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Declines in Opioid Prescribing After a Private Insurer Policy Change — Massachusetts, 2011–2015

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Overdose deaths involving opioid pain medications are epidemic in the United States, in part because of high opioid prescribing rates and associated abuse of these drugs (*1*). In 2014, nearly 2 million U.S. residents either abused or were dependent on prescription opioids (*2*). In Massachusetts, unintentional opioid-related overdose deaths, including deaths involving heroin, increased 45% from 2012 to 2013.* In 2014, the rate of these deaths reached 20.0 per 100,000, nearly 2.5 times higher than the U.S. rate overall (*3*,*4*). On July 1, 2012, Blue Cross Blue Shield of Massachusetts (BCBSMA), the largest insurer in the state with approximately 2.8 million members,† implemented a comprehensive opioid utilization program after learning that many of its members were receiving new prescriptions with a >30-day supply of opioids. The 2016 CDC Guideline for Prescribing Opioids for Chronic Pain recommends avoiding opioids as a first-line therapy for chronic pain and limiting quantities when initiating opioids for acute pain (*5*). CDC analyzed BCBSMA prescription claims data for the period 2011–2015 to assess the effect of the new utilization program on opioid prescribing rates. During the first 3 years after policy implementation, the average monthly prescribing rate for opioids decreased almost 15%, from 34 per 1,000 members to 29. The percentage of BCBSMA members per month with current opioid prescriptions also declined. The temporal association between implementation of the program and statistically significant declines in both prescribing rates and proportion of members using opioids suggests that the BCBSMA initiative played a role in reducing the use of prescription opioids among its members. Public and private insurers in the United States could benefit from developing their own best practices for prescription opioid utilization that ensure accessible pain care, while reducing the risk for dependence and abuse associated with these drugs.

In 2012, BCBSMA analyzed its 2011 pharmacy claims data to determine the number of members receiving large quantities of opioid prescriptions from multiple providers. In 2011, approximately 30,000 members received new prescriptions of short-acting opioids with a >30-day supply; 25% of these members obtained opioid prescriptions from multiple providers. BCBSMA's opioid utilization program was developed

* http://www.mass.gov/governor/press-office/press-releases/fy2015/steps-to-combat-opioid-addiction-crisis-announced.html.
† Total state population = 6.79 million (2015 census).

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collaboratively among an extensive network of stakeholders, including physicians, nurses, pharmacists, actuaries, lawyers, data analysts, medical societies, medical and pharmacy boards, the Massachusetts Pain Initiative, and the top 10 opioid-dispensing pharmacies in Massachusetts (Box).

The BCBSMA prescription opioid utilization program was designed around expert-defined best practices for opioid prescribing that include formal agreements between patient and provider, a requirement for BCBSMA approval prior to dispensing new opioid prescriptions, and quantity limits.[§] The program requires providers to conduct a risk assessment for abuse that the patient must sign. Physicians and patients work together to develop a treatment plan that considers options other than prescription opioids. When the decision to prescribe opioids is made, a formal agreement between patient and prescriber outlines specific behaviors expected of both parties. In addition, the prescriber must provide a diagnosis and rationale for prescribing an opiate as part of the prior authorization process. BCBSMA coverage requires prior authorization (including review by a BCBSMA clinician who then notifies the pharmacy) before dispensing new short-acting opioid prescriptions with a >30-day supply and for all new long-acting opioid prescriptions. Pharmacy mail orders are not permitted. If opioid misuse is suspected or if coordination of care among multiple providers is indicated, patients might be assigned a single pharmacy to dispense all opioid prescriptions. Identified patients with chronic pain are referred to case managers who advise on nonopioid therapies. Oncology patients and terminally ill persons are exempt from the requirements for prior authorization for new prescriptions. Members continue to have coverage for physical therapy, pain management, addiction treatment, chiropractic services, and cognitive behavioral therapy.

A retrospective analysis was conducted using BCBSMA prescription claims data from the period July 2011–June 2015. The pre-implementation period was defined as July 1, 2011–June 30, 2012, and the postimplementation period was defined as July 1, 2012–June 30, 2015. All data were deidentified before analysis. Average monthly prescribing rates per 1,000 members and percentage of members with opioid prescriptions were calculated for short-acting,[¶] long-acting,[**] and for both opioid types combined. Average monthly counts of opioid prescriptions for oncology members were also tabulated. To assess the effects of the opioid utilization program, preprogram

[§] https://www.nhpf.org/uploads/Handouts/Kowalski-slides_06-20-14.pdf.

[¶] Short-acting opioids in the BCBSMA opioid utilization program include short-acting formulations of acetaminophen/caffeine/dihydrocodeine, acetaminophen/codeine, acetaminophen/hydrocodone, acetaminophen/oxycodone, alfentanil, aspirin/caffeine/dihydrocodeine, aspirin/hydrocodone, aspirin/oxycodone, codeine, fentanyl, hydromorphone, ibuprofen/hydrocodone, ibuprofen/oxycodone, levorphanol tartrate, meperidine, morphine, oxycodone, oxymorphone, and tapentadol.

[**] Long-acting opioids in the BCBSMA opioid utilization program include extended-release formulations and naturally long-acting opioids: acetaminophen/oxycodone, buprenorphine (transdermal), fentanyl, hydrocodone, hydromorphone, methadone, morphine, oxycodone, oxymorphone, tapentadol.

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BOX. Development plan for the Blue Cross Blue Shield of Massachusetts (BCBSMA) opioid utilization program

- Designed around expert-defined best practices for opioid prescribing
- Collaborative effort involving an extensive network of stakeholders including:
  - Physicians, nurses, and pharmacists
  - Actuaries
  - Lawyers
  - Data analysts
  - Medical societies
  - Medical and pharmacy boards
  - Massachusetts Pain Initiative, a patient advocacy group
  - Top 10 opioid-dispensing pharmacies in Massachusetts

Program elements

- Patient and provider work together to manage pain safely and effectively
  - Providers conduct a risk assessment for abuse that the patient must sign.
  - Physicians and patients develop a treatment plan that considers options other than prescription opioids.
  - If opioids are prescribed, a formal agreement between patient and prescriber outlines behavior expected of both parties.
  - When opioid misuse is suspected or when coordination of care among multiple providers is indicated, patients might be assigned a single pharmacy to dispense all opioid prescriptions.
- Parameters established by BCBSMA
  - Prior authorization required for new short-acting opioid prescriptions with more than a 30-day supply.*
  - Prior authorization required for all new long-acting opioid prescriptions.*
  - Pharmacy mail orders are no longer permitted.
  - All patients with chronic pain are referred to case management who advise them on nonopioid therapies.
  - All members have coverage for physical therapy, pain management, addiction treatment, chiropractic services, and cognitive behavioral therapy.

* Members who are oncology patients or terminally ill are exempt from the requirements of prior authorization for new prescriptions.

and postprogram rates were modeled using an interrupted time series analysis. Outcomes were the proportions of members with prescriptions per month and number of prescriptions per total members per month; changes in rates were estimated by two regression coefficients, one for each period. Differences were considered statistically significant if the 95% confidence interval for the coefficient corresponding to the difference in slopes excluded zero. Prescriptions for buprenorphine, indicated for the treatment of opioid use disorder, were examined separately to determine how prior authorization requirements impact dispensing of drugs used in medication-assisted treatment. Changes in prescribing are reported for all commercial members eligible for BCBSMA pharmacy benefits (excluding patients receiving Medicare benefits).

An average of 1.5 million commercial members with pharmacy benefits were enrolled in BCBSMA each month during the study period. The average monthly prescribing rate for all opioids decreased 14.7%, from 34 per 1,000 before implementation of the program to 29 after implementation (Table 1). Although the average monthly prescribing rates for long-acting opioids remained constant at three per 1,000 members before and after program implementation periods, the average monthly prescribing rate for short-acting opioids decreased 16.1%, from 31 to 26 per 1,000 members (Figure 1). Similarly, while the percentage of all members with a long-acting opioid prescription decreased 8.3%, from 0.24% per month to 0.22%, the percentage of members with short-acting opioid prescriptions decreased 12.9%, from 2.49% per month to 2.17% after program implementation (Figure 2). The number of members with cancer diagnoses was not available to calculate opioid prescribing rates; however, the average monthly number of opioid prescriptions dispensed to members with cancer diagnoses declined 9% following program implementation, which was less than among all members.

Results of the interrupted time series analysis showed a 6%–9% annual decline in the percentage of members on short-acting and long-acting opioid prescriptions and in opioid prescribing rates after implementation of the opioid utilization program compared with the pre-implementation period (Table 2). All differences were statistically significant, regardless of medication type. Overall, the estimated quantity of opioids dispensed before and after implementation of the program indicate that approximately 21 million fewer opioid doses were dispensed in the first 3 years after implementation. Data on prior authorization requirements for buprenorphine indicated for the treatment of opioid use disorder, show that 17% of members with these prescriptions never sought subsequent authorization to fill them following a pharmacy declining to fill a prescription.

Discussion

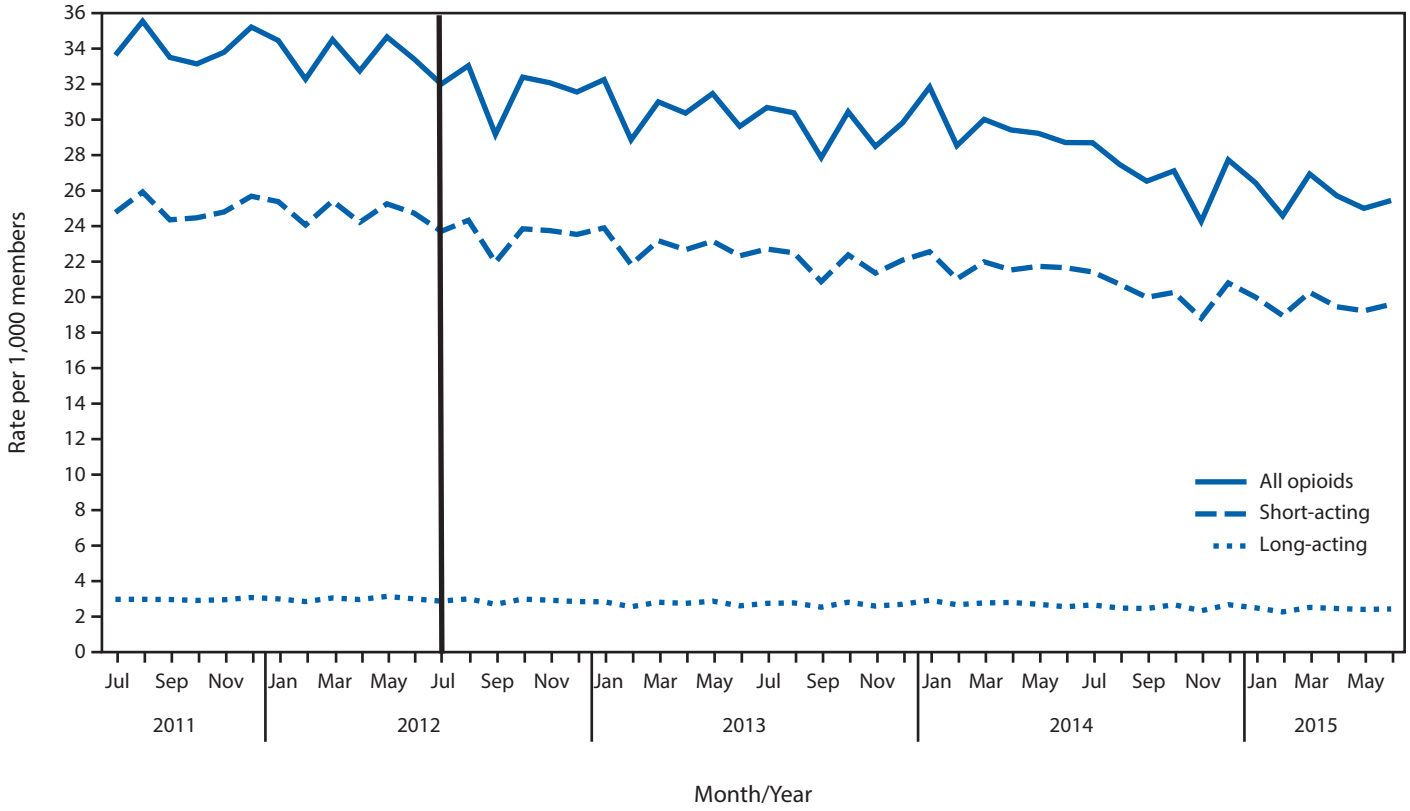
After implementation of an opioid utilization program in July 2012, the number of opioid prescriptions and the percentage of members with an opioid prescription significantly decreased among BCBSMA members. However, it is possible

TABLE 1. Average monthly opioid prescribing rates and percentage of BCBSMA members with opioid prescriptions per month before and after implementation of an opioid utilization program — Massachusetts, July 2011–June 2012 (pre-implementation) and July 2012–June 2015 (postimplementation)

	Average monthly prescribing rate (no. of prescriptions per 1,000 members per month)		Average percentage of members with prescriptions per month	
Opioid prescription drugs	Pre-implementation	Postimplementation	Pre-implementation	Postimplementation
All opioids	**34**	**29**	**2.58**	**2.24**
Long-acting	3	3	0.24	0.22
Short-acting	31	26	2.49	2.17

Abbreviation: BCBSMA = Blue Cross Blue Shield of Massachusetts.

FIGURE 1. Average monthly prescribing rates* for opioids — Blue Cross Blue Shield of Massachusetts (BCBSMA), July 2011–June 2015†



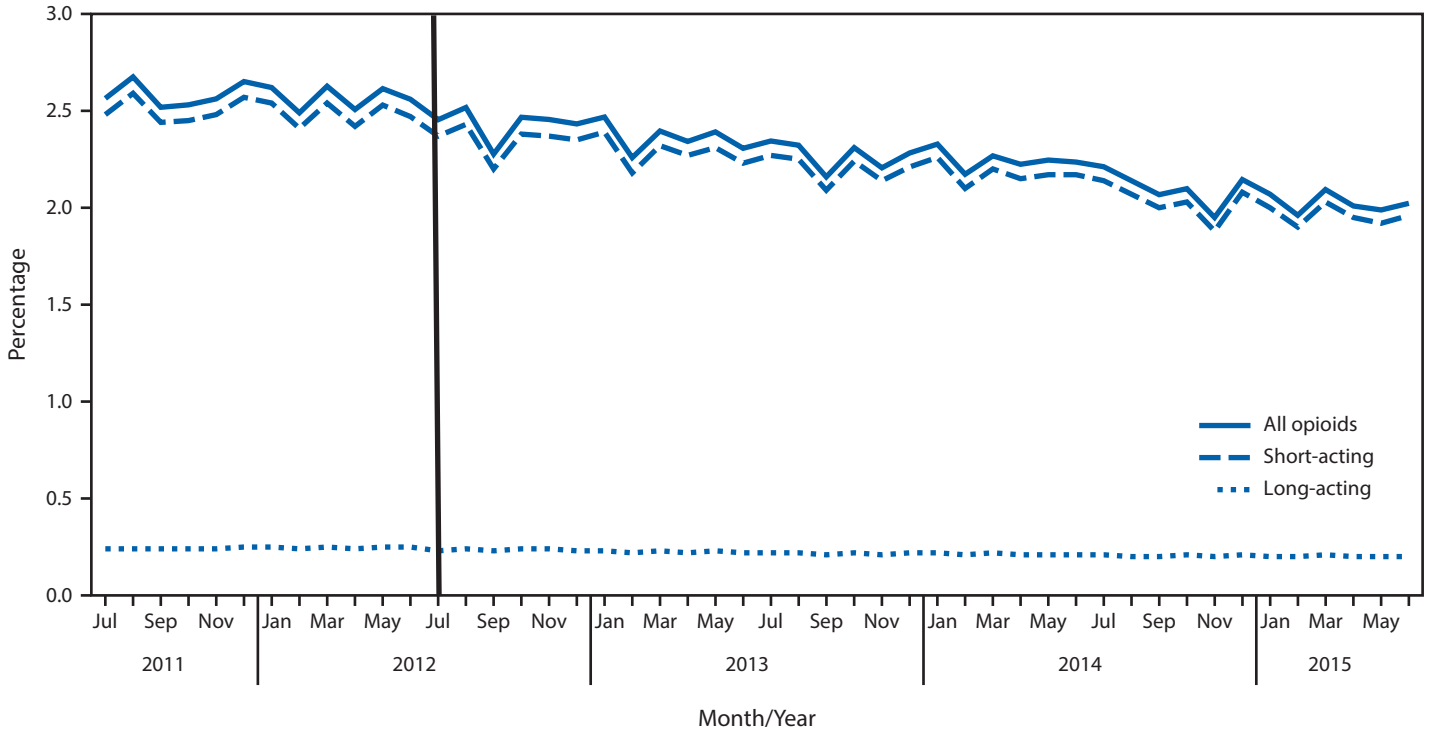
* Per 1,000 members. Based on BCBSMA total monthly member enrollment data.
† July 1, 2012, marked the start date of the BCBSMA opioid utilization program.

that other events, such as changes in policies and media coverage, contributed to the decline. Although the declines in average monthly prescribing rate and the percentage of BCBSMA members with opioid prescriptions appear modest, these data represent significant changes for a 2.8 million-member health plan. In the postimplementation period, the average monthly number of prescriptions for short-acting and long-acting opioids decreased by 14,000. The prior authorization requirement for new short-acting opioid prescriptions for >30 days prompts providers to evaluate the medical necessity of initiating opioids for extended periods, along with the concomitant risks. The decreases in dispensed opioids were highest for short-acting opioids, which also account for most of the opioid prescriptions. In accordance with a Massachusetts statute, the prior authorization requirement was changed to >21 days in August 2016.††

For nearly one in five patients, the pharmacy did not fill a buprenorphine prescription because it did not meet criteria and the patient did not subsequently seek authorization. The rejection might have occurred because the provider wrote the prescription for an off-label use or because the daily dosage was not within recommended parameters. Additional analyses by

†† https://malegislature.gov/Bills/189/House/H4056.

FIGURE 2. Percentage of members with opioid prescriptions — Blue Cross Blue Shield of Massachusetts (BCBSMA), July 2011–June 2015*



* July 1, 2012, marked the start date of the BCBSMA opioid utilization program.

TABLE 2. Annual percentage change (APC) in member opioid prescription drug use before and after implementation of an opioid utilization program, by indicator — Blue Cross Blue Shield of Massachusetts, July 2011–June 2012 (pre-implementation) and July 2012–June 2015 (postimplementation)

Indicator	APC Pre-implementation	APC Postimplementation	APC difference (95% CI)
Members with SA opioid prescription	-0.898	-7.217	-6.319 (-7.354 to -5.284)
SA opioid prescription rate*	-2.248	-8.312	-6.064 (-6.993 to -5.134)
Members with LA opioid prescription (%)	2.921	-5.854	-8.775 (-12.079 to -5.471)
LA opioid prescription rate*	3.062	-6.044	-9.105 (-12.095 to -6.115)
Members with SA or LA opioid prescription (%)	-0.716	-7.238	-6.522 (-7.540 to -5.504)
SA or LA opioid prescription rate*	-1.781	-8.104	-6.322 (-7.210 to -5.435)

Abbreviations: LA = long-acting; SA = short-acting.
* Number of prescriptions per 1,000 members.

BCBSMA found that nearly one third of patients were receiving these prescriptions from multiple providers, indicating a potential problem with poorly coordinated care. Whereas prior authorization might prevent misuse or diversion of buprenorphine, it might also be a barrier to medication-assisted treatment. Insurers can weigh the benefits and harms of requiring prior authorization for drugs used as part of medication-assisted treatment to determine what is most effective for their member population.

Although oncology patients were exempt from prior authorization requirements for new prescription opioids, the number of opioid prescriptions also declined among these patients following program implementation. Insurers frequently observe a sentinel effect following a new drug utilization program in which provider behaviors extend to their entire patient populations (*6*). Effective management of pain is a core component of quality end-of-life care and care for patients with serious advanced illness. To avoid unintentionally limiting access to pain medication for these patients, insurers can evaluate how policies affect this population to ensure that comprehensive care addresses their specific needs, including pain management. Data are not available on the impact of the decrease in prescribing among BCBSMA oncology patients on their pain management and functioning. However, in the 4 years since program launch, the only appeal of a claim related to the insurer's policy resulted from a clerical error, suggesting that these members continue to receive medically appropriate access to pain medication.

Summary

What is already known about this topic?

Overdose deaths involving opioid pain medications have reached epidemic levels in the United States, in part because of high opioid prescribing rates. Health systems and insurers play an important role in the delivery and management of pain care.

What is added by this report?

A private insurer implemented a comprehensive opioid utilization policy that included treatment plans, risk assessments, patient-provider agreements, requirements for dispensing from a single pharmacy, prior authorizations, quantity limits, and a ban on mail-order opioid prescriptions. Following implementation, monthly opioid prescribing rates and percentage of members with opioid prescriptions declined significantly.

What are the implications for public health practice?

Public health agencies and private health insurers can collaborate to ensure that both public and private insurers promote best practices in opioid prescribing.

The findings in this report are subject to at least four limitations. First, rates for nononcology opioid prescriptions might be underestimated by the inclusion of oncology members in the denominator, but the impact on trends is likely minimal because of the relatively small number of members who are oncology patients. Second, the role of other factors that potentially affected prescribing rates during this period (e.g., media coverage of opioids, increased use of the prescription monitoring program, and overlapping policy changes) could not be evaluated. In 2012, for example, the Massachusetts state legislature provided a statutory directive to address prescription drug abuse (*7*). Effective October 2014, the Drug Enforcement Administration rescheduled hydrocodone combination products to schedule II,[§§] which was followed by a decrease in hydrocodone prescribing at the national level (*8*). Although tramadol is a frequently prescribed opioid, it was excluded from the program. As a Schedule IV opioid, tramadol has a lower potential for abuse than Schedule II and Schedule III opioids; it is possible that providers, cognizant of the risks associated with opioids, altered their prescribing behaviors and substituted tramadol where possible. However, tramadol prescribing data from BCBSMA show neither an increasing nor decreasing trend, indicating tramadol substitution was not likely. Third, these results reflect a privately insured population and might not be generalizable to other populations, including persons covered under public health plans. Finally, it is not known from these data how patient pain and function were affected by limiting access to opioid prescriptions.

[§§] Imposing the same restrictions that apply to pure hydrocodone, as well as oxycodone and morphine.

State and federal initiatives to address the opioid epidemic in the United States have been implemented in the past several years, with some resulting in reduced opioid prescribing (*8*,*9*). The U.S. Department of Health and Human Services initiative targets three priority areas: improving opioid prescribing practices, distribution of naloxone to reverse overdoses, and access to medication-assisted treatment (*10*). The significant decrease in dispensing of opioids immediately after the implementation of the BCBSMA opioid utilization program suggests that this intervention played a role in the reduction of the observed monthly prescription rate. As part of quality improvement efforts, public and private insurers can implement policies that promote best practices in opioid prescribing to reduce risk among their members while ensuring access to appropriate pain management. The CDC Guideline for Prescribing Opioids for Chronic Pain (*5*), released March 2016, supports this effort and provides a comprehensive list of recommendations that can inform insurer opioid utilization programs and policies.

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References

1. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000–2014. MMWR Morb Mortal Wkly Rep 2016;64:1378–82. http://dx.doi.org/10.15585/mmwr.mm6450a3
2. Substance Abuse and Mental Health Services Administration. Results from the 2012 National Survey on Drug Use and Health: summary of national findings. NSDUH Series H-46. Rockville, MD: US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration; 2013.
3. National Center for Health Statistics. Multiple cause of death, 1999–2014. US Department of Health and Human Services, CDC, National Center for Health Statistics. https://wonder.cdc.gov/mcd-icd10.html
4. Massachusetts Department of Public Health. Data brief: opioid-related overdose deaths among Massachusetts residents. August 2016. Boston, MA: Massachusetts Department of Public Health; 2016. http://www.mass.gov/eohhs/docs/dph/quality/drugcontrol/county-level-pmp/opioid-related-overdose-deaths-among-ma-residents-august-2016.pdf
5. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain—United States, 2016. MMWR Recomm Rep 2016;65(No. RR-1). http://dx.doi.org/10.15585/mmwr.rr6501e1
6. LaPensee KT. LaPensee. Analysis of a prescription drug prior authorization program in a Medicaid health maintenance organization. J Manag Care Pharm 2003;9:36–44. http://dx.doi.org/10.18553/jmcp.2003.9.1.36
7. Massachusetts Department of Public Health. Response to the Massachusetts opioid prescription drug epidemic. 2014 report of best practices. Boston, MA: Massachusetts Department of Public Health; 2015. http://www.mass.gov/eohhs/docs/dph/quality/drugcontrol/best-practices/best-practices-workgroup-report.pdf

8. Jones CM, Lurie PG, Throckmorton DC. Effect of US Drug Enforcement Administration's rescheduling of hydrocodone combination analgesic products on opioid analgesic prescribing. JAMA Intern Med 2016;176:399–42. http://dx.doi.org/10.1001/jamainternmed.2015.7799
9. Johnson H, Paulozzi L, Porucznik C, Mack K, Herter B; Hal Johnson Consulting; Division of Disease Control and Health Promotion, Florida Department of Health. Decline in drug overdose deaths after state policy changes—Florida, 2010–2012. MMWR Morb Mortal Wkly Rep 2014;63:569–74.
10. US Department of Health and Human Services. ASPE issue brief. Opioid abuse in the U.S. and HHS actions to address opioid-drug related overdoses and deaths. March 26, 2015. Washington, DC: US Department of Health and Human Services; 2015. https://aspe.hhs.gov/basic-report/opioid-abuse-us-and-hhs-actions-address-opioid-drug-related-overdoses-and-deaths

National Progress Toward Hepatitis C Elimination — Georgia, 2015–2016

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The country of Georgia has a high prevalence of hepatitis C virus (HCV) infection, associated with exposures to HCV in health care settings with inadequate infection control and unsafe injections among persons who inject drugs (*1*). In April 2015, in collaboration with CDC and other partners, Georgia embarked on a program to eliminate HCV infection, subsequently defined as achieving a 90% reduction in prevalence by 2020. The initial phase of the program focused on providing HCV treatment to infected persons with advanced liver disease and at highest risk for HCV-associated morbidity and mortality. By April 27, 2016, a total of 27,392 HCV-infected persons registered for the program, 8,448 (30.8%) started treatment, and 5,850 patients (69.2%) completed HCV treatment. Among patients completing treatment who were eligible for posttreatment testing, 2,398 received polymerase chain reaction (PCR) testing for HCV at least 12 weeks after completion of treatment; 1,980 (82.6%) had no detectable virus, indicative of a sustained virologic response* (i.e., cure). Major challenges to achieving elimination remain, including the need to increase access to care and treatment services and implement a comprehensive approach to prevention and control of HCV infection. As a global leader in this effort, the Georgia HCV Elimination Program can help pave the way for other countries experiencing high rates of HCV infection to undertake similar initiatives.

Georgia is a country with a population of 3.7 million (*2*) and borders the Black Sea, Russia, Turkey, Armenia, and Azerbaijan. Results from a serosurvey conducted in 2015 among adults found an estimated HCV infection prevalence (i.e., tested HCV-antibody positive) of 7.7% (5.4% tested positive for active infection by PCR) (Georgia Ministry of Labor, Health, and Social Affairs [MoLHSA], unpublished data, 2016). With strong stakeholder support, including partnership and technical assistance from CDC, and commitment from Gilead Sciences to donate direct-acting antiviral HCV medications (DAAs), Georgia embarked on the world's first HCV elimination program on April 28, 2015 (*1*). Initially, four treatment centers located in Tbilisi (Georgia's capital) provided HCV treatment to program participants. By April 27, 2016, the number of treatment centers had increased to 17 and they were located throughout the country, with staff members that included 95 physicians and infectious disease specialists or gastroenterologists providing HCV treatment services. All patients had access to point-of-care and laboratory-based HCV antibody testing, viral load determination, and genotyping. Noninvasive tests used to determine the degree of hepatic fibrosis included the following: FIB-4 score, which combines age and standard blood tests (platelet count, alanine aminotransferase, aspartate aminotransferase) (*3*), and ultrasound or transient elastography, which measures the decrease in tissue elasticity that accompanies liver fibrosis (*4*,*5*). Genotyping was performed for all patients who tested positive for HCV by PCR. Six major genotypes of HCV are recognized worldwide, and treatment of HCV infection varies by genotype (*6*). Patients with advanced liver disease (F3 or F4 by METAVIR† fibrosis score) were prioritized to receive treatment during the first year of the program.

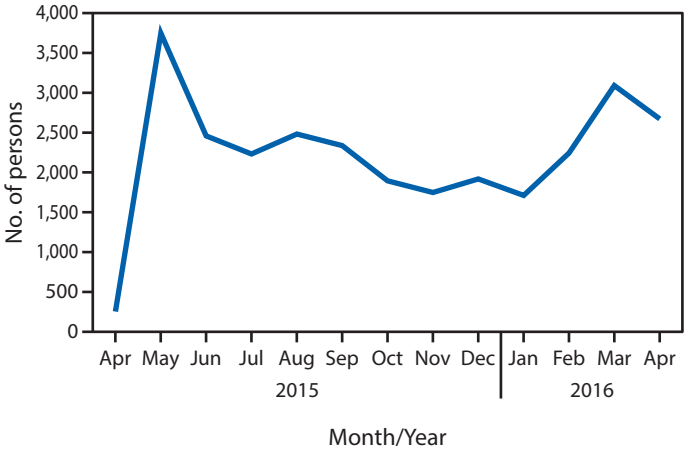
A sliding-scale approach was used for diagnostics and clinical monitoring, with patients charged based on their ability to pay and the local government or MoLHSA paying the balance. All program participants received sofosbuvir-based treatment regimens, provided free-of-charge by Gilead Sciences; the Georgian government purchased additional medications (i.e., pegylated interferon and ribavirin) and provided them at no cost to patients for whom such treatment was indicated.

During April 28, 2015–April 27, 2016, a total of 27,392 patients with evidence of HCV infection (positive HCV antibody test results) had enrolled in the program. The number of enrollees peaked during the first month of the program and generally declined over time (Figure 1). The number of patients initiating HCV treatment in the country increased linearly during the year, to a total of 8,448 (Figure 2). Of those enrolled, 27,155 (99.1%) initiated diagnostic workup, including confirmation of active HCV infection and assessment of hepatic fibrosis to determine eligibility for treatment. Among those enrolled in the program, 9,615 (36.3%) completed diagnostic workup, and 8,448 (87.9%) initiated treatment for HCV (Figure 3). Most patients treated (92.8%) met advanced liver disease criteria. The most common treatment regimens

* Sustained virologic response is defined as undetectable (or below the lower limit of quantification) HCV RNA at 12–24 weeks after cessation of treatment (Wedemeyer H, et al., http://onlinelibrary.wiley.com/doi/10.1002/hep.25888/pdf).

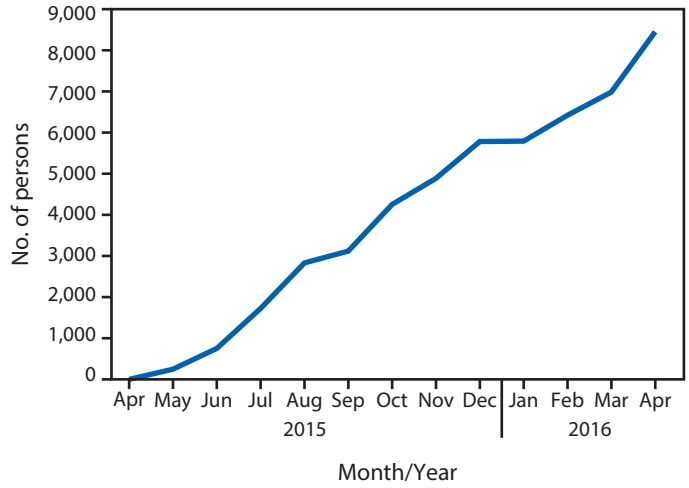
† The METAVIR score is a semiquantitative classification system that consists of an activity score and a fibrosis score, specifically designed and validated for patients with HCV (Bedossa P, et al., http://onlinelibrary.wiley.com/doi/10.1002/hep.510240201/pdf).

FIGURE 1. Number of persons with positive hepatitis C virus (HCV) results enrolling in treatment program, by month — nationwide HCV elimination program, Georgia, April 2015–April 2016*



Source: Georgia Ministry of Labor, Health, and Social Affairs.
* The number of clinical sites increased from four in April 2015 to 17 in April 2016.

FIGURE 2. Cumulative number of persons (N = 8,448) with positive hepatitis C virus (HCV) results who started HCV treatment, by month — nationwide HCV elimination program, Georgia, May 14, 2015–April 27, 2016



Source: Georgia's HCV Elimination Program Treatment Database.

were sofosbuvir in combination with ribavirin (45.4%), and sofosbuvir in combination with ribavirin and pegylated interferon (33.9%).

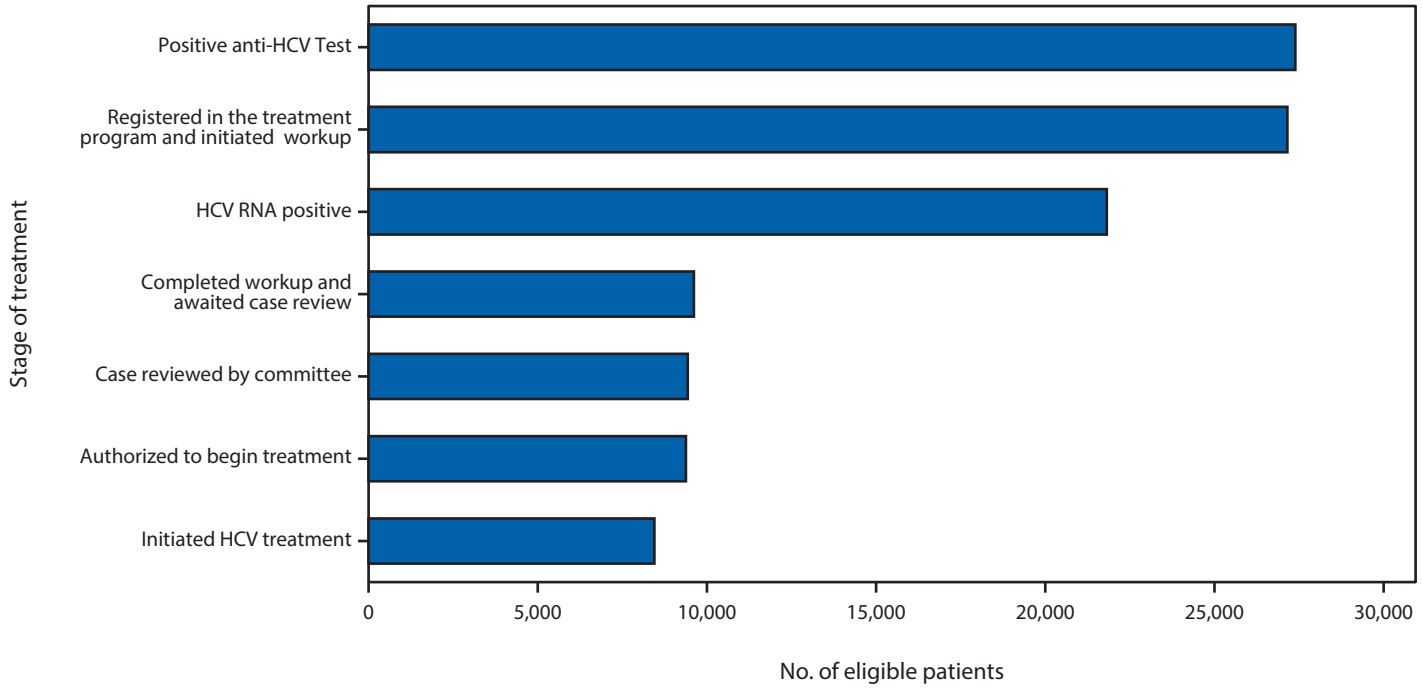
Outcome data for patients treated through April 2016 indicated that among 2,398 persons eligible for a sustained virologic response determination 12 weeks after completion of treatment and who were tested for the presence of HCV RNA, levels of HCV RNA were undetectable in 1,980 (82.6%) of those tested, indicating a virologic cure. Among those completing their course of treatment who were tested, cure rates were lowest among genotype 1 patients (72.6%; 724 of 997 patients), intermediate among those infected with genotype 2 (84.7%; 421 of 497), and highest among those with genotype 3 (92.4%; 834 of 903). Among the 8,448 who initiated treatment, 325 (3.8%), did not complete the treatment course; 173 of the 325 patients died, and 80 discontinued treatment because of an adverse event.

In mid-February 2016, Gilead Sciences began providing (free-of-charge) the newer ledipasvir/sofosbuvir DAA combination drug regimen to the program. Among participants who initiated treatment in the first year, 11.7% (n = 985) received the new regimen. This included 162 persons who restarted treatment with ledipasvir/sofosbuvir after introduction of this combination DAA for various reasons, primarily failure to achieve viral clearance after initial treatment course (n = 155). Treatment outcome data are not available for patients receiving this combination therapy.

Discussion

The Georgia HCV Elimination Program made substantial progress in its first year. Since the launch of the program in April 2015, 27,392 HCV-infected persons were enrolled and 8,448 initiated treatment, which represents a >400% increase in the number treated compared with the total number of HCV-infected persons treated in the country during the previous 4 years (*1*). Persons with advanced liver disease, who are at highest risk for morbidity and mortality, were prioritized for treatment during the first year, and >90% of those treated met this criteria as determined by ultrasound or transient elastography. Rates of virologic cure were >80% among this population. The effect on prevalence of active HCV infection, estimated at 5.4% in 2015, will be reassessed in several years as the HCV elimination program progresses and treatment coverage expands, curing most Georgians currently living with HCV infection. Georgia has taken a collaborative, informed approach to eliminating HCV infection. Together with CDC, the World Health Organization (WHO), and other international partners, Georgia's MoLHSA developed a technical advisory group (TAG), which convened its first meeting in November 2015. To help Georgia reach its proposed elimination goals, TAG recommended that MoLHSA address gaps in advocacy and awareness; surveillance; prevention of transmission, including harm reduction; blood safety; infection control in health and non–health care settings; and evidence-based screening and linkage to care (*7*). Several strategies were proposed at the meeting, including assessing Georgia's prevalence of disease and risk factors for transmission; implementing measures to prevent transmission; identifying all persons living with HCV infection; and providing patients with access to high-quality diagnostics and free treatment with DAA medications. In response to TAG recommendations and collaboration with CDC, Georgia's MoLHSA is developing

FIGURE 3. Cascade of care for hepatitis C virus (HCV)-infected patients — nationwide HCV elimination program, Georgia, April 28, 2015–April 27, 2016*,†



Abbreviation: MOLHSA = Ministry of Labor, Health, and Social Affairs.
* Patients with positive anti-HCV test began treatment at one of 17 provider sites; data from MOLHSA's financial reimbursement system.
† Of the patients who initiated HCV treatment, 162 (1.9%) with different indications have restarted HCV treatment.

a comprehensive HCV elimination plan to address important challenges and outline steps and strategies for enhanced screening and linkage-to-care activities, expansion of HCV treatment to reach populations at high risk for infection, and development of a surveillance system to assess progress toward achieving elimination goals.

Despite notable progress during the last year, major challenges remain. To ensure high-quality screening and monitoring as the program expands, a laboratory quality assurance and quality control system covering all treatment centers is needed. To monitor progress toward elimination goals, surveillance systems capable of capturing data from affected populations and those with acute disease are needed, allowing for monitoring trends and risk factors for infection. Collection of quality and timely treatment data is important to monitor the progress of the care and treatment program. These gaps will be addressed in Georgia's comprehensive HCV elimination plan, which is currently under development. As the HCV treatment program continues to expand and the number of providers and sites that provide HCV care and treatment services grows, the capacity of the information system will need to be increased. Georgia's MoLHSA is anticipating this growth and is working with partners to ensure the system is upgraded to handle additional demands.

In its first year, Georgia's HCV elimination program primarily served patients who already knew their infection status, voluntarily came to participating clinics, and enrolled in the program. However, most persons living with HCV infection are unaware of their HCV infection and consequently are not participating in the program and not receiving care and treatment. Georgia is developing a comprehensive plan that will increase patient testing, ensure that tested patients are informed of their test results, and ensure that those who test positive for HCV antibodies are provided confirmatory testing and if infected, linked to care and treatment services. As more Georgians are tested for HCV, the demand for treatment will increase. Primary care providers and settings serving populations at high risk (e.g., centers providing services such as opioid substitution therapy and needle and syringe provision to people who inject drugs) need to be prepared to provide HCV treatment, as the demand for therapy is anticipated to exceed the current capacity of providers offering treatment (i.e., infectious disease specialists and gastroenterologists).

In the near future, Georgians will likely have access to even newer DAAs associated with high rates of virologic cure regardless of HCV genotype, suggesting that genotype testing might not remain a prerequisite for treatment. Use of these antiviral medications is expected to simplify HCV diagnostics

Summary

What is already known about this topic?

Georgia is among the countries worldwide with the highest prevalence of hepatitis C virus (HCV) infection. The recent availability of highly effective, direct-acting antivirals (DAAs) capable of curing >90% of persons treated has made HCV elimination a possibility. On April 28, 2015, Georgia committed to an elimination plan, embarking on an ambitious program that included HCV screening and provision of curative treatment at no cost to infected persons.

What is added by this report?

During the first year of the HCV elimination program in Georgia, 27,392 persons enrolled in the treatment program, and 8,448 initiated treatment with DAAs. Most persons (92.8%) who began treatment had advanced liver disease. Among 2,398 persons who completed treatment and were tested to determine treatment response, >80% were cured of their HCV infection. Georgia is developing a comprehensive HCV elimination plan that will include prevention and enhanced screening and linkage to care, with the goal of reaching HCV elimination by 2020.

What are the implications for public health practice?

Substantial progress has been made to eliminate HCV infection in Georgia, and the country has demonstrated the ability for rapidly scale up of care and treatment services. To achieve elimination, substantial challenges remain, including increasing access to care and treatment services and implementing a comprehensive approach to prevention and control of HCV infection. Georgia's HCV elimination program could provide lessons for future programs to control HCV infection worldwide, particularly as treatment becomes more affordable and more countries seek to provide care and treatment services.

and patient management and monitoring in Georgia, allowing more patients to receive timely treatment. In many low-to-middle income countries with a high prevalence of HCV infection, access to advanced diagnostics is limited. Specific models of care and treatment that use simplified testing and patient management are needed to demonstrate feasibility of HCV-related care and treatment in resource-limited settings like Georgia.

The World Health Assembly endorsed the WHO strategic framework for hepatitis prevention that includes goals for the elimination of hepatitis C as a public health threat by 2030, with interim measures by 2020 (*8*). Georgia's HCV elimination program model could provide important lessons for future initiatives to control HCV infection worldwide, particularly as testing is simplified, treatment becomes more affordable, and more countries seek to address the growing prevalence of HCV infection.

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References

1. Mitruka K, Tsertsvadze T, Butsashvili M, et al. Launch of a nationwide hepatitis C elimination program—Georgia, April 2015. MMWR Morb Mortal Wkly Rep 2015;64:753–7. http://dx.doi.org/10.15585/mmwr.mm6428a2
2. National Statistics Office of Georgia. Main statistics: population. Tbilisi, Georgia: National Statistics Office of Georgia; 2016. http://geostat.ge/index.php?action=page&p_id=152&lang=eng
3. Vallet-Pichard A, Mallet V, Nalpas B, et al. FIB-4: an inexpensive and accurate marker of fibrosis in HCV infection. Comparison with liver biopsy and fibrotest. Hepatology 2007;46:32–6. http://dx.doi.org/10.1002/hep.21669
4. Talwalkar JA, Kurtz DM, Schoenleber SJ, West CP, Montori VM. Ultrasound-based transient elastography for the detection of hepatic fibrosis: systematic review and meta-analysis. Clin Gastroenterol Hepatol 2007;5:1214–20. http://dx.doi.org/10.1016/j.cgh.2007.07.020
5. Afdhal NH. Fibroscan (transient elastography) for the measurement of liver fibrosis. Gastroenterol Hepatol (N Y) 2012;8:605–7.
6. Smith DB, Bukh J, Kuiken C, et al. Expanded classification of hepatitis C virus into 7 genotypes and 67 subtypes: updated criteria and genotype assignment web resource. Hepatology 2014;59:318–27. http://dx.doi.org/10.1002/hep.26744
7. Ministry of Labour Health and Social Affairs of Georgia. Hepatitis Technical Advisory Group (TAG) recommendations for achieving the 2020 goals towards eliminating hepatitis C infection in the country of Georgia. Tbilisi, Georgia: Ministry of Labour Health and Social Affairs of Georgia; 2015. http://www.moh.gov.ge/files//2016/Failebi/09.06.16-1.pdf
8. World Health Organization. Draft global health sector strategies: viral hepatitis, 2016–2021. Geneva, Switzerland: World Health Organization; 2016. http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_32-en.pdf?ua=1

Status of New Vaccine Introduction — Worldwide, September 2016

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Since the global Expanded Program on Immunization (EPI) was launched in 1974, vaccination against six diseases (tuberculosis, polio, diphtheria, tetanus, pertussis, and measles) has prevented millions of deaths and disabilities (*1*). Significant advances have been made in the development and introduction of vaccines, and licensed vaccines are now available to prevent 25 diseases (*2*,*3*). Historically, new vaccines only became available in low-income and middle-income countries decades after being introduced in high-income countries. However, with the support of global partners, including the World Health Organization (WHO) and the United Nations Children's Fund, which assist with vaccine prequalification and procurement, as well as Gavi, the Vaccine Alliance (Gavi) (*4*), which provides funding and shapes vaccine markets through forecasting and assurances of demand in low-income countries in exchange for lower vaccine prices, vaccines are now introduced more rapidly. Based on data compiled in the WHO Immunization Vaccines and Biologicals Database* (*5*), this report describes the current status of introduction of *Haemophilus influenzae* type b (Hib), hepatitis B, pneumococcal conjugate, rotavirus, human papillomavirus, and rubella vaccines, and the second dose of measles vaccine. As of September 2016, a total of 191 (99%) of 194 WHO member countries had introduced Hib vaccine, 190 (98%) had introduced hepatitis B vaccine, 132 (68%) had introduced pneumococcal conjugate vaccine (PCV), and 86 (44%) had introduced rotavirus vaccine into infant vaccination schedules. Human papillomavirus vaccine (HPV) had been introduced in 67 (35%) countries, primarily targeted for routine use in adolescent girls. A second dose of measles-containing vaccine (MCV2) had been introduced in 161 (83%) countries, and rubella vaccine had been introduced in 149 (77%). These efforts support the commitment outlined in the Global Vaccine Action Plan (GVAP), 2011–2020 (*2*), endorsed by the World Health Assembly in 2012, to extend the full benefits of immunization to all persons.

Data on the status of vaccine introduction into the country's routine immunization program, as of September 2016, were obtained from the WHO Immunization Vaccines and Biologicals Database, which receives vaccine introduction reports from 194 WHO countries. Vaccine introduction status is also presented by the 73 countries that were eligible† for support from Gavi for new vaccine introduction at any time since 2000 (*5*).

In 1992, WHO recommended hepatitis B vaccine as the first new vaccine in the childhood immunization schedule beyond the original EPI vaccines.§ Hepatitis B vaccine is now included in childhood immunization schedules in 190 (98%) countries, including 119 (61%) countries that have implemented a birth dose to prevent perinatal transmission of hepatitis B virus, as recommended by WHO in 2009 (*6*).

In 2000, Hib vaccine was only in widespread use in the WHO Region of the Americas and European Region. By 2006, when WHO recommended Hib vaccine in all routine infant immunization schedules, 108 countries, accounting for >55% of the world's children, had introduced routine Hib vaccination (*7*). During the last decade, with continued WHO and Gavi support, expansion has continued and, as of September 2016, a total of 191 (98%) countries had incorporated Hib vaccine in national immunization schedules, including all 73 Gavi-eligible countries. Hib vaccine has not yet been introduced in China, the Russian Federation, and Thailand (*5*) (supplemental map 1, at https://stacks.cdc.gov/view/cdc/41681).

In 2007, WHO recommended use of PCV in all countries, prioritizing its introduction in countries with high pneumonia prevalence and high mortality rates among children aged <5 years. By 2008, although 24 high-income and two middle-income countries had initiated routine PCV vaccination, no countries in Africa or Asia, regions with high rates of pneumonia mortality among children aged <5 years, had yet introduced PCV (*8*). However, by September 2016, PCV had been introduced in national immunization schedules in 132 (68%) countries, and six more are planning introduction by the end of 2016. Among the 73 Gavi-eligible countries, 56 (77%) had introduced PCV, and three are planning introduction by the end of 2016 (*5*) (Figure 1).

Rotavirus vaccination has been recommended by WHO for inclusion in all national immunization schedules since 2009, particularly in countries with high rotavirus gastroenteritis–associated mortality, including South and Southeast Asia and sub-Saharan Africa. By September 2016, rotavirus vaccine had been introduced in 86 (44%) countries, including 38 (52%) Gavi-eligible countries. Five more countries plan to introduce rotavirus vaccine by the end of 2016 (*5*) (Figure 2).

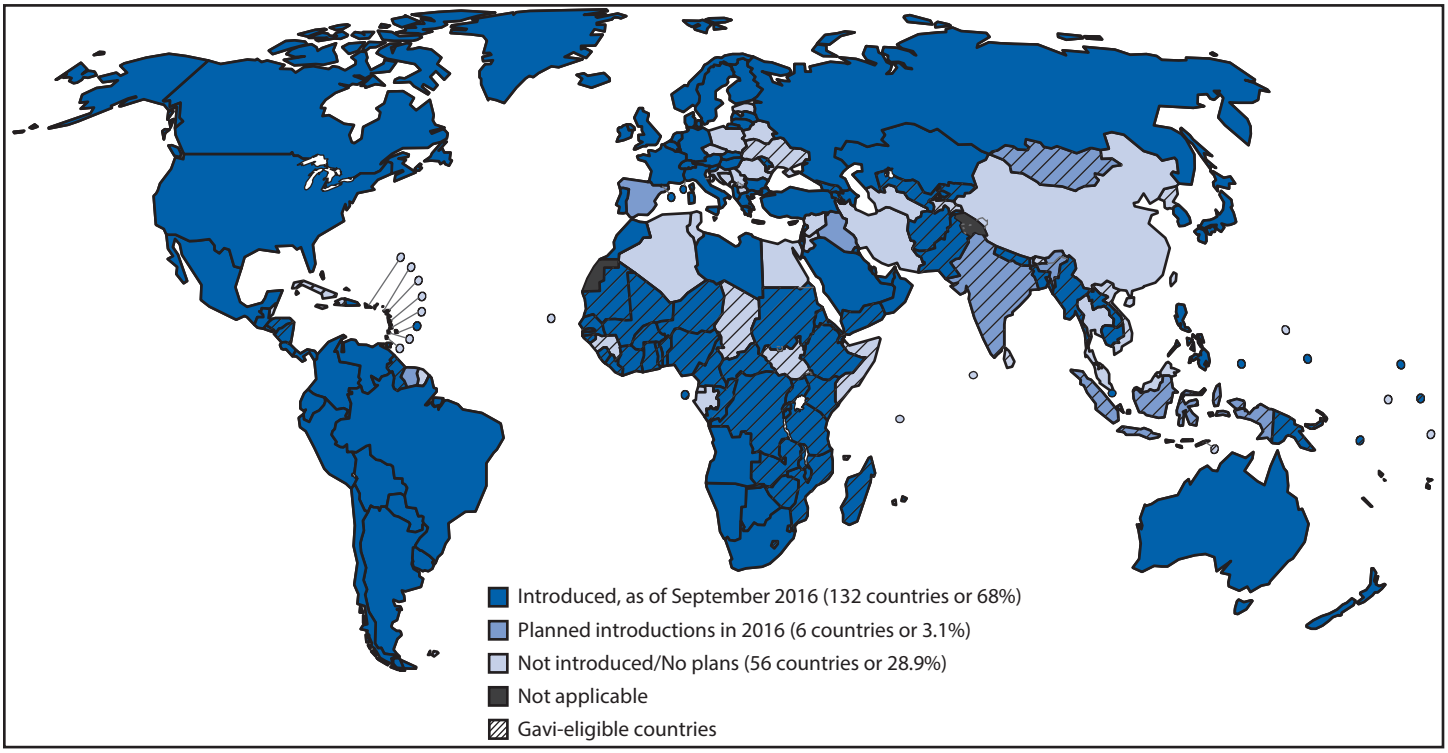
Before 2012, HPV was not widely used outside North America, Australia, and Europe. In 2009, WHO recommended

* http://www.who.int/immunization/monitoring_surveillance/data/en.

† Gavi-eligible countries can choose to introduce a new vaccine without Gavi support. These data show Gavi eligibility, not necessarily Gavi support.

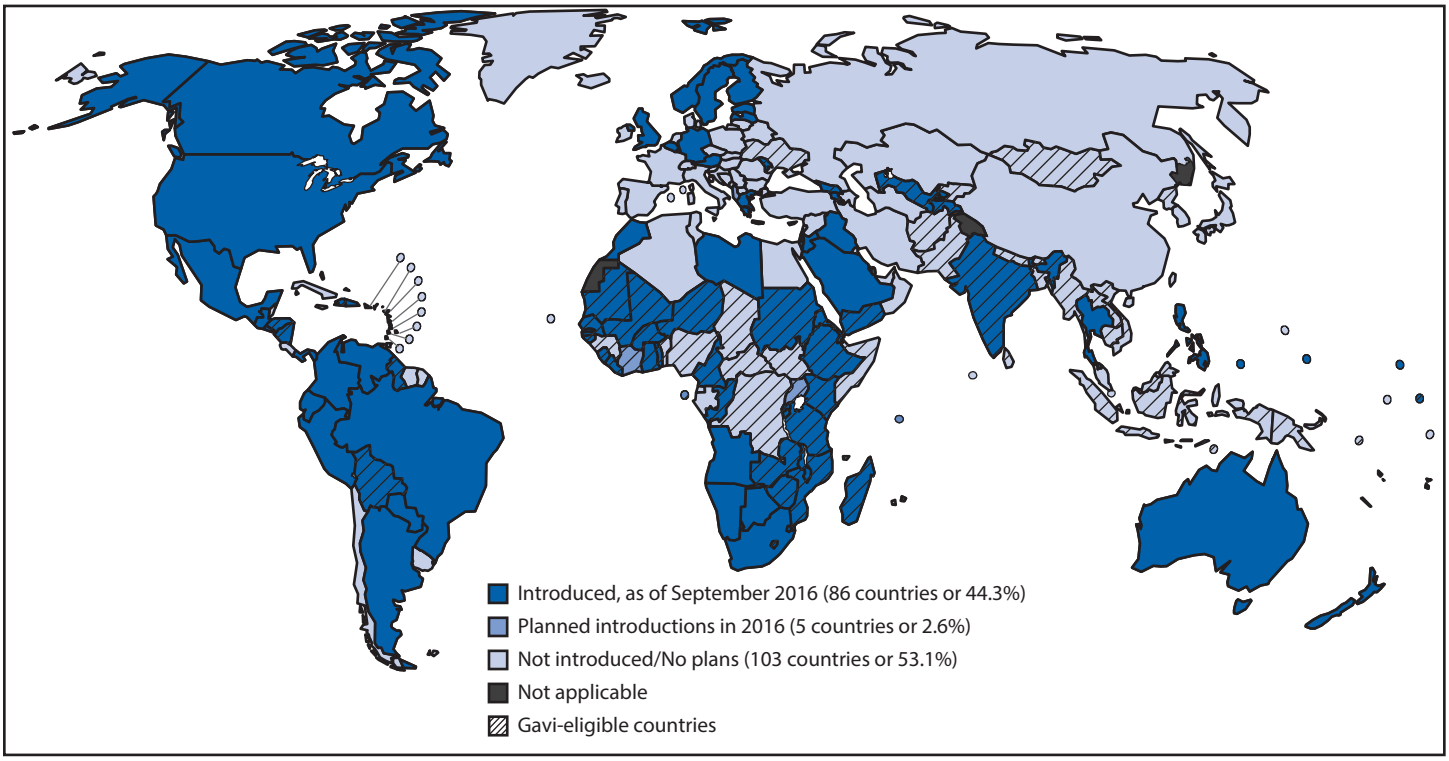
§ The original EPI vaccines protect against complications of tuberculosis in childhood (Bacille Calmette-Guérin [BCG] vaccine); diphtheria, tetanus, and pertussis (DTP vaccine); polio; and measles.

FIGURE 1. Countries with current or planned use of pneumococcal conjugate vaccine (PCV) in the national immunization program, as of September 2016



Source: World Health Organization, Immunization Vaccines and Biologicals Database, September 2016. http://www.who.int/immunization/monitoring_surveillance/data/en/.
Abbreviation: Gavi = Gavi, the Vaccine Alliance.

FIGURE 2. Countries with current or planned use of rotavirus vaccine in the national immunization program, as of September 2016



Source: World Health Organization, Immunization Vaccines and Biologicals Database, September 2016. http://www.who.int/immunization/monitoring_surveillance/data/en/.
Abbreviation: Gavi = Gavi, the Vaccine Alliance.

HPV for adolescent girls in all countries where cervical cancer prevention is a public health priority and introduction is feasible and sustainable. By September 2016, HPV had been introduced in 67 (35%) countries (*5*) (Figure 3). Among Gavi-eligible countries, 23 (32%) had conducted HPV pilot demonstration projects, and three had introduced HPV nationally.

Since 2009, WHO recommended 2 doses of MCV as the standard for all national immunization schedules (*9*). Routine MCV2 is usually administered during the second year of life, although in some countries it is scheduled around the age of school entry. As of September 2016, MCV2 had been introduced in 161 (83%) countries, and two countries have planned introduction in 2016 (*5*) (supplemental map 2, at https://stacks.cdc.gov/view/cdc/41682). Forty-six (63%) Gavi-eligible countries had introduced MCV2.

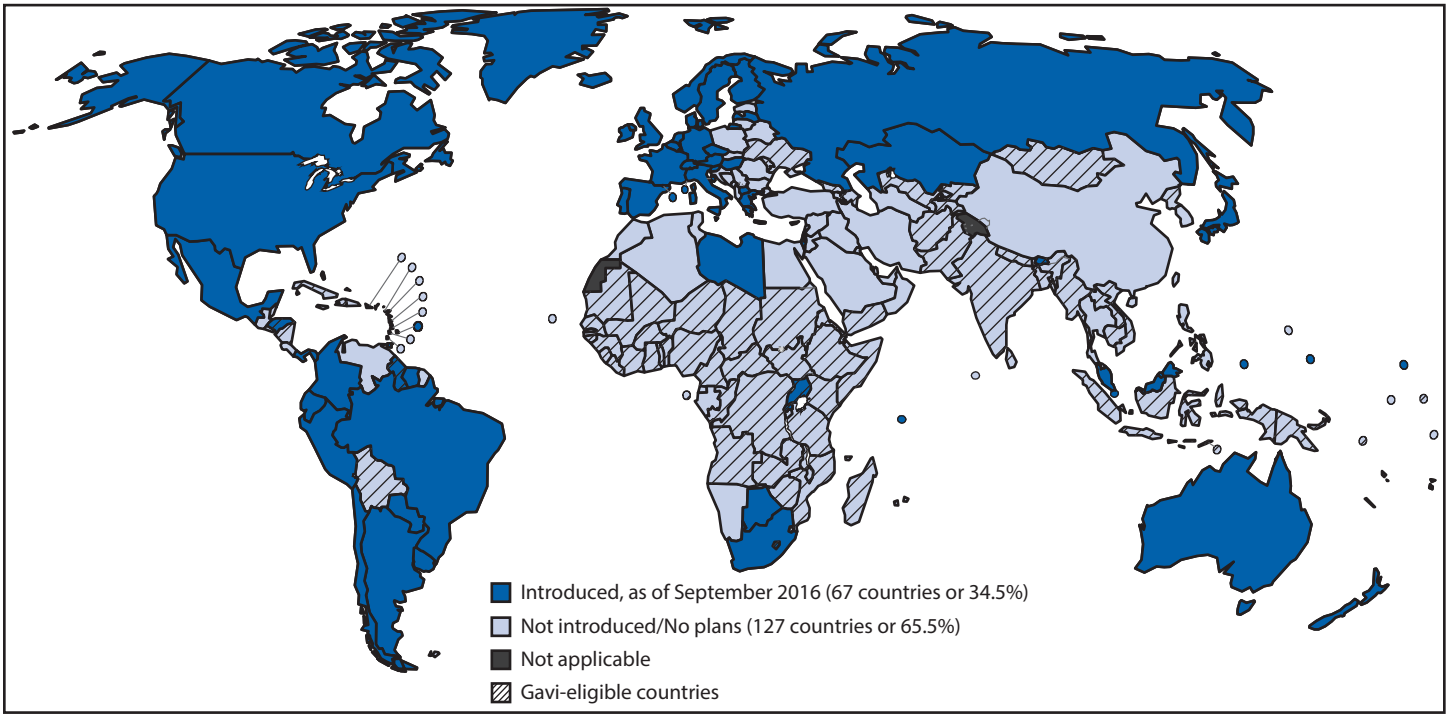
Rubella vaccine was first licensed in 1969 and initially was used primarily in high-income and middle-income countries. By 1996, only 85 countries included rubella vaccine in national immunization schedules. Since a 2011 Gavi commitment to support rubella vaccine introduction using combined measles-rubella vaccine, more countries have introduced rubella-containing vaccines, and, as of September 2016, rubella vaccine was included in national immunization schedules in 149 (77%) countries (*5*) (supplemental map 3, at https://stacks.cdc.gov/view/cdc/41683). Thirty-five (48%) Gavi-eligible countries had introduced rubella-containing vaccine in national immunization schedules.

Discussion

With the recognition of immunization as a core component of the human right to health, the availability of innovative funding mechanisms, and stronger international partnerships, vaccines are increasingly being introduced into national immunization schedules (*2*). Nearly all countries have introduced hepatitis B vaccine, more than three fourths have introduced rubella, MCV2 and Hib vaccines, and two thirds have introduced PCV. However, fewer than half have introduced rotavirus vaccine or HPV. In addition, market analyses indicate that recently introduced vaccines are reaching low-income countries faster than in the past. For example, Hib vaccine, introduced in 1989, took 20 years to reach 70% of low-income countries; PCV, introduced in 2000, is anticipated to reach 70% of low-income countries 5 years sooner (*10*). Although uneven, the overall success in extending vaccine introduction reflects both global commitment to achieving the GVAP goals and growing technical and resource capacities in low-income and middle-income countries.

Despite available resources from donors to introduce vaccines in countries, countries might choose not to introduce a particular vaccine because of national policies; financial

FIGURE 3. Countries with current or planned use of human papillomavirus vaccine (HPV) in the national immunization program, as of September 2016



Source: World Health Organization, Immunization Vaccines and Biologicals Database, September 2016. http://www.who.int/immunization/monitoring_surveillance/data/en/.
Abbreviation: Gavi = Gavi, the Vaccine Alliance.

Summary

What is already known about this topic?

Historically, new vaccines only became available in low-income and middle-income countries decades after being introduced in high-income countries. However, with support of global partners including the World Health Organization (WHO) and the United Nations Children's Fund, which assist with vaccine prequalification and procurement, as well as Gavi, the Vaccine Alliance, which provides funding and shapes vaccine markets through forecasting and assurances of demand in low-income countries, in exchange for lower vaccine prices, vaccines are now introduced more rapidly.

What is added by this report?

As of September 2016, a total of 191 (99%) of 194 WHO member countries had introduced Hib vaccine, 190 (98%) had introduced hepatitis B vaccine, 132 (68%) had introduced pneumococcal conjugate vaccine (PCV), and 86 (44%) had introduced rotavirus vaccine into infant vaccination schedules. Human papillomavirus vaccine (HPV) had been introduced in 67 (35%) countries, targeted toward adolescent girls. A second dose of measles-containing vaccine (MCV2) had been introduced in 161 (83%) countries, and rubella vaccine had been introduced in 149 (77%).

What are the implications for public health practice?

Sustaining the health gains made through new vaccine introduction will require country commitment and funding, ensuring vaccine supply, creating and maintaining new age and target population delivery platforms, and addressing competing demands on health care systems and resources. New or improved vaccines for diseases such as meningitis, cholera, typhoid, malaria, and dengue will be available in the near future, bringing with them additional delivery and financing challenges along with the promise of decreased morbidity and mortality and the opportunity to further strengthen health systems.

constraints on implementation; lack of disease burden data; or vaccine hesitancy by the community, health system, or policymakers. Establishing and strengthening independent advisory mechanisms at the national level (e.g., National Immunization Technical Advisory Groups) is critical for improving leadership in making informed and evidence-based recommendations about the introduction and financial sustainability of vaccines.

In countries where vaccines have been recently introduced into the national schedule, incomplete coverage might result in many children not receiving these vaccines. Immunization programs must closely review vaccine implementation and coverage to identify actions necessary to ensure equity and optimize impact. Continued progress in vaccine introduction will require national commitment and funding, ensuring vaccine supply and procurement, creating and maintaining new age and target population delivery platforms, and addressing competing demands on health care systems and resources. This is particularly critical for lower–middle-income countries and countries transitioning from eligibility for Gavi support, based on the World Bank data for gross national income.

Strategies that can help provide vaccine supply security include innovative pricing and procurement mechanisms, especially for lower–middle-income countries, as well as supply-side interventions and support for the manufacture of affordable vaccines in middle-income countries (*1*). Recent supply shortages of rotavirus, PCV, and other vaccines demonstrate the need to work with manufacturers at the global level to prevent stockouts (i.e., situations in which local vaccine providers run out of stock) or missed opportunities. Global and regional training initiatives targeting national programs have contributed to considerable improvements in vaccine stock management and cold-chain capacity; sustaining these infrastructure efforts will be important, particularly for vaccines that involve delivery and monitoring in new settings (e.g., school-based or outreach vaccination).

Vaccine introduction provides opportunities for strengthening a country's immunization program and overall health system. Although vaccine introductions might require additional resources and innovative delivery strategies (e.g., school-based delivery of HPV, delivery of the hepatitis B birth dose as part of neonatal care), platforms for providing immunization to new age groups offer opportunities to improve access to health care and facilitate vaccination throughout the life course. Scheduled immunization visits provide a platform for integrating other public health interventions (e.g., vitamin A supplementation, deworming, bed nets for malaria prevention, and growth monitoring) to improve overall health. Delivering vaccination services beyond infancy (e.g., MCV2 in the second year of life) also offers an opportunity to provide vaccines missed during infancy to protect the child and improve vaccination coverage in the community. New partnerships established for vaccine introduction can enhance the delivery and efficiency of health services in new settings (e.g., ministries of education for school-based HPV vaccination) and strengthen traditional sites of service delivery. These partnerships also can support social and operational research and new communication strategies needed to increase acceptance of new vaccines by the target populations and among persons involved in the delivery of vaccines.

Sustaining the health gains made through vaccine introduction requires continued support for implementation, as well

as support for surveillance to monitor disease burden, vaccine effectiveness, and vaccine safety. New or improved vaccines for diseases such as meningitis, cholera, typhoid, malaria, and dengue will be available in the near future, bringing with them additional delivery and financing challenges along with the promise of decreased morbidity and mortality and the opportunity to further strengthen health systems.

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References

1. Bland J, Clements J. Protecting the world's children: the story of WHO's immunization programme. World Health Forum 1998;19:162–73.
2. World Health Organization. Global Vaccine Action Plan: 2011–2020. Geneva, Switzerland: WHO Press; 2013. http://www.who.int/immunization/global_vaccine_action_plan/en/
3. World Health Organization. WHO recommendations for routine immunization—summary tables. Geneva, Switzerland: World Health Organization; 2015. http://www.who.int/immunization/policy/immunization_tables/en/
4. Gavi, the Vaccine Alliance. Keeping children healthy: the Vaccine Alliance Progress Report 2015. Geneva, Switzerland: Gavi, the Vaccine Alliance; 2015. http://www.gavi.org/progress-report/
5. World Health Organization. Immunization Vaccines and Biologicals Database, September 2016. Geneva, Switzerland: World Health Organization; 2016. http://www.who.int/immunization/monitoring_surveillance/data/en/
6. World Health Organization. Hepatitis B vaccines. Wkly Epidemiol Rec 2009;84:405–19.
7. Watt JP, Wolfson LJ, O'Brien KL, et al.; Hib and Pneumococcal Global Burden of Disease Study Team. Burden of disease caused by *Haemophilus influenzae* type b in children younger than 5 years: global estimates. Lancet 2009;374:903–11. http://dx.doi.org/10.1016/S0140-6736(09)61203-4
8. O'Brien KL, Wolfson LJ, Watt JP, et al.; Hib and Pneumococcal Global Burden of Disease Study Team. Burden of disease caused by *Streptococcus pneumoniae* in children younger than 5 years: global estimates. Lancet 2009;374:893–902. http://dx.doi.org/10.1016/S0140-6736(09)61204-6
9. World Health Organization. A guide to introducing a second dose of measles vaccine into routine immunization schedules. Geneva, Switzerland: World Health Organization; 2013. http://www.who.int/immunization/documents/WHO_IVB_13.03/en/
10. Vaccine Information Management System (VIMS) Report: Global Vaccine Introduction, December 2015. In: a report on current access to new childhood vaccines. Baltimore, MD: International Vaccine Access Center (IVAC), Johns Hopkins Bloomberg School of Public Health; 2015. http://www.jhsph.edu/research/centers-and-institutes/ivac/view-hub/IVAC-VIMS-Report-2015Dec.pdf

Vital Signs: Dental Sealant Use and Untreated Tooth Decay Among U.S. School-Aged Children

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On October 18, 2016, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Abstract

Background: Tooth decay is one of the greatest unmet treatment needs among children. Pain and suffering associated with untreated dental disease can lead to problems with eating, speaking, and learning. School-based dental sealant programs (SBSP) deliver a highly effective intervention to prevent tooth decay in children who might not receive regular dental care. SBSPs benefits exceed their costs when they target children at high risk for tooth decay.

Methods: CDC used data from the National Health and Nutrition Examination Survey (NHANES) 2011–2014 to estimate current prevalences of sealant use and untreated tooth decay among low-income (≤185% of federal poverty level) and higher-income children aged 6–11 years and compared these estimates with 1999–2004 NHANES data. The mean number of decayed and filled first molars (DFFM) was estimated for children with and without sealants. Averted tooth decay resulting from increasing sealant use prevalence was also estimated. All reported differences are significant at $p<0.05$.

Results: From 1999–2004 to 2011–2014, among low- and higher-income children, sealant use prevalence increased by 16.2 and 8.8 percentage points to 38.7% and 47.8%, respectively. Among low-income children aged 7–11 years, the mean DFFM was almost three times higher among children without sealants (0.82) than among children with sealants. Approximately 6.5 million low-income children could potentially benefit from the delivery of sealants through SBSP.

Conclusions and Implications for Public Health Practice: The prevalence of dental sealant use has increased; however, most children have not received sealants. Increasing sealant use prevalence could substantially reduce untreated decay, associated problems, and dental treatment costs.

Introduction

National data from 1999–2004 indicate that by age 19 years, approximately one in five children have untreated tooth decay (*1*). Children living in poverty are more than twice as likely to have untreated decay (27%) than are children in families whose income exceeds 200% of the federal poverty level (FPL) (13%). Untreated tooth decay can lead to pain and infection, resulting in problems with eating, speaking, and learning (*2*). Approximately 16% of children living in poverty were reported by a parent to have had a toothache within the last 6 months (*3*). A recent multivariate analysis also found that children with poor oral health miss more school days and receive lower grades than children with good oral health (*4*).

Approximately 90% of tooth decay in permanent teeth occurs in the chewing surfaces of the back teeth (*5*). Much of this decay could be prevented with the application of dental sealants. Sealants are plastic coatings applied to the pits and fissures in tooth surfaces to prevent decay-causing bacteria and food particles from collecting in these hard-to-clean surfaces. Studies on sealant effectiveness indicate that sealants delivered in clinical or school settings prevent about 81% of decay at two years after placement, 50% at four years and can continue to be effective for up to 9 years through adolescence (*6*); no clinically significant adverse effects have been associated with receipt of sealants (*6*). Sealants are underused, especially among low-income children who have the highest risk for decay. National data from 1999–2004 indicated the prevalence of sealant use among children aged 6–11 years living in poverty was 21% compared with 40% among children from families with incomes >200% of the FPL (*1*). Increasing sealant use prevalence is a national health goal (*7*) and the National Quality Forum* has endorsed dental care performance measures aimed at increasing sealant use prevalence in children at elevated risk for tooth decay (*8*).

School-based sealant programs (SBSP) typically deliver sealants in schools attended by a large number of children participating in the free/reduced-price meal program (i.e., family

* http://www.qualityforum.org/Home.aspx.

Key Points

- Tooth decay is one of the most common chronic diseases of childhood. If left untreated, tooth decay can have serious consequences including problems with eating, speaking, and learning.
- Two years after placement, dental sealants prevent >80% of cavities in the permanent molars, in which nine in 10 cavities occur. Most children, however, do not have dental sealants, especially children from low-income families. These children are twice as likely as higher-income children to have untreated tooth decay.
- Providing sealants through school-based programs is an effective way to increase sealant use. The benefits of school-based dental sealant programs exceed their cost when they serve children at high risk for tooth decay. The programs become cost-saving after 2 years and save $11.70 per sealed tooth over 4 years.
- In this study, approximately 60% of children aged 6–11 years from low-income families (approximately 6.5 million children), did not have dental sealants. Although sealant prevalence during the last decade increased by 72% among low-income children, these children were still 20% less likely than children from higher-income families to have dental sealants. Children without sealants had almost three times more cavities in permanent first molars compared with children with sealants.
- Providing sealants to the approximately 6.5 million low-income children who currently do not have them would prevent 3.4 million cavities over 4 years.
- Additional information is available at http://www.cdc.gov/vitalsigns.

income ≤185% of the FPL) (*6*). The Community Preventive Services Task Force† (Task Force) recommends SBSP, on the basis of strong evidence that these programs prevent tooth decay and increase the number of children receiving sealants at schools (*6*). A second, systematic review of economic evaluations of SBSP conducted for the Task Force found that the benefits of SBSP exceed their cost when they serve children at high risk for tooth decay, becoming cost-saving after 2 years (*6*) and saving $11.70 per tooth sealed over 4 years (*9*).

In this report, CDC estimated prevalence of sealant use and untreated tooth decay among low-income (≤185% of FPL, the qualification point for free/reduced-price meal program) and higher-income children aged 6–11 years using data from the recently released 2011–2014 NHANES and compared these data with data from the 1999–2004 NHANES. Estimates of tooth decay averted by providing sealants to children were also calculated.

Methods

To estimate current prevalences of sealant use and untreated decay for U.S. children aged 6–11 years, CDC combined the two most recent cycles of NHANES data (2011–2012 and 2013–2014). NHANES is a multistage probability sample of the noninstitutionalized U.S. population.§ A child was classified as having sealants if at least one permanent tooth was assessed by a dentist to have a sealant present and as having untreated tooth decay if at least one permanent tooth had untreated decay.

Sealant use prevalence is presented for all children aged 6–11 years as well as for the following characteristics: sex; race/ethnicity; family income ≤185% of FPL versus >185% of FPL; and highest level of education achieved by the head of household. Sealant use and untreated decay prevalence stratified by family income from NHANES 2011–2014 were compared with prevalences from NHANES 1999–2004. Sealant use and untreated decay status were assessed in the same way for both periods (*1*). Among children aged 7–11 years,¶ the mean number of decayed and filled first molars (DFFM) was estimated for children with and without sealants, by family income status. For each income group, CDC used a published methodology to estimate the number of DFFM that would have occurred over 4 years if a child had not received sealants soon after eruption of the first molars (*10*). This value was multiplied by the prevented fraction (50%) (*6*) to estimate averted DFFM per child attributable to sealants over 4 years. Estimates were standardized by year of age to the distribution in the 2000 U.S. Census (*1*).

Analyses were conducted using statistical software that accounts for the complex sample design of NHANES. Estimates from NHANES were obtained using the examination sample weights. All statistical tests were conducted at a 95% significance level ($p<0.05$). Estimates with relative standard errors >0.3 were classified as unstable. To test whether sealant use prevalence varied with the characteristic of the child during 2011–2014, CDC used a chi-square test of independence. A t-test was used to determine whether changes in sealant use and decay prevalences between surveys or mean DFFM by sealant status and income were significant.

† http://www.thecommunityguide.org/about/aboutTF.html.

§ http://www.cdc.gov/nchs/nhanes.htm.

¶ Children aged 6 years were excluded because permanent first molars can erupt between ages 6 and 7 years (http://www.ada.org/~/media/ADA/Publications/Files/patient_58.ashx).

Results

Approximately 43% of children aged 6–11 years received at least one dental sealant (Table 1), and sealant use prevalence among low-income children (38.7%) was approximately 9.1 percentage points lower than among higher-income children (47.8%). Sealant use prevalence was highest among non-Hispanic white children (46.0%) and children from households where the head of household had more than a high school education (45.2%) and lowest among non-Hispanic black children (32.2%) and children from households where the head of household had a high school education (37.7%).

From 1999–2004 to 2011–2014, overall prevalence of dental sealant use increased from 31.1%–43.6% (Table 2); increased by 16.2 percentage points to 38.7% (relative increase of 72.0%) among low-income children; and increased by 8.8 percentage points (relative increase of 22.6%) among higher-income children. Untreated decay decreased by 4.9 percentage points to 7.5% among low-income children and remained at about 4% among higher-income children.

Among children aged 7–11 years, the mean DFFM was significantly lower for both higher-income and low-income children with at least one sealant (0.19 and 0.29, respectively) compared with children with no sealants (0.52 and 0.82, respectively) (Table 3). The difference in mean DFFM between children with and without sealants was 0.33 and 0.52 for higher- and low-income children, respectively.

The estimated average annual probability of a permanent first molar developing decay, calculated with DFFM data by year of age for children aged 7–11 years, was 0.07 for low-income children (data not shown). Because of unstable estimates, this probability was not estimated for higher-income children. Over 4 years, sealing all four permanent first molars of low-income children is estimated to prevent 0.52 DFFM per child (Table 4). The NHANES 2011–2014 dataset had sealant and income information for 1,371 low-income children aged 6–11 years, representing 10.5 million children nationally. Based on the proportion of low-income children without sealants in the NHANES dataset, it is estimated that approximately 6.5 million low-income children currently are not receiving the preventive benefits of dental sealants. Providing sealants to these low-income children would prevent 3.4 million DFFM over 4 years.

TABLE 1. Prevalence of dental sealants among children aged 6–11 years* by selected sociodemographic characteristics — National Health and Nutrition Examination Survey, United States, 2011–2014

Characteristic	No.	Weighted no. (millions)	% (95% CI)
Total†	**2,365**	**22.5**	**43.2 (39.8–46.8)**
Sex			
Male	1,202	11.4	43.0 (38.8–47.5)
Female	1,163	11.1	43.3 (39.1–47.6)
Race/Ethnicity§			
White, non-Hispanic	592	11.8	46.0 (41.3–50.9)
Black, non-Hispanic	665	3.2	32.2 (25.9–39.1)
Mexican American	494	3.6	42.7 (37.0–48.7)
Family Income§			
≤185% FPL	1,371	10.5	38.7 (34.3–43.3)
>185% FPL	850	10.9	47.8 (42.6–53.0)
Head-of-household education§			
Less than high school	500	3.6	40.3 (35.1–45.7)
High school	461	3.7	37.7 (30.8–45.0)
More than high school	1,367	14.8	45.2 (41.8–48.7)

Abbreviations: CI = confidence interval; FPL = federal poverty level.
* Total N = 2,365, representing 22,581,565 U.S. children; standardized by year of age, to age distribution in 2000 U.S. Census.
† Includes 614 persons of other races (including multiracial persons), 144 with missing family income, and 37 who were missing/refused head-of-household education status.
§ Chi-square test of independence significant at p<0.05.

Conclusions and Comments

Increasing sealant use prevalence among low-income children could substantially reduce tooth decay. Because the benefits of sealants can last up to 9 years, and untreated decay prevalence is about twice as high for adolescents and young adults aged 12–19 years compared with younger children, it is likely that much of the pain and limitations in eating and learning associated with untreated decay could be prevented by timely application of sealants. In addition, providing sealants to these children could save societal resources. The systematic review of economic evaluations of SBSP conducted for the Task Force found that SBSP became cost-saving within 2 years of placing sealants (*6*). That review further found that delivering sealants to children at high risk for tooth decay could be cost-saving to Medicaid (*9*).

Data from the Agency for Healthcare Research and Quality indicate that less than half of children aged 6–11 years from families with incomes <125% of the FPL had a past-year dental visit in 2013 (*11*). Sealants must be placed by a licensed dental professional with dental equipment; therefore, the lack of timely dental visits among low-income children might be an important reason that 60% lack sealants. Applying sealants in schools is an effective strategy to increase the prevalence of sealant application among children not accessing regular dental care, but few schools offer these programs. One survey of state oral health programs found that few states have SBSP in the majority of their high-need schools (i.e., >50% of students participating in free/reduced meal program) (*12*). Financing is a major barrier to implementing and maintaining SBSP (*13*). Federal funding of state oral health programs is largely competitive and varies widely by state (*13*). Many state and local SBSP cover part of their expenses by Medicaid billing (*13*). Because labor accounts for about two thirds of SBSP costs (*6*),

TABLE 2. Changes* in prevalence of dental sealants and untreated decay among children aged 6–11 years by family income — National Health and Nutrition Examination Survey, United States, 1999–2004 and 2011–2014

	1999–2004		2011–2014		Difference	
Prevalence	No.	% (95% CI)	No.	% (95% CI)	Percentage points	(95% CI)
Sealants						
All income groups	2,789	31.1 (27.7 to 34.7)	2,221	43.6 (39.9 to 47.3)	12.4†	(7.3 to 17.5)
≤185% FPL	1,655	22.5 (18.6 to 26.9)	1,371	38.7 (34.3 to 43.3)	16.2†	(10.1 to 22.4)
>185% FPL	1,134	39.0 (34.8 to 43.3)	850	47.8 (42.6 to 53.0)	8.8†,§	(2.1 to 15.6)
Untreated decay						
All income groups	2,854	7.6 (6.1 to 9.5)	2,284	5.9 (4.8 to 7.1)	-1.8§	(-3.8 to 0.3)
≤185% FPL	1,692	12.4 (9.9 to 15.5)	1,410	7.5 (5.8 to 9.5)	-4.9†,§	(-8.3 to -1.6)
>185% FPL	1,162	3.5 (2.5 to 5.0)	874	4.3 (3.0 to 6.1)	0.8§	(-1.2 to 2.7)

Abbreviations: CI = confidence interval, FPL = federal poverty level.
* Standardized by year of age to age distribution in 2000 U.S. Census.
† Significant at p<0.05 for t-test.
§ Relative standard error >30%.

TABLE 3. Mean number of decayed and filled first molars (DFFM) among children aged 7–11 years,* by family income and sealant status — National Health and Nutrition Examination Survey, United States, 2011–2014

	With sealants			No sealants			Difference	
Family income status	No.	DFFM	(95% CI)	No.	DFFM	(95% CI)	DFFM	(95% CI)
≤185% FPL	467	0.29	(0.23–0.36)	698	0.82	(0.69–0.94)	0.52†	(0.37–0.67)
>185% FPL	362	0.19	(0.11–0.28)	381	0.52	(0.35–0.69)	0.33†	(0.14–0.51)

* Children aged 6 years excluded because permanent first molar can erupt between ages 6 and 7 years.
† Difference is significant at p<0.05 for t-test.

TABLE 4. Estimated mean number of new decayed and filled permanent first molars (DFFM) per child without sealants and DFFM averted with sealants for each year since placement and four-year total, among children aged 6–11 years from families with incomes ≤185% of federal poverty level — United States, 2011–2014

Years since sealant placement	DFFM per child (without sealants)	DFFM averted per child (with sealants)
1	0.29	0.15
2	0.27	0.13
3	0.25	0.13
4	0.23	0.12
Total	**1.04**	**0.52**

revenues from Medicaid billing are more likely to cover costs if state policies allow dental hygienists or therapists to assess a child's need for and to place sealants without a dentist being present. For example, in South Carolina, SBSPs managed and staffed by dental hygienists deliver sealants in approximately 40% of high-need schools (*12*). These SBSP are primarily financed by Medicaid billing (*13*).

Another barrier to children receiving sealants in clinical and school settings is low health literacy. A study of California third graders found that their parent's health literacy and speaking English at home were strong predictors of the child having sealants (*14*). An Institute of Medicine report on increasing access to dental care among vulnerable and underserved populations also found that low oral health literacy was a major barrier to receiving preventive dental services (*15*).

The findings in this report are subject to at least one limitation. Because NHANES is not designed to provide estimates by year of age, a large number of estimates of DFFM by year of age and sealant status were unstable. However, among low-income children, all estimates of DFFM used to estimate the annual probability that an unsealed first molar developed decay were stable.

Children with sealants can still be at risk for tooth decay. Whereas fluoride can prevent decay in all teeth, sealants are primarily used to protect the back teeth from decay. Healthy behaviors documented to prevent decay include brushing with fluoride toothpaste and drinking fluoridated water or taking fluoride supplements if drinking water is not optimally fluoridated (*2*). Many of the studies included in the evidence informing the Task Force's recommendation for SBSP were conducted among children using fluoride toothpaste in communities with fluoridated water (*6*), suggesting that sealants provide additional benefit even among children receiving fluoride. Regularly scheduled dental visits are important to deliver preventive services (e.g., topical fluoride) and to monitor and control tooth decay and other oral conditions (*2*). SBSP can help caregivers of eligible children enroll in public insurance programs (*5*,*6*) and can increase utilization of dental care by identifying tooth decay in children who are not regularly seen by a dentist and referring them for needed dental treatment.

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References

1. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988–1994 and 1999–2004. Vital Health Stat 11 2007;(248):1–92.
2. US Department of Health and Human Services. Oral health in America: a report of the Surgeon General. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000. http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/Documents/hck1ocv.@www.surgeon.fullrpt.pdf
3. Lewis C, Stout J. Toothache in US children. Arch Pediatr Adolesc Med 2010;164:1059–63. http://dx.doi.org/10.1001/archpediatrics.2010.206
4. Jackson SL, Vann WF Jr, Kotch JB, Pahel BT, Lee JY. Impact of poor oral health on children's school attendance and performance. Am J Public Health 2011;101:1900–6. http://dx.doi.org/10.2105/AJPH.2010.200915.
5. Gooch BF, Griffin SO, Gray SK, et al. Preventing dental caries through school-based sealant programs: updated recommendations and reviews of evidence. J Am Dent Assoc 2009;140:1356–65. http://dx.doi.org/10.14219/jada.archive.2009.0070
6. Community Preventive Services Task Force. Guide to community preventive services. Preventing dental caries: school-based dental sealant delivery programs. US Department of Health and Human Services, Community Preventive Services Task Force; 2016. http://www.thecommunityguide.org/oral/schoolsealants.html
7. US Department of Health and Human Services. Healthy people 2020. Topics and objectives: oral health. Washington, DC: US Department of Health and Human Services; 2013. https://www.healthypeople.gov/2020/topics-objectives/topic/oral-health?topicid=32
8. National Quality Forum. Oral health performance measurement: environmental scan, gap analysis and measure topics prioritization—technical report. Washington, DC: National Quality Forum; 2012. http://www.qualityforum.org/Publications/2012/07/Oral_Health_Performance_Measurement_Technical_Report.aspx
9. Griffin SO, Naavaal S, Scherrer CR, Patel M, Chattopadhyay S. Evaluation of school-based dental sealant programs: an updated community guide systematic economic review. Am J Prev Med. In press 2016.
10. Griffin SO, Jones K, Crespin M. Calculating averted caries attributable to school-based sealant programs with a minimal data set. J Public Health Dent 2014;74:202–9. http://dx.doi.org/10.1111/jphd.12047
11. Agency for Healthcare Research and Quality. Table 3: Dental services—mean and median expenses per person with expense and distribution of expenses by source of payment: United States, 2013. Rockville, MD: US Department of Health and Human Services, Agency for Healthcare Research and Quality; Medical Expenditure Panel Survey; 2013. https://meps.ahrq.gov/data_stats/quick_tables_results.jsp?component=1&subcomponent=0&tableSeries=1&year=-1&SearchMethod=1&Action=Search
12. The Pew Charitable Trusts. States stalled on dental sealant programs. Philadelphia, PA: The Pew Charitable Trusts; 2015. http://www.pewtrusts.org/en/research-and-analysis/reports/2015/04/states-stalled-on-dental-sealant-programs
13. Children's Dental Health Project. Dental sealants proven to prevent tooth decay: a look at issues impacting the delivery of state and local school-based sealant programs. Washington, DC: Children's Dental Health Project; 2014. https://www.cdhp.org/resources/314-dental-sealants-proven-to-prevent-tooth-decay
14. Mejia GC, Weintraub JA, Cheng NF, et al. Language and literacy relate to lack of children's dental sealant use. Community Dent Oral Epidemiol 2011;39:318–24. http://dx.doi.org/10.1111/j.1600-0528.2010.00599.x
15. Institute of Medicine; National Research Council. Improving access to oral health care for vulnerable and underserved populations. Washington, DC: The National Academies Press; 2011. http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2011/Improving-Access-to-Oral-Health-Care-for-Vulnerable-and-Underserved-Populations/oralhealthaccess2011reportbrief.pdf

Notes from the Field

Outbreak of Zika Virus Disease — American Samoa, 2016

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During December 2015–January 2016, the American Samoa Department of Health (ASDoH) detected through surveillance an increase in the number of cases of acute febrile rash illness. Concurrently, a case of laboratory-confirmed Zika virus infection, a mosquito-borne flavivirus infection documented to cause microcephaly and other severe brain defects in some infants born to women infected during pregnancy (*1*,*2*) was reported in a traveler returning to New Zealand from American Samoa. In the absence of local laboratory capacity to test for Zika virus, ASDoH initiated arboviral disease control measures, including public education and vector source reduction campaigns. On February 1, CDC staff members were deployed to American Samoa to assist ASDoH with testing and surveillance efforts.

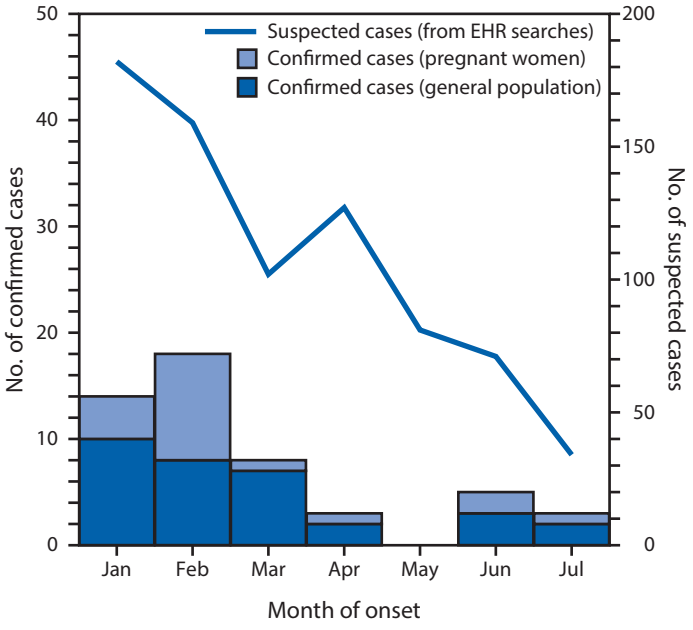
To track the progression of the outbreak in the absence of confirmed case results, trends in the number of suspected Zika virus disease cases were monitored through syndromic surveillance using automated searches of the electronic health record (EHR) system at the one hospital and four health care clinics in the territory. Suspected cases were identified among persons having ≥1 admission diagnosis of "Zika," "dengue," "chikungunya," "viral exanthem," "acute fever," or "rash." During January–July 2016, among a total population of 55,502 persons, 756 suspected cases were identified for an overall incidence of 13.6 per 1,000 persons. The incidence of suspected cases was highest (18.4 per 1,000) in Ituau County (population = 4,676).

To establish laboratory capabilities, ASDoH collaborated with the Pacific Island Health Officer Association, the Hawaii Department of Health, and CDC. During January–July 2016, serum specimens were collected from 98 pregnant women who had sought testing, regardless of their symptoms, as well as from 90 nonpregnant female and male patients within 5 days of at least one sign or symptom of Zika virus disease, including fever, rash, arthralgia, or conjunctivitis. Weekly shipments of two to 25 specimens (median = eight specimens per week) were sent to the Hawaii Department of Health laboratory for testing and to CDC's Arboviral Diseases Branch for confirmatory testing; among the 188 specimens collected, two were damaged during shipping and could not be tested. Fifty-one (27%) of the 186 specimens tested had evidence of recent Zika virus infection by real-time, reverse transcription–polymerase chain reaction (rRT-PCR) (n = 25) or by sequential testing using immunoglobulin M antibody capture enzyme-linked immunosorbent assay (MAC-ELISA) and neutralizing antibody titers against Zika virus that were ≥fourfold higher than titers against dengue virus (n = 26) (*3*).

Among the 98 pregnant women who were tested, 19 (19%) had laboratory evidence of recent Zika virus infection, including 18 of 70 (26%) symptomatic women and one of 28 (4%) asymptomatic woman. One case of dengue virus infection was identified by MAC-ELISA and neutralizing antibody testing; no cases of chikungunya were identified. The overall incidence of confirmed Zika virus infection was 0.92 per 1,000 persons and was highest (2.77 per 1,000) in Leasina County (population = 1,807). The weekly number of both suspected infections identified through syndromic surveillance and confirmed infections peaked during January 24–30; the month with the highest number of confirmed cases was February (Figure). In any week, there were four to 34 (median = 11) times as many suspected cases as confirmed cases identified.

A registry of all currently pregnant women identified in the territory was created to facilitate monitoring for adverse

FIGURE. Number of laboratory-confirmed* cases of Zika virus infection in pregnant women (n = 19) and the general population (n = 32), and number of suspected cases derived from electronic health record (EHR) searches (n = 756), by month of onset — American Samoa, January 3–July 16, 2016



* By real-time reverse transcription–polymerase chain reaction or serology.

outcomes and implementing targeted prevention efforts. Pregnancies beginning as early as May 2015 were identified through EHR searches, and newly identified pregnancies were reported by the four prenatal clinics on the island. Data from 674 women were entered in the registry, including all 98 pregnant women who were tested. Initial medical record review indicated that the majority of pregnant women who sought prenatal care did so during their third trimester of pregnancy. To encourage women to seek earlier prenatal care, public messaging and clinic fee waivers were implemented. To reduce the risk of Zika virus transmission, prenatal health clinics distributed Zika prevention kits containing mosquito repellents, bed nets, and condoms to 674 pregnant women.

This report details the introduction of Zika virus into American Samoa and the challenges presented during the response. Off-island testing by the Hawaii Department of Health and CDC facilitated identification of 51 confirmed Zika virus infections. Because of delays inherent in off-island testing, the existing ASDoH EHR system was used to identify suspected cases for outbreak tracking, and to identify pregnancies for monitoring. The trend in suspected cases approximated the trend in confirmed cases over time, but not by county. Collaboration among multiple public health agencies helped to mitigate these challenges and highlights the importance of continued strengthening and coordination of epidemiologic and laboratory capacity in the Pacific Islands.

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References

1. Rasmussen SA, Jamieson DJ, Honein MA, Petersen LR. Zika virus and birth defects—reviewing the evidence for causality. N Engl J Med 2016;374:1981–7. http://dx.doi.org/10.1056/NEJMsr1604338
2. Broutet N, Krauer F, Riesen M, et al. Zika virus as a cause of neurologic disorders. N Engl J Med 2016;374:1506–9. http://dx.doi.org/10.1056/NEJMp1602708
3. CDC. Zika virus disease and Zika virus infection, 2016 case definition. Atlanta, GA: CDC; 2016. https://wwwn.cdc.gov/nndss/conditions/zika-virus-disease-and-zika-virus-congenital-infection/case-definition/2016/

Notes from the Field

Pediatric Emergency Department Visits for Buprenorphine/Naloxone Ingestion — United States, 2008–2015

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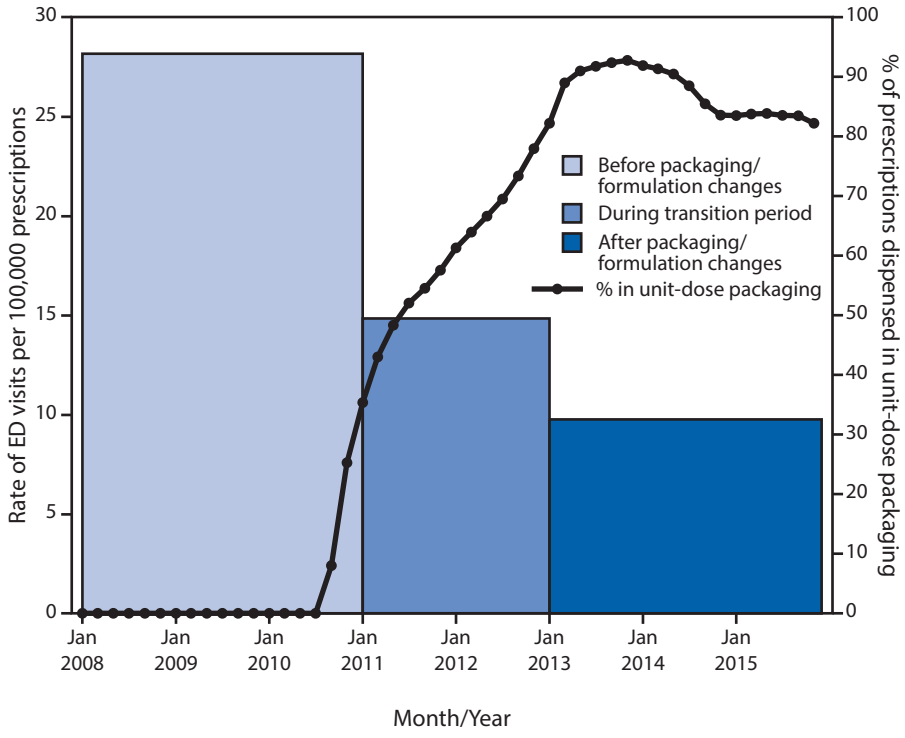
Expanding access to office-based medication-assisted treatment with buprenorphine/naloxone for opioid dependence is a key part of the national strategy to address the opioid abuse epidemic (*1*). However, as buprenorphine/naloxone prescribing increased, emergency department (ED) visits and hospitalizations for unsupervised ingestions by young children began to increase, with buprenorphine/naloxone ingestions becoming the most common cause of hospitalization for medication ingestions by young children during 2010–2011 (*2*). Buprenorphine ingestions might be asymptomatic or can cause drowsiness, vomiting, or respiratory depression, which if untreated can result in death (*3*). Buprenorphine/naloxone was available only as tablets in multidose child-resistant bottles (Suboxone) until late 2010, when film strips packaged in unit-dose, child-resistant pouches were introduced. In 2013, tablets became available in unit-dose packaging (Zubsolv). Because unit-dose, child-resistant packaging encloses each dose until opened, it might limit unintended ingestions by young children compared with traditional child-resistant bottles that must be resecured after every use (*4*). This study compared ED visits for pediatric buprenorphine/naloxone ingestions before and after these product packaging/formulation changes.

Rates of ED visits for ingestions by children aged <6 years were calculated for the years 2008–2015 from estimates of ED visits for buprenorphine/naloxone ingestions (National Electronic Injury Surveillance System-Cooperative Adverse Drug Event Surveillance [NEISS-CADES] project) and dispensed outpatient prescriptions (IMS Health: National Prescription Audit) (*5*). NEISS-CADES and IMS Health are national samples, with each case or prescription weighted to allow calculation of nationally representative estimates. A two-tailed test was used to evaluate any change in rates over the study period.

The estimated number of dispensed buprenorphine/naloxone prescriptions nearly tripled from 2008 (3,178,571) to 2015 (9,122,150). During 2008–2010, nearly all (97.6%) buprenorphine/naloxone prescriptions were dispensed as tablets in multidose bottles; by 2013–2015, most (86.9%) prescriptions were dispensed as unit-dose packaged tablets or film strips (Figure).

Based on 183 cases, there were an estimated 8,136 (95% confidence interval [CI] = 4,892–11,380) ED visits for buprenorphine/naloxone ingestions by children aged <6 years from 2008–2015. Three fourths of visits (75.4%;

FIGURE. Estimated rate of emergency department (ED) visits for unsupervised buprenorphine/naloxone ingestions by children aged <6 years per 100,000 dispensed prescriptions, compared with estimates of the percentage of outpatient buprenorphine/naloxone prescriptions dispensed in unit-dose packaging — United States, 2008–2015*



* Estimates of ED visits for pediatric buprenorphine/naloxone ingestions were based on 2008–2015 data from the National Electronic Injury Surveillance System-Cooperative Adverse Drug Event Surveillance project. Estimates of dispensed prescriptions and the percentage dispensed in unit-dose packaging were based on data from the IMS Health National Prescription Audit (2008–2015). Key dates of product changes were as follows: Suboxone buprenorphine/naloxone film in unit-dose packaging available (October 2010); first generic buprenorphine/naloxone products available as tablets in multidose bottles (February 2013); Suboxone buprenorphine/naloxone tablets in multidose bottles discontinued (March 2013); first buprenorphine/naloxone tablets (Zubsolv) available in unit-dose packaging (September 2013).

CI = 67.5%–83.2%) involved children aged 1 or 2 years, and half the visits (50.5%; CI = 36.6%–64.5%) involved boys. Most visits required hospitalization (61.6%; CI = 46.7%–76.5%). During 2008–2010, there were an estimated 1,246 ED visits (CI = 662–1,830) annually for buprenorphine/naloxone ingestions by children aged <6 years, compared with an estimated 799 visits (CI = 324–1,274) annually during 2013–2015. Accounting for prescribing frequency, ED visits for unsupervised buprenorphine/naloxone ingestions declined 65.3%, from an estimated 28.2 ED visits per 100,000 dispensed prescriptions during 2008–2010 to an estimated 9.8 per 100,000 dispensed prescriptions during 2013–2015 (p = 0.011).

The approximate two thirds reduction in the rate of ED visits by children for buprenorphine/naloxone ingestions as the proportion of prescriptions dispensed in unit-dose packaging increased to over 80%, suggests that packaging/formulation changes might reduce pediatric ingestions. A study of poison center calls for pediatric buprenorphine/naloxone exposures also found a significantly lower rate of calls involving film strips in unit-dose packaging, compared with tablets in multidose bottles (*6*). Other factors potentially contributing to the rate reduction include increased counseling of patients on safe use and storage (*7*) and a decline in pediatric medication ingestions overall (22% from 2010 to 2013) (*8*).

Although substantially decreased, ED visits for pediatric ingestions of buprenorphine/naloxone were not eliminated after widespread adoption of unit-dose, child-resistant packaging. One explanation might be that some patients using buprenorphine/naloxone for medication-assisted treatment divide doses rather than consuming the entire unit, leaving unused partial doses accessible to children. In addition, the proportion of buprenorphine/naloxone prescriptions dispensed in unit-dose packaging began to decline at the end of 2013, reflecting the introduction of generic buprenorphine/naloxone tablets packaged in multidose bottles. Citing concern for pediatric exposures, the Massachusetts Office of Medicaid made unit-dose packaged products available to those in households with children aged <6 years (*9*). At least one manufacturer of the generic product has voluntarily transitioned to unit-dose packaging, but others continue to use multidose bottles (*7*).

To improve access to medication-assisted treatment, the U.S. Department of Health and Human Services nearly tripled the maximum patient limit for buprenorphine prescribers in July 2016 (*1*). As prescribing increases, and if multidose bottles again become the predominant form of packaging, it will be important to monitor the rate of ED visits for pediatric buprenorphine ingestions and respond if the rate increases.

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References

1. Medication assisted treatment for opioid use disorders. 42 C.F.R. 8. (2016). https://www.federalregister.gov/articles/2016/07/08/2016-16120/medication-assisted-treatment-for-opioid-use-disorders
2. CDC. Notes from the field: emergency department visits and hospitalizations for buprenorphine ingestion by children—United States, 2010–2011. MMWR Morb Mortal Wkly Rep 2013;62:56.
3. Kim HK, Smiddy M, Hoffman RS, Nelson LS. Buprenorphine may not be as safe as you think: a pediatric fatality from unintentional exposure. Pediatrics 2012;130:e1700–3. http://dx.doi.org/10.1542/peds.2012-1342
4. Budnitz DS, Salis S. Preventing medication overdoses in young children: an opportunity for harm elimination. Pediatrics 2011;127:e1597–9. http://dx.doi.org/10.1542/peds.2011-0926
5. IMS Health. National prescription audit: January 2008 through December 2015. Collegeville, PA: IMS Health; 2016.
6. Lavonas EJ, Banner W, Bradt P, et al. Root causes, clinical effects, and outcomes of unintentional exposures to buprenorphine by young children. J Pediatr 2013;163:1377–83.e1–3. http://dx.doi.org/10.1016/j.jpeds.2013.06.058
7. Buprenorphine-Containing Transmucosal Products for Opioid Dependence Companies. Risk evaluation and mitigation strategy. Medication guides. https://www.btodrems.com/SitePages/MedicationGuides.aspx
8. Lovegrove MC, Weidle NJ, Budnitz DS. Trends in emergency department visits for unsupervised pediatric medication exposures, 2004–2013. Pediatrics 2015;136:e821–9. http://dx.doi.org/10.1542/peds.2015-2092
9. The Commonwealth of Massachusetts Executive Office of Health and Human Services. Suboxone film and unintentional pediatric exposures (prescriber letter). Quincy, MA: The Commonwealth of Massachusetts Executive Office of Health and Human Services; 2012. http://www.mass.gov/eohhs/docs/masshealth/pharmacy/suboxone-film-ped-exposures.pdf

Notes from the Field

Chlorination Strategies for Drinking Water During a Cholera Epidemic — Tanzania, 2016

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Since August 2015, the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) of Tanzania has been leading the response to a widespread cholera outbreak. As of June 9, 2016, cholera had affected 23 of 25 regions in Tanzania, with 21,750 cumulative cases and 341 deaths reported (Ally Nyanga, MoHCDGEC Emergency Operations Center, personal communication, June 2016). Approximately one fourth of all cases occurred in the Dar es Salaam region on the east coast. Regions surrounding Lake Victoria, in the north, also reported high case counts, including Mwanza with 9% (Ally Nyanga, MoHCDGEC Emergency Operations Center, personal communication, June 2016). Since the start of the outbreak, MoHCDGEC and the Ministry of Water (MOW) have collaborated with the Tanzania Red Cross Society, United Nations Children's Fund (UNICEF), World Health Organization (WHO), and CDC to enhance the water, sanitation, and hygiene (WASH) response to prevent the further spread of cholera.

Access to safe drinking water is critical and prevents cholera transmission (*1*). Chlorination effectively and affordably disinfects water and protects against recontamination. Because water quality might deteriorate after chlorination (*2*), during cholera outbreaks WHO recommends a minimum free chlorine residual of 2.0 mg/L at the point-of-filling for tanker trucks, 1.0 mg/L for standpipes and wells, and 0.2-0.5 mg/L at point-of-use (*3*). To ensure adequate free chlorine residual in drinking water, MoHCDGEC and MOW have encouraged municipal water authorities to increase chlorination of piped water to WHO-recommended free chlorine residual levels, and, because of the variety of water delivery mechanisms, developed two additional strategies in collaboration with WASH partners, including a bulk chlorination strategy in Dar es Salaam and a household water treatment strategy in Mwanza.

The bulk chlorination strategy in Dar es Salaam targeted water tanks of private vendors. These vendors sell to households where piped water supplies are limited. Vendors received a supply of 8.68-g sodium dichloroisocyanurate (NaDCC) tablets that disinfect up to 5,000-L volumes as well as instructions on proper use (*4*). In February 2016, this strategy was piloted in the Manzese Ward, one of 27 wards in the Kinondoni District, in Dar es Salaam. Ward health officers were given test kits and trained to monitor free chlorine residual in water tanks each week. Activities included mapping of vendor locations, distribution of a 3-month supply of NaDCC tablets, and weekly free chlorine residual monitoring of storage tanks. The pilot in Manzese Ward was successful, and the strategy was then expanded to four additional cholera-affected wards in Kinondoni District. As of June 9, 2016, a total of 430 vendors, representing the majority of water vendors, have been mapped and 313 vendors in Kinondoni received tablets. Because of encouraging results, this program was subsequently expanded to two other districts in Dar es Salaam, as well as to parts of Morogoro and Zanzibar. An evaluation of the program will be completed in October 2016.

To increase access to safe drinking water at the household level, especially for communities that rely on untreated lake water for drinking, WASH partners developed a strategy for distribution of 67-mg NaDCC tablets that treat 20-L volumes. Cholera-affected communities in four regions of Tanzania were identified based on case counts, case-fatality rates, and recent cholera cases as reported by local Tanzania Red Cross volunteers. With support from UNICEF, the Tanzania Red Cross Society distributed a 1-month supply of NaDCC tablets and provided cholera prevention education to households in communities in the Mwanza region; distribution to three other regions followed. CDC provided 9 million tablets for this campaign, including 6 million tablets for distribution to cholera-affected regions and 3 million tablets as a reserve supply for future outbreaks. Distribution of NaDCC tablets to priority communities in Mwanza has been completed. WASH partners are committed to providing continued support in implementation and monitoring to improve access to safe drinking water during the cholera epidemic and beyond.

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References

1. Waldman RJ, Mintz ED, Papowitz HE. The cure for cholera—improving access to safe water and sanitation. N Engl J Med 2013;368:592–4. http://dx.doi.org/10.1056/NEJMp1214179
2. World Health Organization. Guidelines for drinking-water quality, 4th ed. Geneva, Switzerland: World Health Organization; 2016. http://apps.who.int/iris/bitstream/10665/44584/1/9789241548151_eng.pdf
3. World Health Organization. Chlorine monitoring at point sources and in piped distribution systems. Fact Sheet 2.30. Geneva, Switzerland: World Health Organization; 2016. http://www.who.int/water_sanitation_health/hygiene/emergencies/fs2_30.pdf
4. Clasen T, Edmondson P. Sodium dichloroisocyanurate (NaDCC) tablets as an alternative to sodium hypochlorite for the routine treatment of drinking water at the household level. Int J Hyg Environ Health 2006;209:173–81. http://dx.doi.org/10.1016/j.ijheh.2005.11.004

Errata

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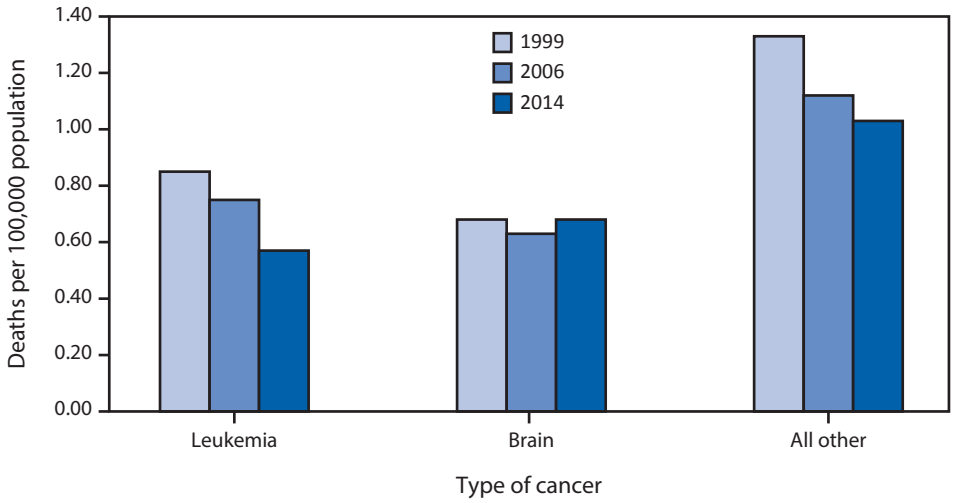
In the report, "Physical Inactivity Among Adults Aged 50 Years and Older — United States, 2014," on page 955, in "TABLE. Self-reported prevalence of inactivity among adults aged ≥50 years, by selected characteristic — Behavioral Risk Factor Surveillance System, 2014" two footnote symbols in the first column were incorrect. The cancer category header should have read **Cancer**[††] and the coronary heart disease category header should have read **Coronary heart disease**[§§]. The corresponding footnotes beneath the Table were correct: "[††]Excluding skin cancer" and "[§§]Coronary heart disease includes myocardial infarction and coronary heart disease."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Cancer Death Rates* for Children and Teens Aged 1–19 Years — United States, 1999, 2006, and 2014†



* Includes leukemia, brain cancer, and all other types of cancer (including "unspecified" types of cancer) determined using *International Classification of Disease, Tenth Revision* underlying cause of death codes: brain cancer (C71), leukemia (C91-C95), and all other sites (C00-C97).
† Decline from 1999 to 2014 for leukemia and cancer of all other types was statistically significant ($p<0.05$).

The death rate for children and teens aged 1–19 years caused by leukemia decreased by 33%, from 0.85 per 100,000 population in 1999 to 0.57 in 2014. The brain cancer death rate fluctuated from 1999 to 2014, but remained statistically stable (0.68 in 1999 and in 2014). For all other cancer types, death rates for children and teens aged 1–19 years declined by 23%, from 1.33 in 1999 to 1.03 in 2014. Brain cancer replaced leukemia as the leading cancer death type in 2014.

Sources: CDC/NCHS, National Vital Statistics System, Mortality Data (http://www.cdc.gov/nchs/nvss/deaths.htm); NCHS Data Brief No. 257 (http://www.cdc.gov/nchs/products/databriefs/db257.htm).

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