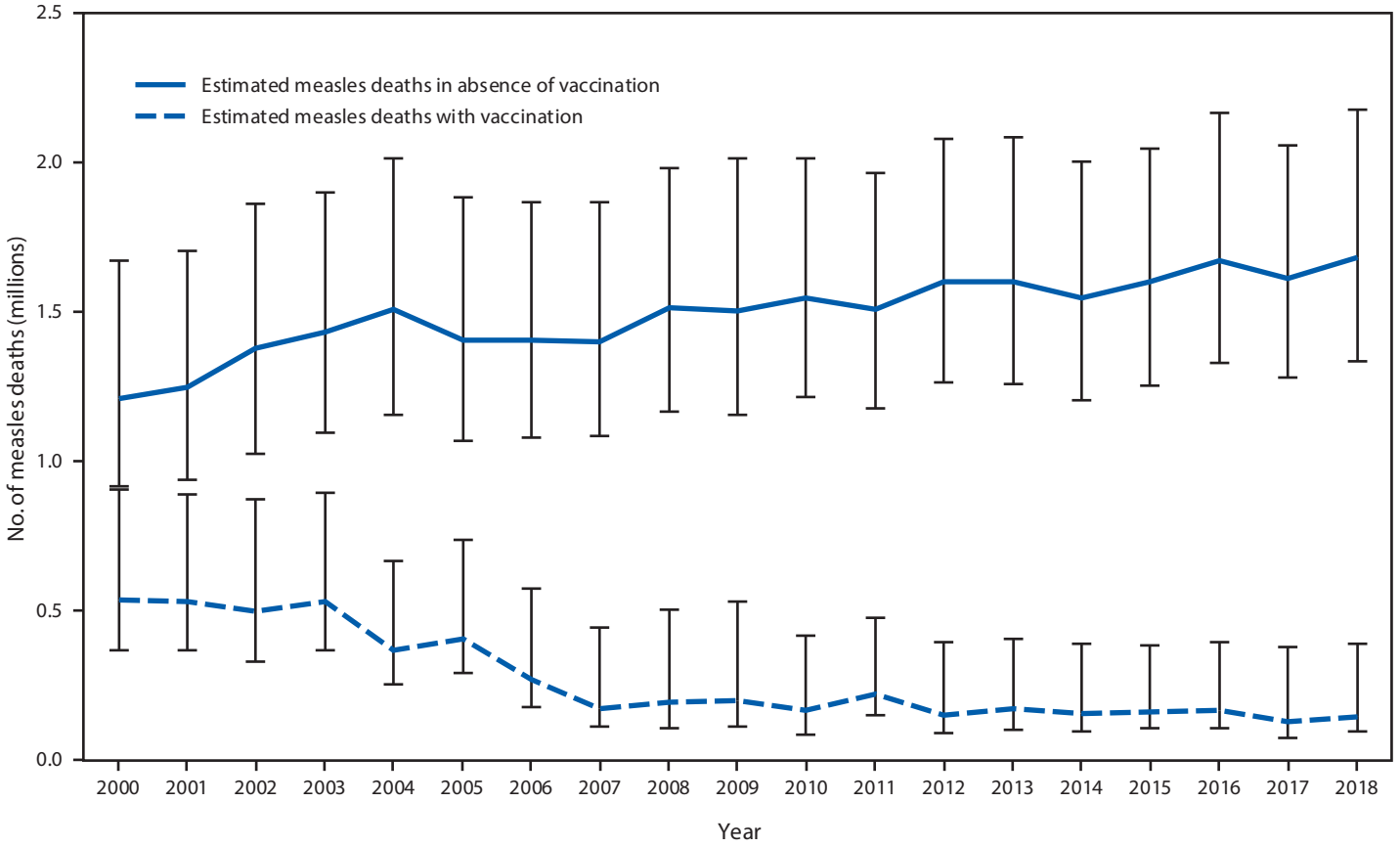


FIGURE 2. Estimated annual number of measles deaths, with and without vaccination programs — worldwide, 2000–2018*



* Deaths prevented by vaccination are estimated by the area between estimated deaths with vaccination and those without vaccination (cumulative total of 23.2 million deaths prevented during 2000–2018). Error bars represent upper and lower 95% confidence limits around the point estimate.

been appropriately vaccinated against measles. Progress toward measles elimination will regress without a unified effort by all communities and countries.

Evaluations of routine immunization programs to identify barriers to vaccination indicate that children miss MCV1 and MCV2 doses for many reasons, including families' limited awareness of the need for vaccination, limited access to or financial barriers to receiving vaccination; vaccine stock-outs; political instability; and vaccine hesitancy and misinformation. WHO's Global Routine Immunization Strategies and Practices and The Guide to Tailoring Immunization Programmes provides guidance on identifying demand and supply barriers to routine vaccination and strengthening immunization programs (*8*,*9*). Outbreaks should serve as opportunities to investigate underlying causes of undervaccination and to design specific routine immunization strengthening activities to prevent future outbreaks. In addition, population immunity gaps should be identified through triangulation of data, including surveillance and vaccination coverage data, and should be targeted by vaccination activities.

The findings in this report are subject to at least two limitations. First, large differences between estimated and reported incidence indicate overall low surveillance sensitivity, making comparisons between regions difficult to interpret. Second, the measles mortality model estimates might be affected by biases in model inputs, including vaccination coverage and surveillance data.

The trends of increasing measles incidence and mortality are reversible; however, further progress toward achieving elimination goals will require 1) resource commitments to strengthen routine immunization systems, close historical immunity gaps, and improve surveillance to rapidly detect and respond to cases, and 2) a new perspective to use measles as a stimulus and guide to improving immunization programs. To achieve measles elimination, all communities and countries need coordinated efforts aiming to reach ≥95% coverage with 2 doses of measles vaccine.

As the period covered by the Global Vaccine Action Plan 2012–2020 approaches its end, a new vision and strategy for accelerated progress on immunization for 2021–2030 is being

Summary

What is already known about this topic?

In 2012, the World Health Assembly endorsed the Global Vaccine Action Plan; countries in all six World Health Organization regions have adopted goals to eliminate measles by 2020.

What is added by this report?

During 2000–2018, annual reported measles incidence decreased 66%, and annual estimated measles deaths decreased 73%. Since 2000, measles vaccination has prevented an estimated 23.2 million deaths globally. However, measles incidence increased in five regions during 2016–2018.

What are the implications for public health practice?

To achieve regional measles elimination goals, resource commitments are needed to strengthen routine immunization systems, close immunity gaps, and improve case-based surveillance.

developed by countries and stakeholders (*10*). Pillars of this evolving strategy include commitment and demand, research and innovation, life course and integration, and supply and sustainability; all of these are vital to achieving and maintaining measles elimination. This new agenda should be used to secure the necessary resource commitments to improve coverage and equity substantially and, in so doing, further progress toward achieving the measles elimination goals.

Corresponding author: Minal K. Patel, patelm@who.int.

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

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Progress Toward Measles Elimination — China, January 2013–June 2019

Chao Ma, PhD[1]; Lance Rodewald, MD[1]; Lixin Hao, PhD[1]; Qiru Su, PhD[1]; Yan Zhang, PhD[2]; Ning Wen, MPH[1]; Chunxiang Fan, MPH[1]; Hong Yang, MPH[1]; Huiming Luo, MPH[1]; Huaqing Wang, PhD[1]; James L. Goodson, MPH[3]; Zundong Yin, PhD[1]; Zijian Feng, MPH[1]

In 2005, the World Health Organization (WHO) Western Pacific Region countries, including China, resolved to eliminate measles by 2012 or as soon as feasible thereafter (*1*). As of 2018, nine* of the 37 Western Pacific Region countries or areas† had eliminated§ measles. China's Measles Elimination Action Plan 2006–2012 included strengthening routine immunization; conducting measles risk assessments, followed by supplementary immunization activities (SIAs) with measles-containing vaccine (MCV) at national and subnational levels; strengthening surveillance and laboratory capacity; and investigating and responding to measles outbreaks. Most recently, progress toward measles elimination in China was described in a 2014 report documenting measles elimination efforts in China during 2008–2012 and a resurgence in 2013 (*2*). This report describes progress toward measles elimination in China during January 2013–June 2019.¶ Measles incidence per million persons decreased from 20.4 in 2013 to 2.8 in 2018; reported measles-related deaths decreased from 32 in 2015 to one in 2018 and no deaths in 2019 through June. Measles elimination in China can be achieved through strengthening the immunization program's existing strategy by ensuring sufficient vaccine supply; continuing to improve laboratory-supported surveillance, outbreak investigation and response; strengthening school entry vaccination record checks; vaccinating students who do not have documentation of receipt of 2 doses of measles-rubella vaccine; and vaccinating health care professionals and other adults at risk for measles.

Immunization Activities

China introduced measles vaccine in 1965 and implemented nationwide measles vaccination in 1978 with the start of the national Expanded Program on Immunization (EPI). In 1986, the schedule was changed to include 2 MCV doses, with the first dose given at age 8 months and the second at age 7 years (the age of administration of the second dose was lowered to 18 months in 2005, as recommended in WHO guidelines).** Administrative coverage, calculated as the number of vaccine doses administered divided by estimated target population, is assessed monthly at the township level (the lowest administrative level), aggregated to the national level using vaccine administration and target population data reported by EPI clinics, and reported annually to WHO and the United Nations Children's Fund (UNICEF). During 2013–2018, annual estimates of coverage with the first MCV dose (MCV1) and the second dose (MCV2) were both 99%. In 2016, among the 40,787 townships in China's 31 mainland provinces, 40,089 (98%) reported >90% MCV2 coverage by age 3 years. In 2010, a nationwide SIA was conducted, during which 103 million children received MCV regardless of previous vaccination history. Each province then used a measles risk assessment tool developed by the Chinese Center for Disease Control and Prevention (China CDC) to determine the need for additional selective or nonselective follow-up SIAs in their jurisdiction. During 2013–2018, 56.9 million children and adults were vaccinated in these follow-up SIAs. During this time, the risk assessment–based SIA target population sizes decreased approximately sixfold, from 23 million in 2013 to 3 million in 2018. To ensure that school children are protected from vaccine-preventable diseases, China has had a national requirement since 2005 that vaccination status is checked upon entry to kindergarten and primary school; children with missing vaccine doses are referred to EPI clinics for catch-up vaccination. Although the school entry record check is required, receiving missing vaccine doses is not mandatory, and unvaccinated children are not excluded from school.

Measles Surveillance Activities

Measles has been nationally notifiable since the 1950s, with aggregated data reported annually to the National Notifiable Disease Reporting System (NNDRS). In 1997, China developed a case-based, laboratory-supported measles surveillance system, initially in selected provinces and in parallel with NNDRS. The two surveillance systems were unified in 2009.

* Australia, Brunei, Cambodia, Hong Kong (China), Macao (China), Japan, New Zealand, South Korea, and Singapore.

† The Western Pacific Region, one of the six regions of WHO, consists of 37 countries and areas with a population of almost 1.9 billion, including American Samoa (USA), Australia, Brunei, Cambodia, China, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia (France), Guam (USA), Hong Kong (China), Japan, Kiribati, Laos, Macao (China), Malaysia, Marshall Islands, Mongolia, Nauru, New Caledonia (France), New Zealand, Niue, Northern Mariana Islands (USA), Palau, Papua New Guinea, Philippines, Pitcairn Islands (UK), Samoa, Singapore, Solomon Islands, South Korea, Tokelau (New Zealand), Tonga, Tuvalu, Vanuatu, Vietnam, and Wallis and Futuna (France).

§ Measles elimination is defined as the absence of endemic measles virus transmission in a defined geographical area (e.g., region or country) for ≥12 months with a well-performing surveillance system.

¶ Population of 1.4 billion, not including Hong Kong Special Administrative Region, Macao Special Administrative Region, and Taiwan.

** https://www.who.int/immunization/documents/positionpapers/en/.

Every suspected case is investigated by county-level China CDC staff members using a standardized, in-person questionnaire; outbreaks are investigated and reported by local China CDC staff members as needed. China's Measles Laboratory Network comprises 31 provincial laboratories and one national laboratory that has been accredited by WHO as a Regional Reference Laboratory since 2003[††] (*3*). Rubella case-based surveillance was integrated into the measles surveillance system in 2014. Since 2011, measles surveillance in China has met or exceeded WHO surveillance quality criteria (*4*).

Measles Incidence and Epidemiologic Characteristics

From 2013 to 2014, measles incidence per million persons increased from 20.4 to 38.8; incidence subsequently declined each year, reaching 2.8 in 2018 (Table). Among confirmed cases reported during 2013–2018, the case count among infants aged <8 months (younger than the routinely recommended age for MCV1) decreased from 8,448 (31%) in 2013 to 532 (14%) in 2018 (Figure). Among the 1,839 measles cases reported in the first half of 2019, 109 (5.9%) were among infants aged <8 months, 965 (52.5%) were among children aged 8 months–14 years, and 765 (41.6%) were among persons aged ≥15 years. During 2013–2018, the number, size, and duration of measles outbreaks decreased steadily. Until 2019, almost all (98.9%) cases that had a measles virus genotype result were found to be the indigenous genotype H1. However, in the first half of 2019, this pattern changed: 82% of genotyped measles viruses were found to be import-associated genotypes B3 or D8 (Table) (*5*).

Discussion

Progress toward measles elimination in China has been considerable. Measles cases, incidence, and outbreaks were all at historically low levels in 2017 and 2018 and have decreased further through June 2019. Measles deaths are now rare in this country of 1.4 billion persons, with just one measles-associated death reported in the last 18 months.

Laboratory-supported surveillance is critical for guiding measles elimination activities and strengthening routine immunization. Outbreak investigations have identified gaps in population immunity that are addressed with follow-up immunization activities and program strengthening. The risk assessment–based SIA target population sizes markedly decreased during 2013–2018, providing indirect evidence of strengthened routine immunization service delivery.

Consultations with international partners, including CDC, WHO, UNICEF, the World Bank, the Japan International Cooperation Agency, and the Measles & Rubella Initiative[§§] have helped guide activities. Research and evaluation have also provided valuable information for measles elimination. MCVs used in China were found to be highly immunogenic in infants aged 8 months, and coadministration of Japanese encephalitis vaccine did not reduce measles seroconversion rates (*6*). In a Chinese study of risk factors for measles in children aged 8 months–14 years after a nationwide SIA, the estimated measles vaccine effectiveness among children was >95%, and being unvaccinated was the leading risk factor for infection (*7*). In addition, hospitals were important sites of measles virus transmission, and internal migration was associated with risk for measles acquisition (*7*). In a 2013 assessment of vaccination coverage in China during an outbreak following a nationwide SIA, administrative vaccination coverage might have overestimated coverage by 5%–10% (*8*). Finally, application of false contraindications to vaccination led to missed opportunities to immunize some children against measles (*9*).

Research and evaluation have led to action. In 2015, the Chinese Ministry of Health recommended measles vaccination for hospital professionals, and in 2017, China CDC and WHO hosted an international consultation to improve coverage assessment methods. Immunogenicity results provided evidence of adequate seroconversion when MCV1 is given at age 8 months, satisfying the WHO evidence requirement for routine MCV1 administration before age 9 months. EPI clinics are now directed to vaccinate migrant children after 3 months of residence.

Mathematical modeling has also proven useful. A metapopulation measles virus transmission model that estimated the basic reproduction number for measles to be 18 nationwide indicated that by 2014, the effective reproduction number was 2.3 and was <1 in 14 provinces (*10*). The model predicts that measles will eventually be eliminated by the current strategy and that measles elimination can be accelerated by vaccinating middle school and high school students lacking evidence of receipt of 2 MCV doses.

The global nature of measles virus transmission is evident in the patterns of measles virus importations and exportations. China's measles surveillance system detects imported cases, and other countries have detected importations from China. For example, during January 2016–June 2019, CDC detected only one importation from China into the United States, compared with six, four, and five such importations each year during

[††] https://www.who.int/immunization/monitoring_surveillance/burden/laboratory/measles/en/.

[§§] The Measles & Rubella Initiative is a partnership established in 2001 as the Measles Initiative, spearheaded by the American Red Cross, CDC, the United Nations Foundation, UNICEF, and WHO. https://measlesrubellainitiative.org/.

TABLE. Epidemiologic characteristics of reported measles, cases, outbreaks, and isolate genotypes — China, January 2013–June 2019

Characteristic	Year						
	2013	2014	2015	2016	2017	2018	Jan–Jun 2019
Measles incidence, cases per million population*	20.42	38.84	31.09	18.11	4.31	2.84	1.27
No. of 31 total provinces with incidence <1 per million population	1	0	0	2	4	5	NA
No. of measles cases	27,646	52,628	42,361	24,820	5,941	3,940	1,839
Age group distribution, no. (%)							
<8 mos	8,448 (30.6)	11,193 (21.3)	10,575 (24.9)	4,652 (18.7)	950 (16.0)	542 (13.8)	109 (5.9)
8–23 mos	8,227 (29.8)	11,928 (22.7)	10,070 (23.8)	5,910 (23.8)	1,786 (30.0)	1,231 (31.2)	530 (28.8)
2–6 yrs	2,890 (10.4)	4,554 (8.6)	3,933 (9.3)	2,521 (10.2)	866 (14.6)	554 (14.1)	233 (12.7)
7–14 yrs	648 (2.3)	1,696 (3.2)	1,313 (3.1)	971 (3.9)	445 (7.5)	273 (6.9)	202 (11)
≥15 yrs	7,433 (26.9)	23,257 (44.2)	16,470 (38.9)	10,766 (43.4)	1,894 (31.9)	1,340 (34.0)	765 (41.6)
No. of vaccine doses received by measles patients aged 8 mos–14 yrs†							
0	7,636 (64.9)	10,964 (60.3)	9,158 (59.8)	5,332 (56.7)	1,146 (37.0)	629 (30.5)	127 (14.6)
1	1,889 (16.1)	2,947 (16.2)	2,725 (17.8)	1,865 (19.8)	945 (30.5)	749 (36.4)	311 (35.9)
≥2	724 (6.1)	1,577 (8.7)	1,453 (9.5)	1,128 (12.0)	495 (16.0)	551 (26.8)	340 (39.2)
Unknown	1,516 (12.9)	2,690 (14.8)	1,980 (12.9)	1,077 (11.5)	511 (16.5)	129 (6.3)	89 (10.3)
Laboratory-confirmed (%)	96.3	96.3	96.3	96.1	85.6	96.5	92.6
Male sex (%)	59.8	56.5	56.2	55.2	57.2	57.6	56.5
No. of measles-related deaths	24	28	32	18	5	1	0
Measles deaths per million population	0.018	0.020	0.023	0.013	0.004	0.001	0
Administrative MCV2 coverage (%)	99.6	99.9	99.4	99.4	99.4	99.2	NA
No. of persons vaccinated in SIAs (million)	22.67	12.81	9.12	4.06	5.44	2.84	NA
No. of outbreaks reported§	109	283	329	230	38	37	18
No. of outbreak-related cases	436	2,080	1,847	1,235	238	158	83
Median no. of cases per outbreak (range)	2 (2–29)	3 (2–271)	2 (2–278)	4 (2–122)	3 (2–59)	3 (2–29)	3 (2–14)
Median outbreak duration, days (range)	8 (1–44)	7 (1–158)	8 (1–245)	85 (1–65)	13 (1–44)	11 (1–28)	9 (1–35)
Measles virus genotypes (no. identified)¶	H1 (2,208); B3 (3); D8 (51); D9 (47)	H1 (4,872); B3 (10); D8 (3); D9 (9); G3 (1)	H1 (3,948); D9 (1)	H1 (2,467); D8 (3)	H1 (400); B3 (1); D8 (10)	H1 (155); B3 (3); D8 (8)	H1 (24); B3 (18); D8 (91)

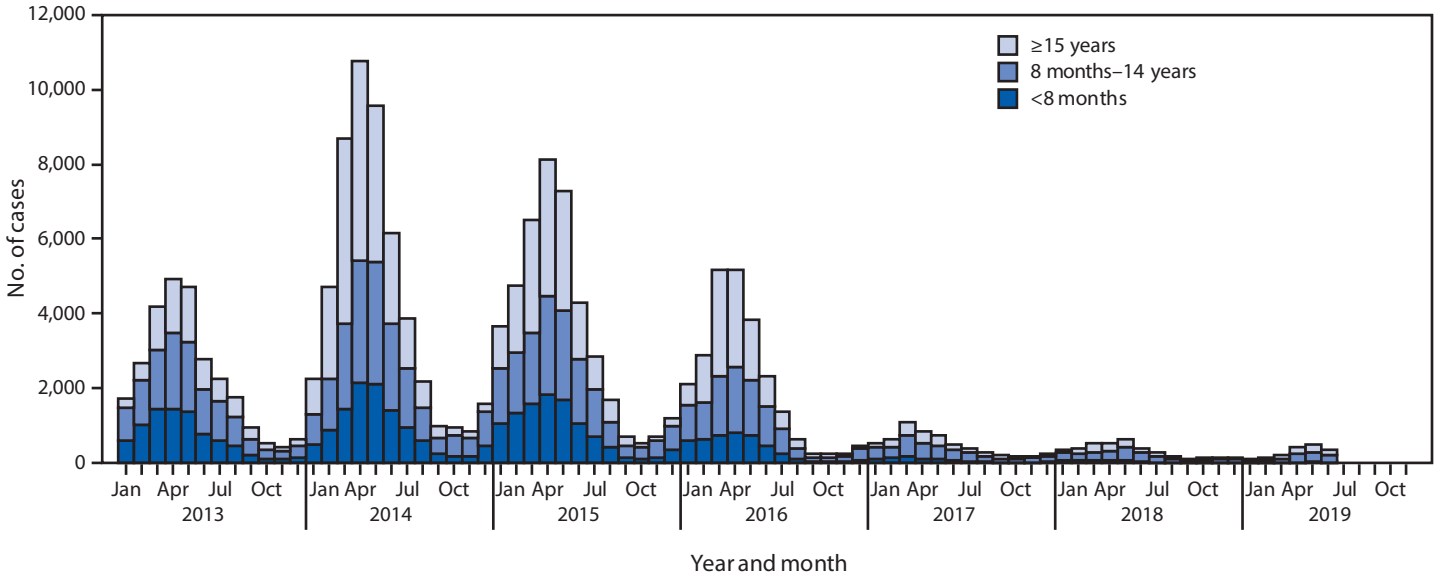
Abbreviations: MCV = measles-containing vaccine; MCV2 = second dose of MCV; NA = not available; SIA = supplementary immunization activity.
* Incidence for January–June 2019 is annualized.
† No. of doses of MCV received by patient as of date of measles illness onset.
§ In China, a measles outbreak is defined as the occurrence, within a 10-day period, of either two or more confirmed measles cases in a village, district, school, or similar unit or five or more confirmed measles cases in a township.
¶ https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0218782.

2013–2015, respectively, supporting the understanding that cooperation among countries in fighting measles can benefit all countries.

The findings in this report are subject to at least two limitations. First, administrative coverage can be affected by inaccurate population estimates leading to under- or overestimates of coverage (*8*). Second, despite meeting WHO Western Pacific Region surveillance quality indicators, surveillance might underestimate incidence because not all measles patients come to medical attention, and some medically attended cases might not be reported.

China is approaching measles elimination, but the high transmissibility of measles virus, the size and density of China's population, and the persistence of global measles virus transmission mean that measles will continue to be detected in China for years to come. Elimination can be achieved with an updated action plan that includes ensuring sufficient vaccine supply, continuing to improve laboratory-supported

FIGURE. Confirmed measles cases,* by age group — China, January 2013–June 2019



* Confirmed cases include those that are laboratory-confirmed, epidemiologically linked to a laboratory-confirmed case, or clinically compatible.

Summary

What is already known about this topic?

China has historically had high measles incidence and many associated deaths. A comprehensive measles elimination plan during 2006–2012 substantially reduced measles incidence; however, a resurgence occurred during 2013–2015.

What is added by this report?

In China, measles surveillance, outbreak response, research, and program evaluation were used to strengthen routine immunization and target immunization activities for eliminating measles. Measles incidence declined from 31 per million in 2015 to 2.8 in 2018; only one measles-associated death has been reported during 2018–June 2019.

What are the implications for public health practice?

The World Health Organization–recommended strategy to eliminate measles can be effective, including in large, densely populated countries like China.

surveillance and outbreak response, strengthening the school-entry vaccination record check, vaccinating students lacking documentation of receipt of at least 2 doses of measles/rubella vaccine, and vaccinating health care professionals and other adults at risk for measles. Data sharing and cooperation among countries and international organizations will continue to be critically important in the global effort to eliminate and eventually eradicate measles.

Corresponding author: Lixin Hao, haolx@chinacdc.cn.

[1]National Immunization Program, Chinese Center for Disease Control and Prevention; [2]World Health Organization Western Pacific Regional Office, Regional Reference Measles and Rubella Laboratory, National Institute for Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention; [3]Global Immunization Division, Center for Global Health, CDC.

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Vital Signs: Status of Human Immunodeficiency Virus Testing, Viral Suppression, and HIV Preexposure Prophylaxis — United States, 2013–2018

Norma S. Harris, PhD[1]; Anna Satcher Johnson, MPH[1]; Ya-Lin A. Huang, PhD[1]; Dayle Kern, MA[1]; Paul Fulton[2]; Dawn K. Smith, MD[1]; Linda A. Valleroy, PhD[1]; H. Irene Hall, PhD[1]

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Abstract

Background: Approximately 38,000 new human immunodeficiency virus (HIV) infections occur in the United States each year; these infections can be prevented. A proposed national initiative, Ending the HIV Epidemic: A Plan for America, incorporates three strategies (diagnose, treat, and prevent HIV infection) and seeks to leverage testing, treatment, and preexposure prophylaxis (PrEP) to reduce new HIV infections in the United States by at least 90% by 2030. Targets to reach this goal include that at least 95% of persons with HIV receive a diagnosis, 95% of persons with diagnosed HIV infection have a suppressed viral load, and 50% of those at increased risk for acquiring HIV are prescribed PrEP. Using surveillance, pharmacy, and other data, CDC determined the current status of these three initiative strategies.

Methods: CDC analyzed HIV surveillance data to estimate annual number of new HIV infections (2013–2017); estimate the percentage of infections that were diagnosed (2017); and determine the percentage of persons with diagnosed HIV infection with viral load suppression (2017). CDC analyzed surveillance, pharmacy, and other data to estimate PrEP coverage, reported as a percentage and calculated as the number of persons who were prescribed PrEP divided by the estimated number of persons with indications for PrEP.

Results: The number of new HIV infections remained stable from 2013 (38,500) to 2017 (37,500) (p = 0.448). In 2017, an estimated 85.8% of infections were diagnosed. Among 854,206 persons with diagnosed HIV infection in 42 jurisdictions with complete reporting of laboratory data, 62.7% had a suppressed viral load. Among an estimated 1.2 million persons with indications for use of PrEP, 18.1% had been prescribed PrEP in 2018.

Conclusion: Accelerated efforts to diagnose, treat, and prevent HIV infection are needed to achieve the U.S. goal of at least 90% reduction in the number of new HIV infections by 2030.

Introduction

Since 2013, progress in reducing the number of new human immunodeficiency virus (HIV) infections has stalled at approximately 38,000 new infections occurring each year (*1*). Infections are preventable. Persons who are aware that they have HIV infection and maintain a suppressed viral load (<200 copies of HIV RNA per mL) have effectively no risk of sexually transmitting the virus to HIV-negative partners (*2*). Nevertheless, 38% of new HIV infections are transmitted from persons with HIV infection who are unaware of their infection. Further, 43% of new HIV infections are transmitted from persons who have received a diagnosis but are not receiving HIV medical care, and 20% of new HIV infections are transmitted from persons receiving medical care for HIV, but who are not virally suppressed (*3*). Preexposure prophylaxis (PrEP), a daily oral pill that includes two HIV antiretroviral medications (tenofovir and emtricitabine), has been found to be highly effective in preventing acquisition of HIV infection (*4*). PrEP coverage has increased in recent years; however, coverage among persons at risk for exposure remains low (*5*). In February 2019, a new national initiative, Ending the HIV Epidemic: A Plan for America, was proposed. The plan calls for intensified efforts to diagnose, treat, and prevent HIV infections in the United States, with an overall goal of reducing new infections by at least 90% by 2030 (*6*). Use of PrEP is a major component of the prevention strategy and is indicated for men and women with sexual or injection drug use behaviors that increase their risk for acquiring HIV (*7*). To focus national and local prevention efforts on eliminating HIV, CDC analyzed surveillance, pharmacy, and other data to determine the status of these strategies (diagnose, treat, and prevent HIV infections) at the national and state levels.

Summary

What is already known about this topic?

The approximately 38,000 new human immunodeficiency virus (HIV) infections that occur annually in the United States are preventable through testing, treatment, and preexposure prophylaxis (PrEP). A proposed initiative seeks to reduce new infections by at least 90% by 2030. The targets for the initiative are at least 95% for testing and treatment and 50% for PrEP.

What is added by this report?

In 2017, 85.8% of persons with HIV infection had received a diagnosis, and 62.7% of persons with diagnosed HIV infection had a suppressed viral load. In 2018, PrEP had been prescribed to 18.1% of persons with indications.

What are the implications for public health practice?

Accelerated efforts to diagnose, treat, and prevent HIV infection are urgently needed.

Methods

CDC analyzed data reported to the National HIV Surveillance System (NHSS) from the beginning of the epidemic in the early 1980s through June 2019 from 50 states and the District of Columbia (DC) for persons aged ≥13 years with diagnosed HIV infection. A CD4-depletion model* (*8*) was applied to NHSS data to estimate 1) the annual number of new HIV infections (2013–2017); 2) the total number of persons living with HIV (diagnosed and undiagnosed infection, or prevalence) at year-end 2017; and 3) the percentage of persons with HIV infection who had received a diagnosis.

NHSS data reported from 41 states and DC that had complete laboratory reporting of viral load test results were used to determine two viral suppression measures: viral suppression among persons with diagnosed HIV infection in the jurisdiction at year-end 2017 and viral suppression within 6 months of diagnosis among persons with HIV infection diagnosed during 2017. These 42 jurisdictions represent 89% of persons with diagnosed HIV infection in the United States.

CDC analyzed national pharmacy data from the IQVIA Real World Data–Longitudinal Prescriptions database to estimate the number of persons aged ≥16 years who were prescribed PrEP in 2017 and 2018. The annual number of PrEP prescriptions for persons aged ≥16 years was determined using an algorithm that included persons who had at least one tenofovir disoproxil fumarate and emtricitabine (TDF/FTC) prescription for >28 days and for whom TDF/FTC was not prescribed for HIV treatment, hepatitis B treatment, or HIV postexposure prophylaxis (*5*,*9*). NHSS, National Health and Nutrition Examination Survey, and U.S. Census data were used to estimate the number of persons aged ≥16 years with indications for PrEP (*10*). PrEP coverage, reported as a percentage, was calculated as the number of persons who were prescribed PrEP divided by the estimated number of persons who had indications for PrEP. To estimate PrEP coverage by race/ethnicity, the proportion among those with recorded race/ethnicity data was applied to those with missing race/ethnicity data. Analyses were conducted using SAS statistical software (version.9.4; SAS Institute).

Results

The annual number of new HIV infections remained stable from 2013 (38,500) to 2017 (37,500) (p = 0.448). Among the estimated 1.2 million persons living with HIV infection in 2017, 85.8% (95% confidence interval [CI] = 84.3–87.5) had received a laboratory-confirmed diagnosis of HIV infection. The lowest percentages of diagnosed HIV infections were among persons aged 13–24 years (54.6%, 95% CI = 52.7–56.7), American Indians/Alaska Natives (79.5%, 95% CI = 58.7–100.0), and heterosexual males (82.0%, 95% CI = 76.5–88.3), compared with other age, racial/ethnic, or transmission risk groups. (Table 1). The percentage of diagnosed infections ranged from 79.7% in Nevada to 94.4% in New Jersey (Table 2).

In 2017, 62.7% of 854,206 persons with diagnosed HIV infections in 42 jurisdictions had a suppressed viral load (Table 1). The lowest percentages of persons with viral suppression were those aged 13–24 years (56.9%), blacks/African Americans (blacks) (57.4%), and males who inject drugs (52.0%), compared with other age, racial/ethnic, and transmission risk groups. The percentage of persons with a suppressed viral load ranged from 47.0% in South Dakota to 79.6% in Iowa (Table 2). The percentage of persons with a suppressed viral load within 6 months of diagnosis of HIV infection was 61.5 overall and <59% in 12 jurisdictions (Figure).

An estimated 1.2 million persons had indications for PrEP; 12.6% were prescribed PrEP in 2017 and 18.1% in 2018. In 2018, PrEP coverage was three times as high among males (20.8%) as among females (6.6%) (Table 1). Compared with other age groups, the lowest PrEP coverage rate was among persons aged 16–24 years (11.4%). Adjusting for missing race/ethnicity, PrEP coverage was 5.9% for blacks, 10.9% for Hispanics/Latinos, and 42.1% for whites. PrEP coverage ranged from 5.0% in Wyoming to 41.1% in New York (Table 2).

*The first CD4 test result after HIV diagnosis and a CD4-depletion model indicating disease progression or duration after infection were used to estimate the number of new HIV infections and total prevalence (persons living with diagnosed or undiagnosed infection) among adults and adolescents in the United States.

TABLE 1. Percentage of diagnosed human immunodeficiency virus (HIV) infections, viral suppression among persons with diagnosed HIV infection, and prescription of preexposure prophylaxis (PrEP) for persons with indications, by demographic and transmission categories — United States, 2017 and 2018

Characteristic	2017		2018
	Diagnosed HIV infection,* % (95% CI)	Viral suppression,†,§ %	PrEP coverage,¶,**,†† %
Sex			
Male	84.9 (83.1–86.8)	63.3	20.8
Female	89.1 (86.1–92.3)	60.8	6.6
Age group (yrs)			
13–24	54.6 (52.7–56.7)	56.9	11.4
25–34	70.4 (69.4–71.4)	58.1	21.5
35–44	84.5 (83.6–85.4)	60.2	21.9
45–54	92.2 (91.5–92.9)	64.6	17.4
≥55	94.7 (93.9–95.5)	65.5	14.4
Race/Ethnicity			
American Indian/Alaska Native	79.5 (58.7–100.0)	62.0	—§§
Asian	83.7 (72.6–98.9)	68.3	—§§
Black/African American	85.5 (83.1–88.0)	57.4	5.9
Hispanic/Latino	83.0 (79.8–86.5)	62.3	10.9
Native Hawaiian/Other Pacific Islander	—*	65.0	—§§
White	88.6 (85.8–91.5)	69.3	42.1
Multiple races	86.7 (80.5–94.0)	69.9	—§§
Transmission category			
Male-to-male sexual contact	83.7 (81.7–85.8)	65.7	—§§
Injection drug use	93.8 (89.1–99.0)	—¶¶	—§§
Male	93.3 (87.0–100.0)	52.0	—§§
Female	94.4 (87.9–100.0)	58.4	—§§
Male-to-male sexual contact and injection drug use	92.0 (85.9–99.0)	63.1	—§§
Heterosexual contact	85.9 (83.0–89.0)	—¶¶	—§§
Male	82.0 (76.5–88.3)	57.6	—§§
Female	87.7 (84.4–91.2)	61.8	—§§
Total	**85.8*** (84.3–87.5)**	**62.7*****	**18.1**

Abbreviation: CI = confidence interval.

* Percentage of diagnosed infections calculated as the number of persons who received a diagnosis of HIV infection divided by the number of persons living with HIV (diagnosed and undiagnosed; n = 1,153,400). Dash in this column indicates estimate not available for some populations because of high relative standard errors.

† Percentage viral suppression calculated as the number of persons with a viral load test result of <200 copies of HIV RNA per mL at last test divided by the number of persons living with diagnosed HIV infection (n = 854,206).

§ Includes data for 42 jurisdictions (41 states and District of Columbia) with complete laboratory reporting. These jurisdictions include Alabama, Alaska, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

¶ PrEP coverage, calculated as the number of persons who were prescribed PrEP (n = 219,691 in 2018) divided by estimated number of persons with indications for PrEP (n = 1,211,777 in 2017).

** Total includes 1,605 persons prescribed PrEP with unknown jurisdiction and 143,168 persons prescribed PrEP with unknown/unavailable race/ethnicity. PrEP coverage for race/ethnicity was adjusted applying the distribution of records with known race/ethnicity to records with missing race/ethnicity.

†† Age group for PrEP coverage is 16–24 years.

§§ Dashes indicate data not available. IQVIA data source has incomplete race/ethnicity data and does not collect data on transmission risk category.

¶¶ Percentage viral suppression is presented for each sex within transmission category.

*** Total includes persons with HIV infection attributed to hemophilia, blood transfusion, perinatal exposure, or whose risk factor was not reported or not identified.

Discussion

The annual number of new HIV infections has remained relatively stable since 2013. In 2017, the percentage of persons with HIV infection whose infection was diagnosed was 86%, a significant increase from 83% in 2010 (*1*). Overall, in 2017, 63% of persons with diagnosed HIV infection had a suppressed viral load, and in 2018, PrEP coverage was low at 18%. These findings confirm substantial gaps in diagnosing, treating, and preventing HIV infection and underscore the need for expanded efforts. The targets for the proposed initiative are at least 95% of persons with HIV infection having received a diagnosis, 95% of persons with diagnosed HIV infection having a suppressed viral load, and 50% of persons with indications for PrEP having been prescribed PrEP (*11*). New infections will occur unless substantial improvements are made in implementing these three strategies.

In this analysis, the lowest percentages of diagnosed HIV infection were among young persons (aged 13–34 years), American Indians/Alaska Natives, and heterosexual males. The low percentage of diagnosed HIV infection in these three populations might be explained by 1) lower testing rates among youths (*12*), 2) HIV-related stigma and lack of

TABLE 2. Percentage of diagnosed human immunodeficiency virus (HIV) infections, viral suppression among persons with diagnosed HIV infection, and prescription of preexposure prophylaxis (PrEP) for persons with indications, by jurisdiction — United States, 2017 and 2018

Jurisdiction	2017		2018
	Diagnosed HIV infection,* % (95% CI)	Viral suppression,†,§ %	PrEP coverage,¶,** %
Alabama	83.9 (72.2–100.0)	57.3	13.2
Alaska	—*	78.7	8.3
Arizona	84.7 (74.1–98.8)	—§	13.1
Arkansas	82.2 (66.3–100.0)	—§	12.5
California	85.9 (81.6–90.5)	66.6	21.9
Colorado	85.8 (74.5–100.0)	58.6	13.3
Connecticut	88.6 (75.1–100.0)	66.8	21.3
Delaware	85.5 (64.9–100.0)	67.7	8.7
District of Columbia	88.6 (76.9–100.0)	56.0	36.5
Florida	87.0 (82.3–92.3)	63.0	11.1
Georgia	82.0 (76.0–89.1)	58.3	15.2
Hawaii	85.5 (63.1–100.0)	68.2	12.2
Idaho	96.6 (65.3–100.0)††	—§	10.0
Illinois	85.6 (77.9–94.9)	53.8	26.8
Indiana	83.8 (71.5–100.0)	61.3	10.1
Iowa	82.3 (61.6–100.0)	79.6	28.1
Kansas	84.0 (63.3–100.0)	—§	13.9
Kentucky	82.7 (68.3–100.0)	—§	9.2
Louisiana	81.2 (71.7–93.7)	64.7	22.8
Maine	85.9 (59.8–100.0)	78.3	11.9
Maryland	86.1 (78.1–95.9)	58.2	14.3
Massachusetts	89.5 (79.6–100.0)	70.9	33.4
Michigan	83.1 (72.2–97.9)	72.2	12.2
Minnesota	84.9 (71.8–100.0)	69.1	15.1
Mississippi	87.9 (73.8–100.0)	49.2	12.9
Missouri	85.2 (73.4–100.0)	66.2	14.2
Montana	—*	78.5	6.6

See table footnotes on next page.

access to HIV-related services among American Indians/Alaska Natives (*13*), and 3) low patient and provider perceived risk for HIV acquisition among heterosexuals (*14*). The percentage of diagnosed HIV infections also varied geographically, possibly reflecting differences in access to and implementation of HIV testing and highlighting the need for developing tailored testing strategies (*15*). CDC recommends routine screening of all persons aged 13–64 years at least once in their lifetime (*16*), yet recent findings indicate that only 40% of persons aged ≥18 years in the United States have ever been tested for HIV (*15*). HIV testing guidelines also recommend at least annual testing for persons at high risk for acquiring HIV. Accelerating implementation of HIV testing strategies such as integrated and routinized HIV screening in health care settings, scaling up partner notification, social/sexual network screening, and mass distribution of HIV self-test kits (*15*) might facilitate early diagnosis.

The lowest percentages of viral suppression were found among young persons, blacks, and heterosexual males. Adherence to medication is critical to viral suppression. Factors associated with lower adherence or viral suppression include young age (*17*) and, for blacks, include health care coverage, homelessness, and incarceration (*18*). Expanded efforts must address these and other social and economic barriers to care. Developing or scaling up the implementation of evidence-based interventions is also important for improving adherence and viral suppression among youths and blacks. For example, one successful approach to improving viral suppression among blacks with HIV infection is an integrated care model that includes collaboration between community pharmacists and HIV medical care providers to develop individualized care plans that address HIV treatment challenges (*19*).

Since 2012, prompt treatment with antiretroviral therapy after diagnosis of HIV infection, regardless of stage of disease, has been recommended (*20*). Yet only 61.5% of persons with HIV infection diagnosed in 2017 had a suppressed viral load within 6 months of diagnosis. Low viral suppression rates within 6 months of HIV diagnosis (59%) occurred mainly in Southern states, which are already disproportionately affected by HIV (*1*). One study in patients with high rates of mental health illness, drug use, and housing instability illustrated success in reaching viral suppression within 1 year using multidisciplinary care and other support (*21*). To rapidly improve viral suppression for all populations, additional research is needed to identify interventions that will achieve viral suppression within 6 months of diagnosis, especially among populations facing severe health and socioeconomic challenges, including homelessness (*22*).

TABLE 2. (*Continued*) Percentage of diagnosed human immunodeficiency virus (HIV) infections, viral suppression among persons with diagnosed HIV infection, and prescription of preexposure prophylaxis (PrEP) for persons with indications, by jurisdiction — United States, 2017 and 2018

Jurisdiction	2017		2018
	Diagnosed HIV infection,* % (95% CI)	Viral suppression,†,§ %	PrEP coverage,¶,** %
Nebraska	82.7 (59.8–100.0)	64.2	18.8
Nevada	79.7 (67.4–97.4)	—§	13.5
New Hampshire	85.5 (57.0–100.0)††	70.3	21.0
New Jersey	94.4 (85.6–100.0)	—§	16.8
New Mexico	81.2 (61.7–100.0)	68.5	12.0
New York	88.3 (84.0–93.0)	63.2	41.1
North Carolina	87.3 (79.0–97.5)	63.2	11.1
North Dakota	—*	77.7	14.8
Ohio	83.9 (74.8–95.5)	54.7	11.6
Oklahoma	82.9 (66.8–100.0)	59.0	7.6
Oregon	85.9 (71.4–100.0)	63.7	13.6
Pennsylvania	92.7 (84.6–100.0)	—§	22.9
Rhode Island	84.5 (62.2–100.0)	76.6	18.9
South Carolina	84.1 (73.9–97.5)	66.3	11.7
South Dakota	—*	47.0	11.3
Tennessee	84.9 (74.2–99.2)	57.6	11.4
Texas	81.1 (76.3–86.6)	61.3	14.3
Utah	81.9 (61.1–100.0)	62.5	21.9
Vermont	93.0 (59.0–100.0)††	—§	17.7
Virginia	86.9 (77.5–98.8)	55.2	9.5
Washington	88.3 (76.9–100.0)	78.6	25.0
West Virginia	86.9 (61.4–100.0)	58.9	9.7
Wisconsin	83.7 (68.3–100.0)	74.5	14.3
Wyoming	—*	76.8	5.0
Total	**85.8 (84.3–87.5)**	**62.7**	**18.1**

Abbreviation: CI = confidence interval.

* Percentage of diagnosed infections calculated as the number of persons who received a diagnosis of HIV infection divided by the number of persons living with HIV (diagnosed and undiagnosed). Dashes in this column indicate estimates not available for some jurisdictions because of high relative standard errors.

† Percentage viral suppression calculated as the number of persons with a viral load test result of <200 copies of HIV RNA per mL at last test divided by the number of persons living with diagnosed HIV infection.

§ Includes data for 42 jurisdictions (41 states and District of Columbia) with complete laboratory reporting. These jurisdictions include Alabama, Alaska, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Data were incomplete or not reported for nine jurisdictions, as indicated by dashes.

¶ PrEP coverage calculated as the number of persons who were prescribed PrEP (in 2018) divided by estimated number of persons with indications for PrEP (in 2017).

** Total includes 1,605 PrEP users with unknown jurisdiction.

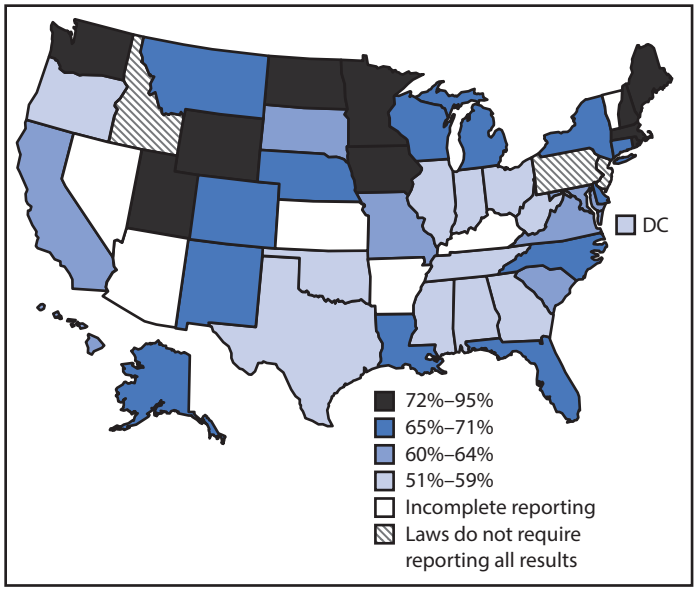
†† Estimate does not meet the standard of reliability; use with caution.

In 2019, the United States Preventive Services Task Force issued a Grade A recommendation† that clinicians offer PrEP to persons at substantial risk for HIV acquisition (*4*). Overall, PrEP coverage was 9% in 2016 (*5*) and improved to 18% in 2018. Similar to earlier findings, PrEP coverage in this analysis was especially low in young persons (aged 16–24 years) compared with that in other age groups, and racial/ethnic and geographic disparities in PrEP prescription exist (*5*). In 2018, approximately 43% of HIV diagnoses were among blacks, and 26% were among Hispanics/Latinos (*23*). However, PrEP coverage among whites was seven times as high as that among blacks and four times as high as that among Hispanics/Latinos, suggesting that PrEP delivery to persons in racial/ethnic minority populations has not been equitable. Improving PrEP coverage will require targeted improvements in PrEP awareness, prescribing practices, and use in underreached demographic groups, especially among young persons, blacks, and Hispanics/Latinos at risk for acquiring HIV. CDC has developed a campaign, Prescribe HIV Prevention, which is designed to help clinicians provide PrEP to prevent acquisition of HIV (*24*).

The findings in this report are subject to at least three limitations. First, estimation of the number of new infections and percentage of undiagnosed infections relies on the assumption that persons received no treatment before their first CD4 test. The CD4 counts of persons with evidence of previous antiretroviral therapy use or viral suppression are excluded from the analysis, minimizing the impact of prior treatment on the HIV depletion model. Second, viral suppression measures in

† Grade A recommendation is a recommendation with high certainty that the net benefit of the intervention is substantial. https://www.uspreventiveservicestaskforce.org/Page/Name/grade-definitions.

FIGURE. Viral suppression*,†,§ within 6 months of diagnosis of human immunodeficiency virus (HIV) infection among persons aged ≥13 years — United States,¶ 2017



Abbreviation: DC = District of Columbia.

* Percentage viral suppression within 6 months of HIV diagnosis, calculated as the number of persons with a viral load test result of <200 copies of HIV RNA per mL at last test divided by the number of persons with HIV diagnosed in 2017. Residence was based on residence at the time of diagnosis of HIV infection.

† Total = 61.5%.

§ Data classified using quartiles.

¶ Analysis based on data reported from 41 states and DC; data for nine states were incomplete or not reported.

this analysis were based on data from 42 jurisdictions and are therefore not necessarily representative of data on all persons living with diagnosed HIV infection in the United States. Finally, although IQVIA recorded 92% of all prescriptions from retail pharmacies in the United States, prescriptions from closed health care systems (e.g., managed care organizations or military health plans) were not included. Therefore, these are minimum estimates of PrEP coverage. Different data sources were used in the numerator and denominator to calculate PrEP coverage. Although the result is expressed as a percentage, it is unknown whether all persons prescribed PrEP (numerator) are also contained in the denominator of the estimate of the number of persons with indications for PrEP. In addition, only 35% of persons with PrEP prescriptions identified in the IQVIA data had race/ethnicity information available. In calculating PrEP coverage, the racial/ethnic distribution of known records was applied to those for which data on race/ethnicity were missing, which might not be valid. The extent to which the missing race/ethnicity is the same as that for those with reported race/ethnicity is unknown. Improvements in the completeness of race/ethnicity data in prescription databases are needed to fully describe disparities in PrEP coverage.

Accelerated efforts to diagnose, treat, and provide PrEP while addressing disparities, are urgently needed to reach the targets for the Ending the HIV Epidemic: A Plan for America initiative. These accelerated efforts, along with other prevention strategies such as quickly responding to increases in diagnoses of HIV infections, will be needed to meet the ambitious U.S. goal of at least a 90% reduction in the number of new HIV infections by 2030.

Corresponding author: Norma S. Harris, nharris@cdc.gov, 404-718-8559.

[1]Division of HIV/AIDS Prevention, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; [2]National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC.

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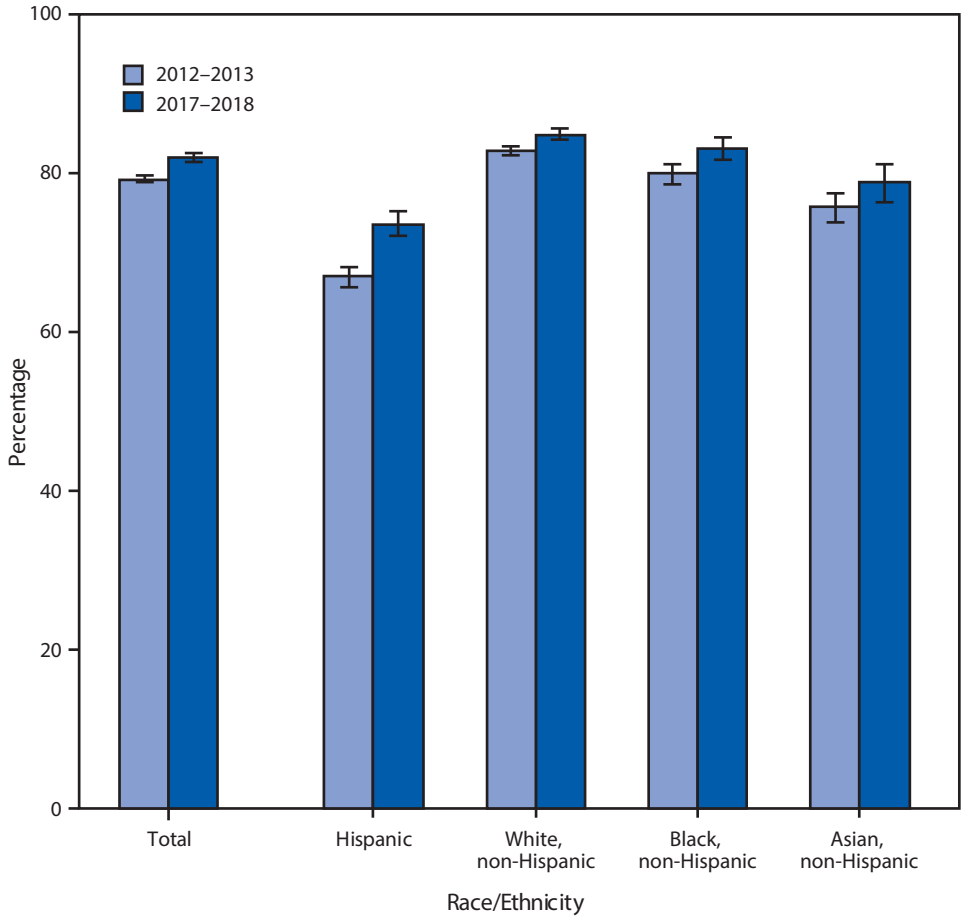
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged 18–64 Years Who Had Seen or Talked to a Health Care Professional in the Past 12 Months,† by Race/Ethnicity§ — National Health Interview Survey, 2012–2013 and 2017–2018¶



* With 95% confidence intervals indicated by error bars.
† Based on a question in the Sample Adult section that asked "About how long has it been since you last saw or talked to a doctor or other health care professional about your own health? Include doctors seen while a patient in a hospital."
§ Categories shown for non-Hispanic respondents are only for those who selected one racial group; respondents had the option to select more than one racial group. Hispanic respondents might be of any race or combination of races. Only selected groups are shown in the individual race/ethnicity bars, but total bar shows results for all adults aged 18–64 years.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population in 2012 and 2013 combined and 2017 and 2018 combined. Estimates are derived from the National Health Interview Survey Sample Adult component.

The percentage of adults aged 18–64 years who had seen or talked to a health care professional in the past 12 months increased from 79.3% in 2012–2013 to 82.1% in 2017–2018. There was an increase in the percentage of Hispanic (67.0% to 73.6%), non-Hispanic white (82.8% to 84.9%), non-Hispanic black (80.0% to 83.2%), and non-Hispanic Asian (75.8% to 78.8%) adults who had seen or talked to a health care professional in the past 12 months between those two periods. During 2012–2013 as well as 2017–2018, non-Hispanic white adults were the most likely and Hispanic adults were the least likely to have seen or talked to a health care professional in the past 12 months.

Source: National Health Interview Survey, 2012, 2013, 2017, and 2018 data. https://www.cdc.gov/nchs/nhis.htm.

Reported by: Michael E. Martinez, MPH, MHSA, bmd7@cdc.gov, 301-458-4758; Tainya C. Clarke, PhD.

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