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HIV Preexposure Prophylaxis in the U.S. Military Services — 2014–2016

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Human immunodeficiency virus (HIV) infection is a substantial health concern for the U.S. Department of Defense (DoD) and for service members stationed throughout the world. Each year, approximately 350 new HIV infections are diagnosed in members of the U.S. military services, with most infections acquired within the United States (*1*). The DoD populations most affected by HIV mirror those in the U.S. civilian population; the highest rates of new military diagnoses are in men and blacks or African Americans (blacks) (*1*). Blacks are disproportionally affected, and most new diagnoses occur among men who have sex with men (MSM). HIV preexposure prophylaxis (PrEP) is approximately 90% effective in preventing HIV infection when used properly (*2*), and an increasing number of active duty personnel have used HIV prevention services and PrEP in the military health system since the repeal of "Don't Ask, Don't Tell"* in 2011 (*3*). Military health system and service records were reviewed to describe HIV PrEP use among military personnel, and military health care providers were surveyed to assess HIV PrEP knowledge and attitudes. Among 769 service members prescribed PrEP during February 1, 2014–June 10, 2016, 60% received prescriptions from an infectious disease provider, 19% were black men, and 42% were aged >28 years. Half of surveyed military health care providers self-rated their PrEP knowledge as poor. DoD is developing new policy to address access to care challenges by defining requirements and establishing pathways for universal patient access to PrEP.

Charts were reviewed for service members without a diagnosis of HIV infection whose records indicated a prescription for emtricitabine/tenofovir disoproxil fumarate (Truvada, Gilead Sciences, Inc.) during February 1, 2014–June 10, 2016, and data were collected on demographic characteristics, service branch, risk behavior, and MSM risk index (*4*). The MSM risk index is a validated seven-item screening index used to prioritize patients for intensive HIV prevention efforts, including PrEP, with a score ≥10 having a sensitivity and specificity of 84% and 45%, respectively (*5*). Laboratory data were obtained from the Defense Medical Surveillance System (*6*). Infection status was ascertained by negative fourth generation HIV antigen/antibody testing and HIV viral load when clinically indicated. During 2015–2017, surveys were administered to 4,217 primary care and infectious disease providers in the Army, Navy, and Air Force to evaluate knowledge, attitudes, experience, and beliefs related to HIV PrEP.

Among 769 service members without HIV infection who were prescribed Truvada during February 1, 2014–June 10, 2016, 759 (99%) were men, and 320 (42%) were aged

* The 1993 Department of Defense policy that prohibited military personnel from discriminating against service members or applicants who did not disclose their homosexual or bisexual sexual orientation, while barring openly gay, lesbian, or bisexual persons from military service.

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>28 years, including 57 aged >40 years (Table) (Figure 1). Blacks accounted for 19% of those prescribed Truvada, compared with 47% who were white. Among the 769 Truvada recipients (including 33 whose education level was unknown), 285 (37%) had at least some college education. The indication for initiating PrEP was most commonly sexual contact with men (87%) and condomless sex (73%); 30% reported exposure to sexual partners with known HIV infection. The MSM risk index score was documented for 156 (20%) PrEP prescription recipients; among those for whom MSM risk index score was available, 72% had scores ≥10.

Service members who received PrEP were assigned to duty locations throughout the United States and several locations overseas; 315 (41%) of all PrEP recipients accessed services at one of three medical centers located in the Maryland/District of Columbia area; Portsmouth, Virginia; and San Diego, California (Figure 2). Of the 769 Truvada recipients, 464 (60%) accessed PrEP at infectious disease clinics. The majority had appropriate laboratory screening; however, 16% did not have an HIV test within 14 days of initiating PrEP, 13% were never evaluated for hepatitis B virus infection, and 20% and 30% did not have kidney function assessed at baseline or within 90 days of PrEP initiation, contrary to recommendations.

Among the 4,217 Army, Navy, and Air Force health care providers who were asked to respond to a web-based survey, 1,599 (38%) responded, including 1,190 (74% of respondents) primary care providers. Overall, 789 (49%) respondents rated their knowledge of PrEP as poor, and 470 (29%) reported ever having prescribed PrEP. Common health care provider concerns included medication adverse effects (915; 57%), compliance (817; 51%), and a need for more clear evidence

TABLE. Number of U.S. military service members (N = 769) without human immunodeficiency virus (HIV) infection who initiated preexposure prophylaxis, by selected characteristics — February 1, 2014–June 10, 2016

Characteristic	No. (%)
Total	**769 (100)**
Sex	
Men	759 (99)
Women	10 (1)
Age group (yrs)	
18–28	449 (58)
29–40	263 (34)
41–48	44 (6)
≥49	13 (2)
Race	
White	361 (47)
Black	149 (19)
Other*	259 (34)
Service branch	
Army	207 (27)
Navy	364 (47)
Air Force	158 (21)
Marine Corps	40 (5)
Education, highest level	
High school or less	451 (59)
Some college	84 (11)
Bachelor's degree	120 (16)
Higher than bachelor's degree	81 (11)
Unknown	33 (4)

* Includes American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, and unknown.

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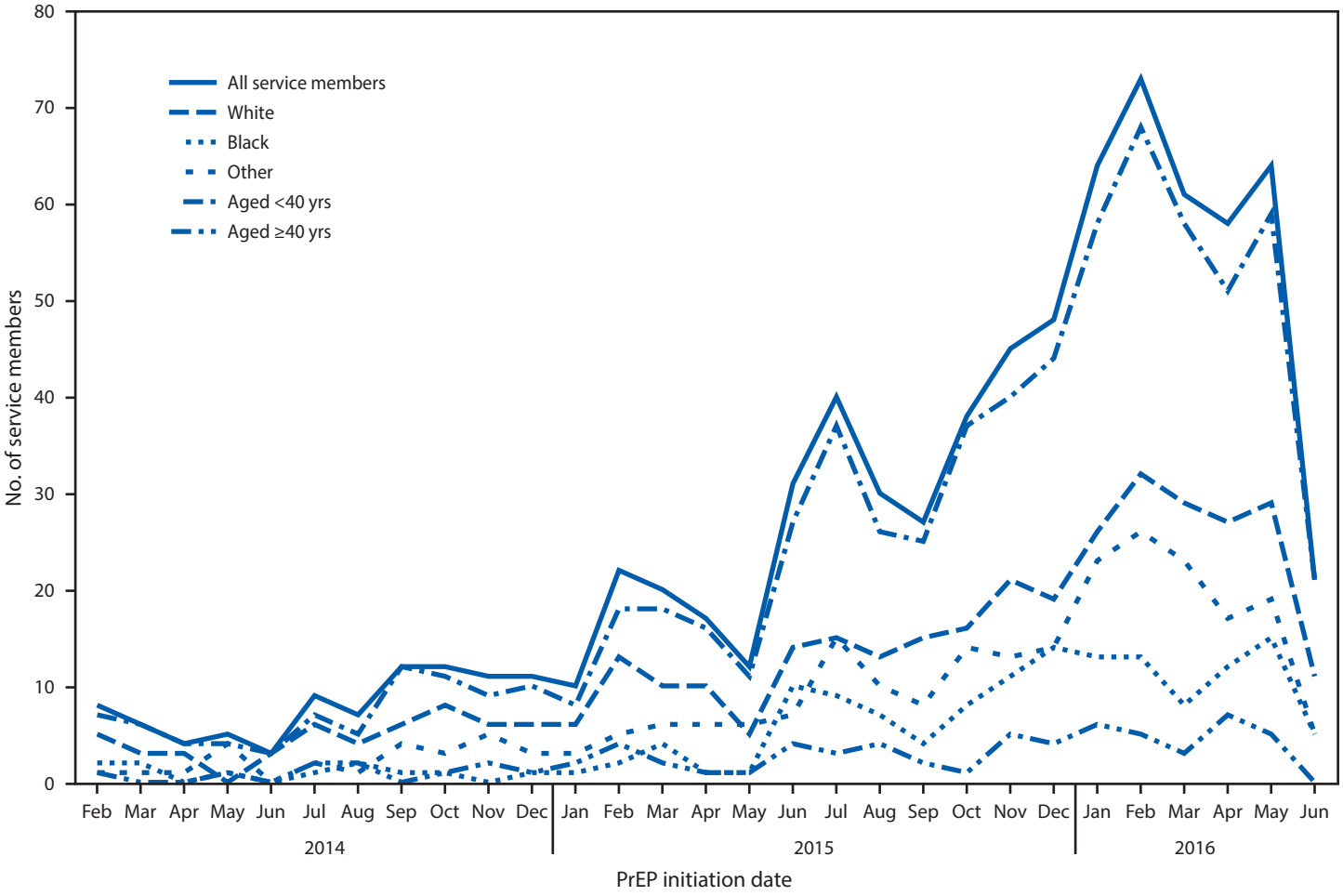
FIGURE 1. Number of military service members who initiated human immunodeficiency virus (HIV) preexposure prophylaxis (PrEP) among U.S. military personnel on active service who did not have HIV infection, by month — 2014–2016*



* Any patient without HIV infection who received an initial prescription for Truvada paid for by the U.S. Department of Defense during February 1, 2014–June 10, 2016, was considered to have received HIV PrEP.

of safety or efficacy (812; 51%). Despite these limitations and concerns, 1,082 (68%) of the responding health care providers endorsed provision of PrEP in the military health care system.

Discussion

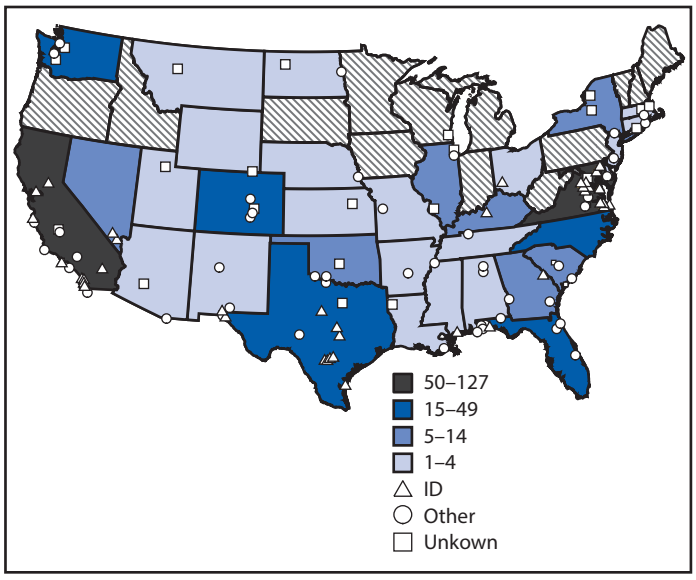
A key goal of the national HIV prevention strategy is effective use of HIV prevention services, including PrEP.[†] As in the U.S. civilian population, in the military, HIV disproportionately affects blacks, who represent 17% of the military force[§] but account for approximately half of all military HIV diagnoses (*7*); during the 2014–2016 study period, only 19% of service members who used PrEP services were black. Further studies are required to learn whether this represents a true disparity and whether improving culturally appropriate efforts will increase PrEP use among black service members who are at increased risk for acquiring HIV infection.

Based on the assumptions that 1) men constitute 85% of the 1.3 million active duty service members, 2) an estimated 4.23% of these men are MSM (including those who self-reported as gay [0.78%], bisexual [2.15%], or other MSM [1.30%]) (*8*), and 3) 25% of MSM have substantially increased risk for HIV (i.e., are candidates for PrEP) (*9*), an estimated 12,000 service members would be eligible for PrEP. However, as of February 2017, approximately 2,000 service members and their beneficiaries had accessed PrEP (Pharmacy Operations Division, Defense Health Agency, unpublished data, 2018). Most patients currently using PrEP are receiving Truvada from major military medical centers after referral to infectious disease specialists. Although a majority of surveyed military

[†] White House Office of National AIDS Policy. National HIV/AIDS strategy for the United States: Updated to 2020; 2016 progress report. December 2016. https://www.whitehouse.gov/sites/whitehouse.gov/files/images/nhas-2016-progress-report.pdf.

[§] Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy, Department of Defense. 2015 demographics: profile of the military community. http://download.militaryonesource.mil/12038/MOS/Reports/2015-Demographics-Report.pdf.

FIGURE 2. Number of military service members who initiated human immunodeficiency virus (HIV) preexposure prophylaxis (PrEP) among U.S. military personnel on active service who did not have HIV infection, by location of duty and prescribing clinic type — 2014–2016*



Abbreviation: ID = infectious disease.

* Any patient without HIV infection who received an initial prescription for Truvada paid for by the U.S. Department of Defense during February 1, 2014–June 10, 2016, was considered to have received HIV PrEP.

health care providers support the use of PrEP for military beneficiaries, increased capacity through provider education and expanded access to the requisite pharmacy and laboratory support services are necessary to meet the anticipated future demand for PrEP and ensure effective delivery of these services in the primary care setting. The transition to use of a fourth-generation HIV immunoassay for HIV screening throughout the DoD has substantially reduced the failure to diagnose acute HIV infection during the "window period" (i.e., the time between exposure to HIV infection and appearance of the first detectable HIV RNA). However, because of variable access to diagnostic tests, some health care providers expressed concern that patients with acute HIV infection might inappropriately be prescribed PrEP instead of antiretroviral treatment because of unrecognized HIV infection.

The maximum estimated annual cost of PrEP to the military health care system is substantial, and new prescriptions for PrEP are expected to continue to rise. Based on the estimate that approximately 12,000 service members would be eligible for PrEP and the current annual cost of Truvada is $12,000 per user,[¶] the potential maximum annual cost to the military health care system in drug costs alone would exceed $140 million. However, these cost estimates are largely based on assumptions using data from civilian populations and do not account for the lower costs of potential generic prescriptions; further evaluation is needed. In addition, the cost of PrEP services in the DoD can be weighed against the cost savings of preventing HIV infection in the service member; the average lifetime cost of medical care for a person with HIV infection is estimated to be nearly $450,000 (*10*). In addition, indirect costs associated with HIV-infected personnel who are prohibited from combat deployment might have substantial impact on military unit readiness and ability to accomplish specific missions.

Considerations unique to DoD are associated with initiation and maintenance of PrEP services among service members subject to worldwide assignment and deployment. Clinical, pharmacy, and laboratory services are limited in some deployment settings; moreover, access to expedited laboratory testing for HIV infection and the three-site (throat, rectum, and urine) gonorrhea and chlamydia nucleic acid amplification testing (NAAT) recommended by CDC's 2017 PrEP guidelines for MSM is either unavailable or not easily accessible at many smaller military medical treatment facilities in the United States. In addition, because some pharmacies have insufficient stock of medication for use for PrEP, not every service member or family member who needs Truvada can obtain it. Occupational considerations also exist. Historically, pilots and air crew members on flight status were prohibited from using Truvada and all other antiretrovirals.** To date, only Navy aviation has formally amended its aeromedical waiver guide to allow PrEP use among pilots and air crew.†† In addition, adherence to the recommended 3-month follow-up evaluations can be difficult in light of the often unpredictable training and mission schedules. These differences between military policy and clinical practice have the potential to create confusion for both patients and health care providers with regard to implementation of standard PrEP management.

Approximately 28% of PrEP users with documented MSM risk indices had scores <10. The DoD legacy "Don't Ask, Don't Tell" policy and reluctance of service members to disclose MSM status might in part explain why only 20% of PrEP users had a documented MSM risk index score and why 28% of those had scores <10. As a result, in the military setting, the risk index alone might not be a reliable discriminator of candidacy for PrEP services. In addition, sexual relations and physical intimacy between unmarried service members,

[¶] National Acquisition Center and U.S. Department of Veteran Affairs. Pharmaceutical Catalog; 2017 https://www.va.gov/nac/Pharma/List?cboContractNumbers=&cboContractorNames=&txtCriteria1=truvada&TxtNDC=&txtPackage=&cboVAClass=&Sort=1&search=Search.

** Official Air Force Aerospace Medicine approved medications. https://www.315aw.afrc.af.mil/Portals/13/Users/096/96/96/Aircrew%20Medication%20List%20June%202017.pdf?ver=2017-07-13-121648-710. Army Regulation 40-501: Standards of Medical Fitness. Updated June 14, 2017. https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN3801_AR40-501_Web_FINAL.pdf.

†† U.S. Navy Aeromedical Reference and Waiver Guide. http://www.med.navy.mil/sites/nmotc/nami/arwg/Documents/WaiverGuide/18_Medications.pdf.

Summary

What is already known about this topic?

Each year, approximately 350 new human immunodeficiency virus (HIV) infections are diagnosed in U.S. military service members, with most diagnoses occurring among men who have sex with men (MSM).

What is added by this report?

Among 769 service members prescribed preexposure prophylaxis (PrEP) during February 1, 2014–June 10, 2016, 87% were MSM. In a survey of health care providers, 49% rated their knowledge of PrEP as poor, and 29% reported ever having prescribed PrEP.

What are the implications for public health practice?

Strategies for reducing barriers to receipt of HIV prevention and care services include patient self-referrals for PrEP evaluations and development of new health policy to provide universal access to the provider, laboratory, and pharmacy services required for an effective PrEP program.

regardless of sex, in the deployed setting has been historically regarded as unprofessional behavior in a combat environment. The currently accepted practice is to discontinue PrEP because Truvada is considered a nondeployable medication in current combat environments.[§§]

The findings in this report are subject to at least three limitations. First, MSM risk index scores were infrequently documented by health care providers, which might have led to candidacy for PrEP services being misclassified. Second, the reported locations of PrEP initiation were based on uneven availability of PrEP services throughout the military health system, which limits generalizability. Finally, the percentage of survey responses from military health care providers was low, which might have led to misrepresentation of provider knowledge of PrEP.

Despite the universal access to care afforded to service members by the military health care system, there is a recognized need to improve and expand access to PrEP for those patients at highest risk for HIV infection. Currently, the availability of PrEP services is heterogeneous, based on the individual patient's geographic location. If located close to a tertiary care medical center, a patient typically is referred by a primary care provider to an infectious disease specialist to receive PrEP services. To reduce the barrier of requiring a consult to a subspecialty provider, several locations with infectious disease specialists are now allowing patients to self-refer for PrEP evaluations. Patients located closer to smaller military treatment facilities might find it difficult to access PrEP because resources required for PrEP services might be lacking, including three-site gonorrhea and chlamydia NAAT testing and adequate supplies of Truvada at the military pharmacy. In addition, primary care providers with limited knowledge and experience might lack confidence to provide PrEP services. New DoD policy is being developed to address identified gaps through initiatives to improve health care provider education and so ensure universal access to PrEP at the primary care level, and to standardize pharmacy and laboratory service delivery at all military treatment facilities.

[§§] Department of Defense. PPG-Tab A: Amplification of the minimal standards of fitness for deployment to the CENTCOM AOR; to accompany MOD thirteen to USCENTCOM individual protection and individual/unit deployment policy. July 12, 2017. https://health.mil/Military-Health-Topics/Access-Cost-Quality-and-Safety/Access-to-Healthcare/Pharmacy-Program/Deployment-Prescription-Program.

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Conflict of Interest

Jason Okulicz reports personal fees from Gilead Sciences, outside the submitted work. No other conflicts of interest were reported.

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Use of Outpatient Rehabilitation Among Adult Stroke Survivors — 20 States and the District of Columbia, 2013, and Four States, 2015

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Stroke is a leading cause of mortality and disability in the United States (*1*,*2*). Approximately 800,000 American adults experience a stroke each year (*2*,*3*). Currently, approximately 6 million stroke survivors live in the United States (*2*). Participation in stroke rehabilitation (rehab), which occurs in diverse settings (i.e., in-hospital, postacute care, and outpatient settings), has been determined to reduce stroke recurrence and improve functional outcomes and quality of life (*3*,*4*). Despite longstanding national guidelines recommending stroke rehab, it remains underutilized, especially in the outpatient setting. Professional associations and evidence-based guidelines support the increasing stroke rehab use in health systems and are promoted by the public health community (*3*–*6*). An analysis of 2005 Behavioral Risk Factor Surveillance System (BRFSS) data revealed that 30.7% of stroke survivors reported participation in outpatient rehab for stroke after hospital discharge in 21 states and the District of Columbia (DC) (*7*). To update these estimates, 2013 and 2015 BRFSS data were analyzed to assess outpatient rehab use among adult stroke survivors. Overall, outpatient rehab use was 31.2% (20 states and DC) in 2013 and 35.5% (four states) in 2015. Disparities were evident by sex, race, Hispanic origin, and level of education. Focused attention on system-level interventions that ensure participation is needed, especially among disparate populations with lower levels of participation.

BRFSS is a telephone survey of the noninstitutionalized U.S. population* conducted annually by all states. The cardiovascular health module, which includes questions about rehab participation, was an optional module in 2013 and 2015. In 2013, the median cardiovascular health module response rate† for 20 states§ was 46.2%. Among the four states¶ participating in the module in both 2013 and 2015, the response rate was 49.3% in 2013 and 51.5% in 2015.

Stroke survivors were identified by the question "Has a doctor, nurse, or other health professional ever told you that you had a stroke?" Participation in outpatient stroke rehab was only asked of those with a history of stroke and was identified among respondents who answered "yes" to the question "Following your stroke, did you go to any kind of outpatient rehabilitation?" Demographic characteristics collected included age, sex, race, Hispanic origin, education (less than high school, high school graduate, some college, or college graduate) and health insurance status. Selected cardiovascular disease risk factors included hypertension, high blood cholesterol, diabetes, obesity, and current smoking. Percentages of respondents who participated in stroke rehab were measured, overall, by demographic characteristics, by cardiovascular disease risk factors in 2013, and by state of residence, and were adjusted for age, sex, race/Hispanic origin, education, insurance status, presence of cardiovascular disease risk factors, and number of cardiovascular disease risk factors (0, 1, 2, 3, 4, or 5). Adjusted percentages and 95% confidence intervals (CIs) were calculated; p-values <0.05 (obtained using Wald F test) were regarded as statistically significant. Statistical software was used to account for the complex sampling design.

In 2013, among 168,655 BRFSS participants, 3.3% (95% CI = 3.1%–3.4%) reported a history of stroke and were classified as stroke survivors. In 2015, among 21,047 participants, 3.3% (95% CI = 3.0%–3.8%) were stroke survivors. In 2013, stroke outpatient rehab participation was 31.2% (95% CI = 29.1%–33.4%) (Table 1). Men, non-Hispanic blacks, and those with a college education or higher more frequently reported participating in stroke outpatient rehab than did women, non-Hispanic others, Hispanics, and those with less than a high school education.

Total adjusted outpatient rehab participation was 31.2% in 2013 and 35.5% in 2015 (Table 2). In 2013, adjusted percentages ranged from 23.1% in Oregon to 43.6% in Minnesota. The unadjusted and adjusted percentages of stroke survivors who took part in outpatient rehab in 2015 were lowest in Maine (28.0% and 31.3%, respectively) and highest in Iowa (46.1% and 49.8%, respectively). Among the four states that included stroke outpatient rehab questions in both 2013 and 2015, the overall adjusted percentage of stroke outpatient rehab participation increased 8.3 percentage points, from 27.2% in 2013 to 35.5% in 2015 (p<0.05).

* https://www.cdc.gov/brfss.
† The overall median response rates were 46.4% in 2013 and 47.2% in 2015 for all 50 states and territories with participants in the BRFSS.
§ Arizona, Arkansas, District of Columbia, Florida, Georgia, Hawaii, Iowa, Maine, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Oklahoma, Oregon, South Carolina, Tennessee, Washington, and Wisconsin.
¶ Georgia, Iowa, Maine, and Oregon.

TABLE 1. Unadjusted and adjusted* percentages of adults who survived a stroke and received outpatient stroke rehabilitation, by demographic characteristics and presence of cardiovascular disease risk factors — Behavioral Risk Factor Surveillance System (BRFSS), 20 U.S. states and the District of Columbia, 2013

Characteristic	Sample size	Unadjusted % (95% CI)	P-value†	Adjusted* % (95% CI)	P-value
Total	**6,743**	**31.2 (29.1–33.4)**	—	**31.2 (29.1–33.4)**	**<0.001**
Sex					
Men	2,616	33.7 (30.4–37.2)	0.038	33.8 (30.5–37.2)	0.030
Women	4,127	29.1 (26.5–31.9)		29.1 (26.4–31.8)	
Age group (yrs)					
18–64	2,468	30.9 (27.6–34.4)	0.798	30.6 (27.5–34.0)	0.622
≥65	4,275	31.5 (29.0–34.1)		31.7 (29.0–34.6)	
Race/Ethnicity					
White, non-Hispanic	5,132	30.3 (28.0–32.7)	0.019	30.0 (27.6–32.5)	0.013
Black, non-Hispanic	966	39.1 (32.9–45.7)		39.8 (33.6–46.2)	
Hispanic	481	26.5 (20.0–34.1)		26.7 (20.3–34.3)	
Other, non-Hispanic	164	24.4 (15.9–35.6)	—§	25.8 (17.0–37.0)	—§
Education					
Less than high school	1,141	25.8 (21.5–30.6)	0.025	25.7 (21.4–30.5)	0.022
High school	2,255	32.5 (28.9–36.2)		32.3 (28.8–36.2)	
Some college	1,923	31.9 (28.0–36.1)		32.1 (28.3–36.2)	
College or higher	1,424	36.3 (31.5–41.2)		36.4 (31.5–41.5)	
Insurance					
Yes	6,276	31.6 (29.5–33.7)	0.492	31.3 (29.2–33.5)	0.836
No	467	28.2 (20.2–38.0)		30.3 (21.9–40.2)	
CVD risk factors (no.)¶					
0	455	35.6 (27.0–45.3)	0.382	35.6 (27.4–40.2)	0.478
1	1,349	29.2 (24.7–34.2)		29.4 (24.9–44.7)	
2	2,103	30.1 (26.5–33.9)		30.3 (26.7–34.4)	
3	1,805	31.5 (28.0–35.2)		31.2 (27.7–34.9)	
4	918	34.8 (28.7–41.5)		34.5 (28.5–41.1)	
5	113	21.8 (12.6–35.1)	—§	22.9 (13.3–36.5)	—§

Abbreviations: CI = confidence interval; CVD = cardiovascular disease.
* Adjusted for age, sex, race/ethnicity, education, insurance status, and CVD risk.
† P-values were obtained using Wald F test to identify statistically significant differences among subgroup.
§ BRFSS recommends that data be suppressed when relative standard error (RSE) is >30% or denominator <50; it is also suggested that if RSE is 20%–30%, the estimates are potentially unreliable.
¶ Selected self-reported CVD risk factors include hypertension, high blood cholesterol, diabetes, obesity, and current smoking. Categories were assigned based on the number of risk factors present: 0, 1, 2, 3, 4, or 5.

Discussion

Overall, approximately one third of stroke survivors reported participating in stroke outpatient rehab. Although outpatient rehab use increased significantly in the four states that collected data in both 2013 and 2015, it remained suboptimal (*3*), highlighting missed opportunities to reach stroke survivors. Stroke recovery can be a long and complex process, involving multiple domains of therapy (e.g., physical, occupational, communication, and cognitive) and occurs in inpatient rehabilitation facilities, skilled nursing facilities, and outpatient rehabilitation facilities. Benefits of stroke outpatient rehab have been determined to improve patient functional status, survival, cardiovascular risk profiles, and quality of life and reduce risks for recurrent strokes and psychological or stress disorders (*3*,*4*,*8*,*9*). Generally, stroke outpatient rehab participation is underutilized (*3*,*8*), which this study found to be true for all subgroups and states included in the analysis. No subgroup had outpatient rehab use rates >40%, and no state had use rates >50%. Although the overall prevalence of outpatient rehab use was low, disparities in use were evident. Younger adults, women, non-Hispanic persons of other than black or white races, Hispanics, and adults with less than a high school education were less likely to use stroke outpatient rehab than their counterparts. Disparities in stroke outpatient rehab at the state level were also apparent. For example, adjusted outpatient rehab use prevalence in Minnesota (43.6%) was almost twice that in Oregon (23.1%).

Increasing participation in stroke outpatient rehab has been recognized as a national priority. *Healthy People 2020*** aims to increase the proportion of adult stroke survivors who are appropriately and effectively assessed and referred for rehabilitation services. The estimates from the *Healthy People 2020* objective are high (90% during 2008–2011); however, they are reflective of assessment or referral, not participation (*4*). Improving

** *Healthy People 2020* Heart Disease and Stroke Objectives (HDS-23). https://www.healthypeople.gov/node/4588/data_details.

TABLE 2. Crude and adjusted percentages* of adults who survived a stroke and received stroke outpatient rehabilitation, by state and ascending adjusted percentage — Behavioral Risk Factor Surveillance System, 20 U.S. states and the District of Columbia (DC), 2013, and four U.S. states, 2015

Year/State†	No.	Unadjusted % (95% CI)	P–value§	Adjusted* % (95% CI)	P–value§
2013					
Total (20 states and DC)	**6,743**	**31.2 (29.1–33.4)**	**0.003**	**31.2 (29.1–33.4)**	**0.012**
Oregon	202	22.7 (16.8–29.9)		23.1 (17.1–30.5)	
Georgia	306	24.8 (19.3–31.2)		23.7 (18.5–29.9)	
Oklahoma	197	23.8 (17.0–32.3)		24.6 (17.3–33.5)	
Hawaii	210	24.1 (17.4–32.3)		25.9 (17.8–36.0)	
North Dakota	230	26.0 (19.5–33.8)		27.0 (20.3–34.9)	
Maine	139	27.2 (19.4–36.6)		28.1 (20.2–37.6)	
Tennessee	254	27.7 (20.8–35.9)		28.1 (21.0–36.5)	
Arkansas	278	27.9 (20.9–36.2)		29.1 (22.3–37.0)	
Florida	1,618	30.6 (25.8–35.8)		30.0 (25.4–35.0)	
Washington	378	30.6 (24.5–37.5)		30.8 (24.5–37.9)	
Arizona	170	30.7 (20.9–42.6)		32.1 (22.2–43.9)	
Wisconsin	166	31.1 (21.2–42.9)		32.4 (22.3–44.4)	
District of Columbia	162	39.0 (28.5–50.8)		32.7 (22.5–44.8)	
Missouri	319	31.8 (24.8–39.7)		32.8 (25.8–40.7)	
North Carolina	204	32.9 (24.5–42.6)		33.4 (24.8–43.2)	
Mississippi	426	35.5 (28.4–43.2)		34.0 (26.8–42.0)	
South Carolina	441	37.4 (31.1–44.1)		35.8 (29.6–42.5)	
Massachusetts	112	38.9 (24.1–56.0)	—¶	37.8 (24.8–52.9)	—¶
Nebraska	291	38.9 (30.6–47.8)		39.6 (30.7–49.3)	
Iowa	263	40.6 (33.4–48.1)		41.7 (34.5–49.4)	
Minnesota	377	43.0 (31.5–55.2)		43.6 (31.0–57.1)	
2013					
Total (four states)	**910**	**27.2 (23.5–31.3)**	**0.001**	**27.4 (23.5–31.3)**	**0.0004**
Oregon	202	22.7 (16.8–29.9)		22.7 (16.2–30.8)	
Georgia	306	24.8 (19.3–31.2)		24.2 (18.8–30.6)	
Maine	139	27.2 (19.4–36.6)		28.4 (20.3–38.2)	
Iowa	263	40.6 (33.4–48.1)		41.7 (34.4–49.4)	
2015					
Total (four states)	**729**	**35.5 (29.6–41.8)**	**0.033**	**35.5 (29.6–41.8)**	**0.008**
Maine	182	28.0 (21.0–36.3)		31.3 (23.1–41.0)	
Georgia	201	34.0 (25.4–43.8)		31.8 (24.2–40.6)	
Oregon	180	36.2 (26.8–46.7)		39.7 (29.6–50.8)	
Iowa	166	46.1 (37.2–55.3)		49.8 (40.3–59.3)	

Abbreviation: CI = confidence interval.
* Adjusted for age, sex, race/ethnicity, education, insurance status and cardiovascular disease risk factors.
† States are listed in ascending order of adjusted percentages for outpatient stroke rehabilitation in 2013 and 2015.
§ P-values were obtained using Wald F test to identify statistically significant differences among states within each year; comparison of differences between 2013 and 2015 among four states only was p = 0.0289.

coordination of care to support assessment, referral, and, ultimately, participation in rehab is needed. The continued underutilization of outpatient stroke rehab might be related to lack of patient access to outpatient facilities, ineffective referral from health care providers, high out-of-pocket costs, lack of health insurance coverage, or lack of knowledge and awareness of benefits of outpatient rehab for stroke survivors (*4*,*6*). The CDC-supported Paul Coverdell National Acute Stroke Program†† seeks to better understand the care provided to stroke survivors to identify disparities and support quality improvement around the assessment for, effective referral to, and provision of stroke rehab services. Experiences from such programs can support system-level changes that encourage use of stroke rehab services across all subgroups and geographies.

The findings in this report are subject to at least five limitations. First, BRFSS data are self-reported and subject to recall bias. Moreover, recall bias might lead to participants inaccurately reporting the type of stroke rehab they used (i.e., outpatient rehab versus inpatient rehabilitation facilities, skilled nursing facilities, and home health rehab) (*10*). Second, the survey does not capture stroke severity, variations in rehabilitation needs, or information about why participants did not participate in outpatient rehab. Third, the optional module was only used by selected states, and the findings should not be considered as nationally representative. Fourth, with few respondents reporting a history of stroke (162 in the

†† The Coverdell program works with health systems across funded recipient states to gather data and drive quality improvement in the prehospital, in-hospital, and posthospital care settings. https://www.cdc.gov/dhdsp/programs/stroke_registry.htm.

Summary

What is already known about this topic?

Each year, approximately 800,000 U.S. persons experience a stroke; outpatient stroke rehabilitation use among survivors helps improve outcomes and might reduce stroke recurrences.

What is added by this report?

In 2013, 31.2% of stroke survivors reported participation in outpatient stroke rehabilitation in 20 states and the District of Columbia. Reported use varied by demographic characteristics and by state. Among the four states reporting rehabilitation use for both 2013 (27.7%) and 2015 (35.5%), use increased significantly but remained suboptimal.

What are the implications for public health practice?

Implementing strategies that remove barriers and increase use of outpatient stroke rehabilitation among stroke survivors, with special focus among underserved populations, can increase positive health outcomes.

District of Columbia to 1,618 in Florida), some state-level confidence intervals were wide, and results should be interpreted with caution. Finally, only participation in outpatient rehab was included in the module, limiting the ability to assess participation in other rehab modalities.

Although estimates of stroke outpatient rehab referral might be high, participation in stroke outpatient rehab remains suboptimal. Barriers to participation in stroke outpatient rehab are evident (*3,8–10*), but focused attention on system-level interventions that ensure participation is needed, especially among populations with lower levels of participation. Interventions that might improve outpatient rehab participation include increasing coverage for outpatient rehab services by health insurers, reducing copayments, extending rehab clinic hours to improve access availability, and implementing standardized assessments by health care professionals to guide appropriate referrals to outpatient rehab at hospital discharge (*3–5,8*). Stroke survivors should be educated about stroke outpatient rehab opportunities possibly available in their community that reduce barriers related to transportation and time (e.g., telehealth, mobileHealth, and home-based care) (*3,5,6,8–10*).

Conflict of Interest

No conflicts of interest were reported.

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Vaccination Coverage Among Children Aged 2 Years — U.S. Affiliated Pacific Islands, April–October, 2016

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Vaccine-preventable diseases (VPDs) cause substantial morbidity and mortality in the United States Affiliated Pacific Islands (USAPI).* CDC collaborates with USAPI immunization programs to monitor vaccination coverage. In 2016,† USAPI immunization programs and CDC piloted a method for estimating up-to-date status among children aged 2 years using medical record abstraction to ascertain regional vaccination coverage. This was the first concurrent assessment of childhood vaccination coverage across five USAPI jurisdictions (American Samoa; Chuuk State, Federated States of Micronesia [FSM]; Commonwealth of the Northern Mariana Islands [CNMI]; Republic of the Marshall Islands [RMI]; and Republic of Palau).§ Differences in vaccination coverage between main and outer islands¶ were assessed for two jurisdictions where data were adequate.** Series coverage in this report includes the following doses of vaccines: ≥4 doses of diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP); ≥3 doses of inactivated poliovirus vaccine (IPV); ≥1 dose of measles, mumps, and rubella vaccine (MMR); ≥3 doses of *Haemophilus influenzae* type B (Hib) vaccine; ≥3 doses of hepatitis B (HepB) vaccine; and ≥4 doses of pneumococcal conjugate vaccine (PCV); i.e., 4:3:1:3:3:4. Coverage with ≥3 doses of rotavirus vaccine was also assessed. Completion of the recommended series of each of these vaccines†† was <90% in all jurisdictions except Palau. Coverage with the full recommended six-vaccine series (4:3:1:3:3:4) ranged from 19.5% (Chuuk) to 69.1% (Palau). In RMI and Chuuk, coverage was lower in the outer islands than in the main islands for most vaccines, with differences ranging from 0.9 to 66.8 percentage points. Medical record abstraction enabled rapid vaccination coverage assessment and timely dissemination of results to guide programmatic decision-making. Effectively monitoring vaccination coverage, coupled with implementation of data-driven interventions, is essential to maintain protection from VPD outbreaks in the region and the mainland United States.

USAPI immunization program staff members report that the geographic remoteness of the USAPI (Figure), particularly the outer islands, affects vaccine distribution and delivery, strains limited resources, and adversely affects vaccination coverage. Additional challenges to maintaining adequate vaccination coverage include a high prevalence of socioeconomic disparities, inaccessibility of vaccination providers and clinics, and difficulty tracking highly mobile populations (*1*). The

* The USAPI consist of three territories or commonwealth nations (Guam, Commonwealth of the Northern Mariana Islands [CNMI], and American Samoa) and three freely associated sovereign nations (Federated States of Micronesia [FSM], Republic of the Marshall Islands [RMI], and Republic of Palau).

† Data were collected during the following months in 2016: Chuuk, FSM: April; RMI: June; Palau: August; CNMI: August; American Samoa: October.

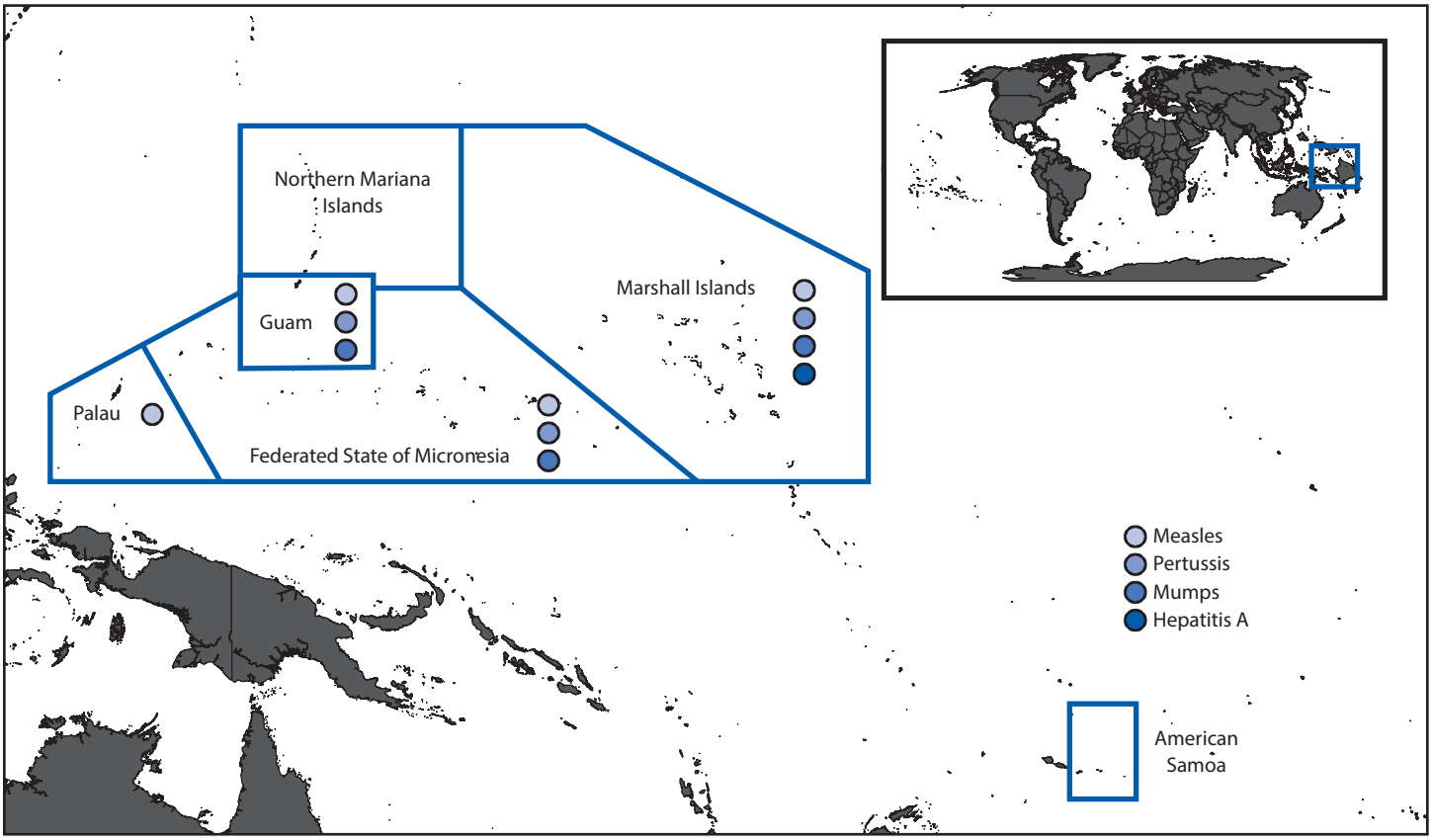
§ Since 2014, biannual National Immunization Surveys (NIS) have been conducted in Guam to assess vaccination coverage among children aged 19–35 months. NIS has not been conducted in the other USAPI because a large proportion of households do not have telephones.

¶ In some USAPI, population, government offices, health care facilities, and other services are centered on one or two "main islands." Islands outside of the main island are referred to as "outer islands." Outer islands can be located hundreds of miles away from the associated main island.

** Differences in vaccination coverage between main and outer islands were assessed in Chuuk and RMI. Chuuk's main island is Weno. RMI's main islands are Majuro and Ebeye. Palau's few outer islands are sparsely populated; child population size was not adequate to assess geographic differences, if any. Data were not adequate to classify geographic region reliably for children in CNMI or American Samoa.

†† Advisory Committee on Immunization Practices (ACIP) recommends routine administration of the second MMR dose at age 4–6 years, but states that the dose may be administered as early as age 13 months provided at least 4 weeks have elapsed since the first dose. FSM, Palau, and RMI recommend routine administration of the second dose as early as the minimum age of 13 months, provided the minimum interval has elapsed. These three jurisdictions do not routinely administer ACIP-recommended varicella vaccine or hepatitis A (HepA) vaccine; however, FSM and RMI recommend Bacillus Calmette-Guerin (BCG) vaccine at birth, which is not an ACIP-recommended vaccine. American Samoa does not routinely administer varicella vaccine or rotavirus vaccine. ACIP approves the use of several licensed Hib vaccine formulations; products used vary by jurisdiction. The Hib primary series includes receipt of ≥2 or ≥3 doses, depending on product type received; Hib full series includes primary series, and booster dose includes receipt of ≥3 or ≥4 doses, depending on product type received. Vaccine doses for all vaccines recommended by age 24 months are listed here, according to jurisdiction. Results in this report are limited to vaccines and number of doses common across all jurisdictions. *American Samoa*: ≥4 DTaP doses, ≥3 IPV doses, ≥1 MMR dose, ≥3 Hib doses, ≥3 HepB doses, and ≥4 PCV doses; *CNMI*: ≥4 DTaP doses, ≥3 IPV doses, ≥1 MMR dose, ≥4 Hib doses, ≥3 HepB doses, ≥4 PCV doses, ≥3 rotavirus vaccine doses, ≥2 HepA doses, and ≥1 varicella dose; *FSM*: 1 BCG dose, ≥4 DTaP doses, ≥3 IPV doses, ≥2 MMR doses, ≥3 Hib doses, ≥3 HepB doses, and ≥4 PCV doses; *RMI*: 1 BCG dose, ≥4 DTaP doses, ≥3 IPV doses, ≥2 MMR doses, ≥3 Hib doses, ≥3 HepB doses, and ≥4 PCV doses; *Palau*: 1 BCG dose, ≥4 DTaP doses, ≥3 IPV doses, ≥2 MMR doses, ≥4 Hib doses, ≥3 HepB doses, and ≥4 PCV doses.

FIGURE. Vaccine-preventable disease outbreaks — U.S. Affiliated Pacific Islands, 2002–2018*



* Federated States of Micronesia: measles 2014, pertussis 2007, mumps 2009 and 2017–2018; Guam: measles 2002–2004 and 2013, pertussis 2001–2006 and 2009–2010, mumps 2006 and 2010–2011; Palau: measles 2003; Marshall Islands: measles 2003, pertussis 2009, mumps 2017, hepatitis A 2017.

United States maintains a military presence in the region, and USAPI citizens can travel, live, and work in the United States without restriction.[§§] As a result of frequent travel, VPD outbreaks in the USAPI have been associated with importations and outbreaks in the mainland United States (*2*,*3*). The USAPI receive economic assistance, immunization infrastructure support, and limited vaccines through Section 317 of the Public Health Services Act, as well as technical assistance from CDC, to ensure protection of the population from VPDs (*4*).

Demographic and vaccination data were collected for children aged 24–35 months (2 years) at the time of data collection in each USAPI. Data sources included labor and delivery log books, vital statistics birth rosters, medical records, public health vaccination log books, and electronic records from the resource and patient management records system and the immunization information system, where available. Up-to-date vaccination status (number of children who received the number of doses recommended by age 24 months, among all children identified by health records) was estimated according to recommended vaccination schedules, which vary across the USAPI.

Unique identifiers, including each child's name, sex, date of birth, geographic region, country of birth, name of parent(s), type of vaccine administered, and date of vaccine administration were abstracted from available records in each jurisdiction. Data collected from each source were matched, deduplicated, and merged to create a complete vaccination record for each child. Geographic differences in vaccination coverage between main islands and outer islands were assessed for Chuuk and RMI.[¶¶]

[§§] For more details, refer to "U.S. Affiliated Pacific Basin Jurisdictions: Legal, Geographic and Demographic Information" https://www.ruralhealthinfo.org/resources/2065.

[¶¶] Differences in vaccination coverage between main and outer islands were assessed in Chuuk, FSM, and RMI. The main island in Chuuk is Weno. RMI has two main islands: Majuro and Ebeye. Palau's few outer islands are sparsely populated; child population size was not adequate to report vaccination coverage by region. Data were not adequate to classify geographic region for children in CNMI or American Samoa reliably.

TABLE 1. Estimated vaccination coverage among children aged 24–35 months,* by selected vaccines and doses — United States Affiliated Pacific Islands, 2016

Vaccine	% Vaccination coverage				
	Chuuk, FSM (N = 1,218)	Republic of the Marshall Islands (N = 1,312)	Republic of Palau (N = 259)	Commonwealth of the Northern Mariana Islands (N = 1,140)	American Samoa (N = 1,180)
DTaP					
≥3 doses	71.6	72.0	94.6	59.5	84.8
≥4 doses	36.7	54.7	79.9	44.7	62.9
IPV (≥3 doses)	71.2	72.7	94.6	58.9	82.8
MMR					
≥1 dose	88.4	68.7	85.7	57.9	75.5
≥2 doses†	68.9	51.0	76.8	NA	NA
Hib (≥3 doses)	53.7	63.5	93.1	48.7	63.1
HepB					
Birth dose§	53.5¶	86.7¶	96.6¶	97.5**	96.7¶
≥3 doses	77.8	76.0	93.1	62.1	82.0
PCV					
≥3 doses	51.0	68.3	87.3	58.0	78.8
≥4 doses	22.2	46.7	70.7	42.4	61.5
Rotavirus (≥3 doses)	16.8	46.5	81.9	40.0	NA††
Combined series§§	19.5	43.0	69.1	40.0	47.9

Abbreviations: CNMI = Commonwealth of the Northern Mariana Islands; DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; FSM = Federated States of Micronesia; HepB = hepatitis B vaccine; Hib = *Haemophilus influenzae* type B vaccine; IPV = inactivated poliovirus vaccine; MMR = measles, mumps, and rubella vaccine; NA = not applicable; PCV = pneumococcal conjugate vaccine; RMI = Republic of the Marshall Islands.

* Children were aged 2 years at time of data collection: Chuuk, FSM: April 2016; RMI: June 2016; Palau/CNMI: August 2016; American Samoa: October 2016.

† CNMI and American Samoa recommend the second dose of MMR at age 4–6 years.

§ One dose of HepB administered within 3 calendar days of birth.

¶ Only includes children born in the jurisdiction: Chuuk, FSM (n = 1,149); RMI (n = 1,181); Palau (n = 237); American Samoa (n = 1,083).

** Includes all children aged 2 years; data insufficient to identify children born outside CNMI.

†† Rotavirus vaccine is not routinely administered in American Samoa.

§§ The combined six-vaccine series (4:3:1:3:3:4) includes ≥4 DTaP doses, ≥3 IPV doses, ≥1 MMR dose, ≥3 Hib doses, ≥3 HepB doses, and ≥4 PCV doses.

Jurisdictional Childhood Vaccination Coverage

Hepatitis B vaccine birth dose*** coverage exceeded 85%††† for each USAPI, except Chuuk (53.5%) (Table 1). Coverage for all other routinely recommended vaccines fell below jurisdictional targets of 90%, except in Palau, where coverage with ≥3 doses of IPV, ≥3 doses of Hib, and ≥3 doses of HepB was 94.6%, 93.1%, and 93.1%, respectively. Palau also had the highest 4:3:1:3:3:4 coverage (69.1%); coverage was <50% in American Samoa (47.9%), RMI (43.0%), CNMI (40.0%), and Chuuk (19.5%).

Coverage with individual vaccines varied considerably across USAPI jurisdictions. For example, coverage with ≥3 doses of IPV ranged from 94.6% (Palau) to 58.9% (CNMI), and with ≥1 MMR dose from 88.4% (Chuuk) to 57.9% (CNMI). For all vaccines requiring more than 1 dose, coverage decreased with subsequent doses§§§; this decrease also varied by vaccine and jurisdiction. For example, coverage with ≥3 doses of DTaP ranged from 94.6% (Palau) to 59.5% (CNMI), and coverage with ≥4 doses of DTaP ranged from 79.9% (Palau) to 36.7% (Chuuk).

Subjurisdictional Differences in Childhood Vaccination Coverage

Vaccination coverage was lower in the outer islands compared with that in the main islands in Chuuk and RMI for most vaccines (Table 2). In Chuuk, coverage with all vaccines except MMR was higher in the main island (Weno) than in the outer islands. Differences ranged from 10.1 to 30.6 percentage points for ≥3 doses of HepB and ≥4 doses of DTaP, respectively. In Ebeye, one of the two main RMI islands, coverage with all vaccines except HepB birth dose was 15.3–51.4 percentage points higher than that in Majuro, the other main island, and 25.3–66.8 percentage points higher than that in the outer islands. Similarly, coverage with all vaccines was higher in Majuro than coverage in the outer islands, except for ≥2 doses of MMR, ≥3 doses of Hib, and ≥3 doses of HepB. The largest disparity was in HepB birth dose coverage both in Chuuk, where there was a 35.8 percentage point difference between coverage in Weno (81.2%), and the outer islands (45.4%),

*** One HepB birth dose administered ≤3 calendar days from birth. Children were excluded from birth dose calculations if they were known to have been born outside of the jurisdiction. RMI results also exclude children with an unknown birth location.

††† HepB birth dose target (≥85%), individual vaccine targets (≥90%), and vaccine series targets (≥85%) set by the USAPI jurisdictions apply to children 19–35 months; children in this assessment were aged 24–35 months.

§§§ Data not shown for HepB, Hib, IPV, or rotavirus vaccine.

TABLE 2. Estimated vaccination coverage among children aged 24–35 months,* by selected vaccines and doses, and by main or outer island area† — Selected United States Affiliated Pacific Islands, 2016

	Chuuk, FSM			Republic of the Marshall Islands§					
Vaccine	Weno (main island) (N = 215) %	Outer islands (N = 1,003) %	Difference¶ %	Majuro (main island) (N = 801) %	Ebeye (main island) (N = 275) %	Outer islands (N = 157) %	Difference (outer islands-Majuro)¶	Difference (outer islands-Ebeye)¶	Difference (Majuro-Ebeye)¶
DTaP									
≥3 doses	80.9	69.6	-11.3	66.9	94.2	52.9	-14.0	-41.3	-27.3
≥4 doses	61.9	31.3	-30.6	46.4	89.8	33.8	-12.6	-56.0	-43.4
IPV (≥3 doses)	80.9	69.1	-11.8	68.3	94.2	51	-17.3	-43.2	-25.9
MMR									
≥1 dose	85.6	89	3.4	58.4	93.5	68.2	9.8	-25.3	-35.1
≥2 doses	69.8	68.9	-0.9	39.2	90.6	37.6	-1.6	-53.0	-51.4
Hib (≥3 doses)	69.8	50.3	-19.5	55.1	92	50.3	-4.8	-41.7	-36.9
HepB									
Birth dose**	81.2††	45.4††	-35.8	94.9††	88.9††	41.3††	-53.6	-47.6	6.0
≥3 doses	86.1	76	-10.1	70.5	94.6	63.1	-7.4	-31.5	-24.1
PCV									
≥3 doses	68.8	47.2	-21.6	66.9	82.2	46.5	-20.4	-35.7	-15.3
≥4 doses	39.5	18.4	-21.1	44.2	68	21	-23.2	-47.0	-23.8
Rotavirus (≥3 doses)	36.3	12.6	-23.7	45.6	73.8	7	-38.6	-66.8	-28.2
Combined series§§	36.7	15.9	-20.8	39	67.6	18.5	-20.5	-49.1	-28.6

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; FSM = Federated States of Micronesia; HepB = hepatitis B vaccine; Hib = *Haemophilus influenzae* type B vaccine; IPV = inactivated poliovirus vaccine; MMR = measles, mumps, and rubella vaccine; PCV = pneumococcal conjugate vaccine; RMI = Republic of the Marshall Islands; USAPI = United States Affiliated Pacific Islands.

* Children were aged 2 years at time of data collection: Chuuk: April 2016; RMI: June 2016.

† In some USAPI, population, government offices, health care facilities, and other services are centered on one or two "main islands." Islands outside of the main island are referred to as "outer islands." Outer islands can be located hundreds of miles away from the associated main island. Chuuk, FSM, and RMI both have main and outer islands.

§ Excludes children known to have lived in more than one local area in RMI (n = 79).

¶ Percentage point difference by local area.

** One dose HepB vaccine administered within 3 calendar days of birth.

†† Only includes children born in the jurisdiction: Chuuk, FSM (n = 1,149); RMI (n = 1,107; [Majuro n = 712; Ebeye n = 252; outer islands n = 143]).

§§ The combined six-vaccine series (4:3:1:3:3:4) includes ≥4 DTaP doses, ≥3 IPV doses, ≥1 MMR dose, ≥3 Hib doses, ≥3 HepB doses, and ≥4 PCV doses.

and RMI, where coverage ranged from 94.9% in Majuro, to 88.9% in Ebeye, and 41.3% in the outer islands.

In Chuuk, coverage for the combined six-vaccine series was higher in Weno (36.7%) than that in the outer islands (15.9%). In RMI, Ebeye had the highest combined six-vaccine series coverage (67.6%), compared with Majuro (39.0%) and the outer islands (18.5%).

Discussion

Vaccination coverage in the five USAPI assessed was lower than the national targets established by each jurisdiction and varied widely among children aged 2 years. Among these jurisdictions, only Palau met the coverage target of ≥90% for ≥3 doses of IPV, ≥3 doses of Hib, and ≥3 doses of HepB. Coverage with vaccine doses recommended in the second year of life, such as the fourth doses of DTaP and PCV, were substantially lower than coverage with doses recommended before the first birthday. The widespread prevalence of under-vaccinated children in the USAPI allows for the rapid and recurrent spread of VPD outbreaks (*5*–*7*). Since 2000, at least 13 documented VPD outbreaks occurred in these islands, and importations to the United States are common (*2*,*3*).

Geographic differences in routinely recommended childhood vaccination coverage were identified in Chuuk and RMI, with substantially higher coverage with most vaccines documented among children on main islands than on outer islands. Proximity to health care providers on the main islands might contribute to these observed coverage differences. For example, HepB birth doses are normally administered in clinical settings at or shortly after the time of delivery, and the differences in birth dose coverage between main and outer islands might reflect differences in access to health care. Information on place of birth documented on medical records suggests that nearly 60% of children on outer islands are born at home and, therefore, might not have had an opportunity to receive a HepB birth dose at delivery. In Ebeye and Majuro, only 11% and <4% of births occur at home, respectively. Approximately 70% of outer island children were identified only by vaccination outreach logbooks, indicating that at the time of the assessment, they might have never accessed health care facilities on Majuro or Ebeye, where they would have been issued a

medical record. In Chuuk, coverage with ≥1 dose of MMR was similar on the main island (86%) and outer islands (89%). This might be attributed to a 2014 mass MMR vaccination campaign, targeting all persons aged 6 months–49 years across the state, in response to a measles outbreak (*8*). Among children in this cohort who received at least one MMR dose (1,077), 42.2% received a dose during the 2014 campaign. Between the two main RMI islands, vaccination coverage was generally higher in Ebeye than in Majuro. Ebeye's higher coverage might derive from its smaller population (9,614 according to 2011 census) and geographic size (0.12 sq. mi.) compared with that of Majuro (population = 27,797; area = 3.75 sq. mi.), which could facilitate Ebeye's community outreach activities to target the entire population. These results underscore the importance of vaccination outreach in reducing coverage disparities between main and outer island children.

Before 2016, assessment of vaccination coverage was conducted infrequently because of the high cost and time commitment required to conduct household surveys. The results of this health facility–based assessment can serve as a baseline for coordinated USAPI and CDC programs to improve vaccination coverage. USAPI immunization programs and stakeholders are currently assessing a range of interventions to increase coverage in the region, including improving vaccine inventory management, eliminating missed vaccination opportunities, and establishing reminder and recall systems (particularly for doses recommended during the second year of life), in conjunction with improving communication and social mobilization measures to educate caregivers about the importance of additional vaccines beyond infancy (*9*,*10*). As a result of increased collaboration and ongoing engagement with CDC staff members and USAPI stakeholders, USAPI immunization programs are actively exploring or implementing these and other public health interventions to improve vaccination coverage in the region to reduce the occurrence of VPDs. For example, Palau is considering increasing the recommended number of well child visits to facilitate vaccination of eligible children; FSM is exploring methods to improve vaccine forecasting and ordering processes, as well as currently conducting catch-up vaccination campaigns in all states; and RMI is working with the Ministry of Health to increase immunization support staff members (Carter Apaisam, Federated States of Micronesia Department of Health, Education and Social Affairs; Merlyn Basilius, Republic of Palau Ministry of Health; Daisy Pedro, Republic of the Marshall Islands Ministry of Health; personal communications, April 2017).

The findings in this report are subject to at least four limitations. First, results might be subject to selection bias because children living in a jurisdiction who did not appear in any of the records that were collected might have been excluded from the analysis. Second, results might be subject to misclassification bias because children who have died or moved away from the jurisdiction but were not identified as such in existing records might be included in the analysis. A recent CDC assessment determined that 4% of persons targeted for a vaccination campaign in FSM using existing records were found to have moved away from the jurisdiction. Third, results might not be generalizable to all age cohorts because only children aged 2 years were assessed. Finally, because the USAPI jurisdictions recommend different vaccination schedules, jurisdictions might prioritize different vaccine targets, thereby making it difficult to compare coverage across the USAPI.

This was the first comprehensive assessment to measure childhood vaccination coverage concurrently across five USAPI. The record abstraction methodology enabled timely dissemination of results to decision makers, who were able to design, fund, and implement intervention strategies within a year of data dissemination in several of the USAPI. Continued and timely monitoring of vaccination coverage, coupled with implementation of vaccination outreach and other interventions, should remain a top priority for immunization programs to prevent future VPD outbreaks in the region and to prevent importation of cases to the mainland United States.

Summary

What is already known about this topic?

The United States Affiliated Pacific Islands (USAPI) face challenges because of their remoteness and limited resources. Low vaccination coverage has contributed to outbreaks in the USAPI; travel between the USAPI and the U.S. mainland has contributed to outbreaks of vaccine-preventable diseases (VPDs) on the mainland.

What is added by this report?

CDC piloted a method of estimating coverage by medical record abstraction in five USAPI jurisdictions. Coverage with the combined six-vaccine series by age 2 years ranged from 19.5% to 69.1%.

What are the implications for public health practice?

Record abstraction can help health authorities conduct surveillance, design and implement interventions, avoid VPD outbreaks, and reduce importation of cases to the mainland.

Acknowledgments

Carla Black, Jamison Pike, CDC; Helen Fisun, Aja Griffin, Association of Schools and Programs of Public Health; Federated States of Micronesia Department of Health and Social Affairs Immunization Program staff members; Republic of Palau Ministry of Health Immunization Program staff members; American Samoa Department of Public Health Immunization Program staff members; Republic of the Marshall Islands Ministry of Health and Human Services Immunization Program staff members; Commonwealth of the Northern Mariana Islands Commonwealth Healthcare Corporation Immunization Program staff members; Seth Meador, Leidos, Inc.

Conflict of Interest

No conflicts of interest were reported.

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Notes from the Field

Vaccine Administration Errors Involving Recombinant Zoster Vaccine — United States, 2017–2018

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Two vaccines for the prevention of herpes zoster (shingles) are licensed for use in the United States and recommended by the Advisory Committee on Immunization Practices (ACIP). Zoster vaccine live (ZVL; Zostavax, Merck), licensed in 2006,* is a live attenuated virus vaccine administered as a single subcutaneous (SQ) dose. Although the Food and Drug Administration (FDA) approved ZVL for adults aged ≥50 years, ACIP recommends ZVL for immunocompetent adults aged ≥60 years (*1*). Recombinant zoster vaccine (RZV; Shingrix, GlaxoSmithKline), licensed October 2017,† is also approved by the FDA for adults aged ≥50 years and is recommended by ACIP for immunocompetent adults aged ≥50 years (*2*). RZV is administered as a 2-dose intramuscular (IM) series, with the second dose given anytime from 2 to 6 months after the first. RZV is preferentially recommended by ACIP over ZVL (*2*). Furthermore, ACIP recommends that persons previously vaccinated with ZVL receive the full 2-dose RZV series (*2*).

RZV and ZVL differ with regard to vaccine type, dose, and schedule; ACIP recommendation; route of administration; and storage requirements (Table). Prior experience indicates that administration errors are reported most frequently shortly after vaccine licensure and publication of recommendations, likely because of lack of vaccine provider familiarity with the new vaccine (*3*).

During the first 4 months of RZV monitoring (October 20, 2017–February 20, 2018), the Vaccine Adverse Event Reporting System (VAERS) (*4*) received 155 reports involving RZV, 13 (8%) of which documented an administration error, including some reports documenting more than one error. Among these reports, nine involved RZV given by the SQ route rather than the IM route; injection site reactions (e.g., pain, erythema, and pruritus) were described in eight of these nine reports. One of the nine reports describing errors in the route of administration also described vaccination of a person aged 48 years (inappropriate age), and two described patients receiving the vaccine information statement for ZVL instead of RZV and not being instructed to return for the second RZV dose. The remaining four reports included 1) administration of RZV instead of the intended varicella (Varivax) vaccine to a person of unreported age, 2) administration of RZV after incorrect frozen storage, 3) administration of RZV to a person aged 39 years, and 4) administration of only the adjuvant component without reconstitution with the vaccine antigen. Vaccine administration errors occurred in a pharmacy (nine reports), a health care provider's office (two), and unknown sites (two). CDC also received 13 public inquiries concerning RZV administration errors or questions asked to avoid errors. Topics included SQ administration (five), reconstitution (five), incorrect interval or schedule (two), and administration of previously frozen vaccine (one).

Although data from passive reporting to VAERS and inquiries submitted to CDC limit the ability to draw conclusions regarding the cause of the administration errors, early monitoring indicates that vaccine providers might confuse administration procedures and storage requirements of the older ZVL and the newer RZV. Failure to reconstitute the vaccine and administration of only one component of RZV also appears to be occurring, similar to errors observed for other vaccines that require mixing (*5*). Whereas RZV administered through the appropriate IM route is associated with high rates of local and systemic reactions (*2*), erroneous SQ injection can increase the likelihood of these episodes (*6*). In addition, some errors could potentially affect vaccine effectiveness. To prevent RZV administration errors, vaccine providers should be aware of prescribing information, storage requirements, preparation guidelines, and ACIP recommendations for herpes zoster vaccines (*1*,*2*).

Conflict of Interest

No conflicts of interest were reported.

* Zostavax (zoster vaccine live) package insert. https://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM132831.pdf.

† Shingrix (zoster vaccine recombinant, adjuvanted) package insert. https://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM581605.pdf.

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TABLE. Recommended storage, use, and administration of currently licensed herpes zoster (shingles) vaccines — United States, 2018

Characteristic	Brand name (manufacturer)	
	Shingrix (GSK)	Zostavax (Merck)
Vaccine type	Recombinant adjuvanted (RZV, licensed 2017)*	Live attenuated virus (ZVL, licensed 2006)†
Packaging	Supplied as 2 components: 1) single-dose vial of lyophilized varicella zoster virus glycoprotein E antigen and 2) a single-dose vial of $AS01_B$ adjuvant suspension	Single-dose vial of lyophilized vaccine and a vial of sterile water diluent
Storage	Antigen and adjuvant should be stored refrigerated between 2°C and 8°C (36°F and 46°F); discard antigen or adjuvant components if frozen; discard reconstituted vaccine if frozen	Vaccine should be stored frozen between -50°C and -15°C (-58°F and +5°F),§ diluent should be stored separately at room temperature or refrigerated between 2° and 8°C (36°F and 46°F); do not freeze reconstituted vaccine
Reconstitution	Reconstitute the lyophilized varicella zoster virus glycoprotein E antigen component with the accompanying $AS01_B$ adjuvant suspension component (single reconstituted dose is 0.5 mL)	Reconstitute lyophilized vaccine with the supplied diluent (single reconstituted dose is 0.65 mL)
Use	Administer immediately after reconstitution or refrigerate and use within 6 hours; discard reconstituted vaccine if not used within 6 hours	Reconstitute immediately upon removal of vaccine from the freezer and administer immediately after reconstitution; discard reconstituted vaccine if not used within 30 minutes
Route	Intramuscular (IM) injection	Subcutaneous (SQ) injection
Dose/Schedule	2 doses; second dose 2–6 months after the first dose	1 dose
Indication	Prevention of herpes zoster in adults aged ≥50 years	Prevention of herpes zoster in adults aged ≥50 years
ACIP recommendation	Immunocompetent adults aged ≥50 years, including those who previously received ZVL,¶ RZV is preferred over ZVL for the prevention of herpes zoster and related complications¶	Immunocompetent adults aged ≥60 years**

Abbreviations: ACIP = Advisory Committee on Immunization Practices, GSK = GlaxoSmithKline; RZV = recombinant zoster vaccine; ZVL = zoster vaccine live.

* Shingrix (zoster vaccine recombinant, adjuvanted) package insert. https://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM581605.pdf.

† Zostavax package insert. https://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM132831.pdf.

§ ZVL (Zostavax) may be stored or transported at refrigerator temperature between 2°C to 8°C (36°F and 46°F) for up to 72 continuous hours before reconstitution; vaccine stored between 2°C to 8°C (36°F and 46°F) that is not used within 72 hours of removal from -15°C (+5°F) storage should be discarded.

¶ Recommendations of the Advisory Committee on Immunization Practices for use of herpes zoster vaccines. https://www.cdc.gov/mmwr/volumes/67/wr/mm6703a5.htm?s_cid = mm6703a5_w.

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Notes from the Field

Acute Poisonings from a Synthetic Cannabinoid Sold as Cannabidiol — Utah, 2017–2018

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On December 8, 2017, the Utah Poison Control Center (UPCC) notified the Utah Department of Health (UDOH) of reports of emergency department visits associated with reported exposure to products labeled as CBD (cannabidiol), a nonpsychoactive compound derived from *Cannabis sativa,* the marijuana plant. Five patients experienced adverse reactions, including altered mental status, seizures, confusion, loss of consciousness, and hallucinations. These reactions were inconsistent with known CBD effects (*1*), which prompted concern for potential adulteration with a synthetic cannabinoid (*2*). CBD is being studied as a treatment for several health conditions* (*3*); however, the Food and Drug Administration has not approved any CBD product for the treatment of any condition, and the U.S. Department of Justice Drug Enforcement Administration considers CBD as a Schedule I drug.† Sale of CBD is currently illegal in Utah, although CBD is readily available online and in shops.

State and federal health and law enforcement officials established a task force on December 11 to investigate cases and identify the source product. A suspected case was defined as the occurrence after October 1, 2017, of adverse reactions inconsistent with known CBD exposures after ingestion, inhalation, or sublingual consumption of a product labeled as CBD or hemp oil. Hospitals and law enforcement agencies or persons experiencing CBD-associated reactions were asked to report any CBD-associated cases to UPCC. Concomitantly, public health investigators searched UPCC's database and Utah's Syndromic Surveillance system as part of CDC's National Syndromic Surveillance Program for CBD-related events.§ UDOH interviewed patients by telephone, using a survey adapted from a synthetic cannabinoid investigation (*4*). Available blood and urine obtained at emergency departments and product samples obtained from patients were submitted for chemical analysis using liquid chromatography and tandem mass spectrometry at the Utah Public Health Laboratory and the Utah Department of Public Safety crime laboratory.

By the end of January 2018, suspected cases were identified in 52 persons. Nine product samples (including one unopened product purchased by investigators from a store and brand reported by a patient) were found to contain a synthetic cannabinoid, 4-cyano CUMYL-BUTINACA (4-CCB), but no CBD.¶ Eight of the tested products were branded as "Yolo CBD oil" and indicated no information about the manufacturer or ingredients. Blood samples from four of five persons were positive for 4-CCB. Press releases were distributed to media outlets December 19–21, 2017, with a warning regarding the dangers of using the counterfeit product; information with a description of the product and associated symptoms was disseminated to health care providers and law enforcement. The number of reported cases peaked during this outreach and dropped shortly thereafter. Thirty-four suspected cases were reclassified as confirmed if the person reported use of a Yolo product or laboratory testing found 4-CCB. Approximately one quarter of persons were aged <18 years, nearly three fourths had vaped the CBD product, and approximately 60% were seen at an emergency department (Table). The top three symptoms experienced were altered mental status, nausea or vomiting, and seizures or shaking. Rapid identification and a coordinated response among state and local agencies contributed to control of the outbreak. This investigation highlights the hazards of consuming unregulated products labeled as CBD. States could consider regulating products labeled as CBD and establishing surveillance systems for illness associated with products labeled as CBD to minimize the risk for recurrences of this emerging public health threat (*5*).

* CBD is used in treating spasticity from multiple sclerosis and Dravet syndrome, a severe form of childhood epilepsy, for which it has shown efficacy.

† A Schedule I drug, defined by the U.S. Department of Justice Drug Enforcement Administration, is a drug with no currently accepted medical use and a high potential for abuse.

§ The compound 4-CCB has been identified in Europe since 2016 when samples were intercepted as synthetic cannabinoids; 4-CCB is chemically related to other indazole-based synthetic cannabinoids, known as NACA derivatives, which are found in other synthetic cannabinoid clusters reported in the United States.

¶ Search terms included CBD-associated slang and brands. Search terms excluded symptoms because they were insufficiently specific.

TABLE. Characteristics of suspected or confirmed cases of poisoning associated with counterfeit cannabidiol products (N = 52) — Utah, 2017–2018

Characteristic	No. (%)
Age group (yrs)	
≥18	28 (53.8)
<18	15 (28.8)
Unknown	9 (17.4)
Sex	
Male	31 (59.6)
Female	14 (26.9)
Unknown	7 (13.5)
County	
Salt Lake	33 (63.5)
Utah	15 (28.8)
Tooele	3 (5.8)
Weber	1 (1.9)
Medical history*	
Mental health treatment	10 (19.2)
Drug abuse	4 (7.7)
Seizures	1 (1.9)
Product brand	
Yolo	33 (63.5)
Other	10 (19.2)
Unknown	9 (17.3)
Source of purchase	
Smoke shop	34 (65.4)
Friend	8 (15.4)
Unknown	10 (19.2)
Reason for use	
Recreational	35 (67.3)
Medicinal†	15 (28.8)
Other	2 (3.8)
Method of use	
Vape	38 (73.1)
Sublingual	9 (17.3)
Other	2 (3.8)
Unknown	3 (5.8)
Seen at an emergency department	
Yes	31 (59.6)
No or unknown	21 (40.4)
Adverse reactions*	
Altered mental status	43 (82.7)
Nausea or vomiting	26 (50.0)
Seizures or shaking	19 (36.5)
Anxiety	14 (26.9)
Unconsciousness	13 (25.0)
Hallucinations	12 (23.1)
Confusion	10 (19.2)
Dizziness	8 (15.4)
Median time to reaction onset after use, minutes (IQR)	35§ (1; 1–5)
Median duration of adverse reaction, minutes (IQR)	27§ (72; 5–72)

Abbreviation: IQR = interquartile range.
* Multiple responses possible.
† Self-reported medicinal use.
§ Number for whom information was available.

Conflict of Interest

No conflicts of interest were reported.

[1]Epidemic Intelligence Service, CDC; [2]Utah Department of Health, Salt Lake City, Utah; [3]Utah Poison Control Center, Salt Lake City, Utah; [4]Utah Department of Health, Public Health Laboratory, Taylorsville, Utah; [5]Utah Department of Public Safety, Bureau of Forensic Services, Taylorsville, Utah; [6]Utah State Bureau of Investigation, Salt Lake City, Utah; [7]Utah Department of Public Safety, Statewide Information and Analysis Center, Sandy, Utah; [8]Salt Lake County Health Department, Salt Lake City, Utah; [9]Utah County Health Department, Provo, Utah.

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Erratum

Vol. 67, No. 16

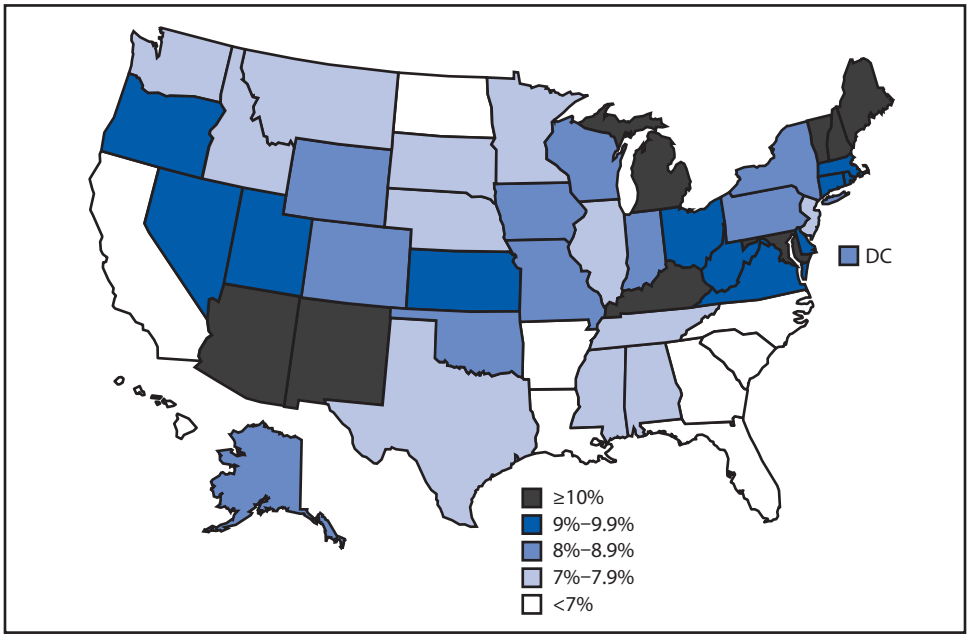
In the announcement "Workers' Memorial Day — April 28, 2018" on page 465, the second sentence should have read "In 2016, work-related injuries claimed the lives of 5,190 U.S. workers, and the fatal injury rate (3.6 per **100,000** full time equivalent workers)† rose for the third consecutive year, to the highest rate since 2010."

The second reference should have read "Case SL, Lincoln JM, Lucas DL. Fatal falls overboard in commercial fishing—United States, **2000**–2016. MMWR Morb Mortal Wkly Rep 2018;67:465–9."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged 18–64 Years with Current Asthma,* by State — National Health Interview Survey,† 2014–2016



* Current asthma is based on positive responses to the survey questions "Have you ever been told by a doctor or other health professional that you had asthma?" and "Do you still have asthma?"

† Estimates are based on household interviews of a sample of the civilian, noninstitutionalized, U.S. adult population and are shown for sample adults aged 18–64 years.

During 2014–2016, 8% of U.S. adults aged 18–64 years had current asthma. Current asthma prevalence was highest in New Hampshire (12.7%), Vermont (12.3%), Arizona (11.0%), Kentucky (10.8%), and Maine (10.8%). The prevalence was lowest in Hawaii (4.9%), North Dakota (5.7%), Arkansas (5.9%), South Carolina (6.2%), and North Carolina (6.2%).

Source: National Health Interview Survey, 2014–2016. https://www.cdc.gov/nchs/nhis.htm. Tabular results available at https://www.cdc.gov/nchs/data/health_policy/asthma_table_SEs.pdf.

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