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World AIDS Day — December 1, 2019

World AIDS Day, observed annually on December 1, draws attention to the status of the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) epidemic. Approximately 37.9 million persons worldwide are living with HIV infection, including 1.7 million persons newly infected in 2018 (*1*).

With support from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), several African countries are on track to achieve HIV epidemic control. In 2017, an estimated 1,020,419 persons in the United States and dependent areas were living with diagnosed HIV infection; 37,832 new cases were diagnosed in 2018 (*2*). The aim of the U.S. Department of Health and Human Services' proposed Ending the HIV Epidemic: A Plan for America initiative (*3*) is to end the U.S. HIV epidemic within 10 years.

Through global efforts, including PEPFAR, in 2018, 23.3 million persons worldwide received antiretroviral therapy. A report in this issue of *MMWR* describes the status of implementation of HIV case-based surveillance systems in 39 PEPFAR-supported countries (*4*).

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Status of HIV Case-Based Surveillance Implementation — 39 U.S. PEPFAR-Supported Countries, May–July 2019

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Human immunodeficiency virus (HIV) case-based surveillance (CBS) systematically and continuously collects available demographic and health event data (sentinel events*) about persons with HIV infection from diagnosis and, if available, throughout routine clinical care until death, to characterize HIV epidemics and guide program improvement (*1*,*2*). Surveillance signals such as high viral load, mortality, or recent HIV infection can be used for rapid public health action. To date, few standardized assessments have been conducted to describe HIV CBS systems globally (*3*,*4*). For this assessment, a survey was disseminated during May–July 2019 to all U.S. President's Emergency Plan for AIDS Relief

* Sentinel events include various events throughout medical care for a client with diagnosed HIV infection, such as HIV recency status (recent or long-term infection at time of diagnosis), clinical laboratory values such as CD4 count and viral load, change in antiretroviral therapy regimens, and death.

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(PEPFAR)–supported countries with CDC presence[†] (46) to describe CBS implementation and identify facilitators and barriers. Among the 39 (85%) countries that responded,[§] 20 (51%) have implemented CBS, 15 (38%) were planning implementation, and four (10%)[¶] had no plans for implementation. All countries with CBS reported capturing information at the point of diagnosis, and 85% captured sentinel event data. The most common characteristic (75% of implementation countries) that facilitated implementation was using a health information system for CBS. Barriers to CBS implementation included lack of country policies/guidance on mandated reporting of HIV and on CBS, lack of unique identifiers to match and deduplicate patient-level data, and lack of data security standards. Although most surveyed countries reported implementing or planning for implementation of CBS, these barriers need to be addressed to implement effective HIV CBS that can inform the national response to the HIV epidemic.

In 2017, CDC initially assessed clinical surveillance among CDC PEPFAR-supported countries (*4*). The survey was revised in 2019 with feedback from stakeholders[**] to focus on CBS and client-level HIV health information system as they relate to CBS. Research Electronic Data Capture (REDCap) (*5*,*6*), an electronic data management tool hosted at CDC and distributed to each PEPFAR-supported CDC country or regional office (representing 46 countries) during May–July 2019 was used to collect responses. CDC country office representatives were asked to complete the survey in partnership with local government officials (ministries of health and implementing partners). The protocol for this activity was reviewed in accordance with CDC human research protection procedures and was determined to be nonresearch.

The survey included questions on functional requirements, security measures, national policies and guidelines, and barriers for CBS implementation (Supplementary table, https://stacks.cdc.gov/view/cdc/82569). Answers were reported based on the country's CBS status (currently implementing CBS, planning to implement, or not planning to implement). In one country, respondents reported uncertainty about future CBS implementation, so this country was grouped with countries

[†] PEPFAR-supported countries include Angola, Barbados, Botswana, Brazil, Burma, Cambodia, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Dominican Republic, El Salvador, Eswatini, Ethiopia, Ghana, Guatemala, Guyana, Haiti, Honduras, India, Jamaica, Kazakhstan, Kenya, Kyrgyzstan, Laos, Lesotho, Malawi, Mali, Mozambique, Namibia, Nicaragua, Nigeria, Panama, Papua New Guinea, Rwanda, Senegal, South Africa, South Sudan, Tajikistan, Tanzania, Thailand, Trinidad and Tobago, Uganda, Ukraine, Vietnam, Zambia, and Zimbabwe.

[§] No data for Barbados, Burma, India, Cameroon, Kazakhstan, Kyrgyzstan, or Tajikistan.

[¶] Implementing countries include those that reported having an HIV case-based surveillance system in their country at any scale (e.g., pilot or national) in which individual-level information on diagnosed HIV cases are reported for surveillance purposes; planning countries include those that reported planning to implement case-based surveillance; the not planning category includes countries that reported not having plans to implement case-based surveillance; and the unsure country reported uncertainty on future implementation.

[**] World Health Organization (WHO), Joint United Nations Programme on HIV/AIDS, Global Fund, ministries of health, and CDC country offices.

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not planning implementation. Functional requirements and facilitators included using unique identifiers[††] to link and deduplicate patient data, having national policies for including HIV infection as a notifiable disease, and reporting unique cases of HIV infection and sentinel events to a public health program for surveillance. Barriers to implementation included lack of policies related to CBS, data security, confidentiality, and privacy of HIV information; criminalization laws; and stigmatization and criminalization of populations at greatest risk for HIV infection.[§§] Additional questions assessing implementation barriers were asked of countries that were not planning to implement CBS.

Several questions applied only to countries that had implemented or were planning to implement CBS. These included whether the system captured (or will capture) date of diagnosis of HIV infection and subsequent sentinel events data and security measures for transmitting paper-based data and for transmitting and storing electronic data. Implementing countries also reported information on whether they were using a health information system for CBS.

Among the 46 PEPFAR-supported countries surveyed, 39 (85%) completed the survey. Despite multiple follow-up attempts, seven countries did not complete the assessment. Skip patterns in the survey resulted in some questions not being asked of all responding countries. Descriptive statistics for aggregated and country-level responses[¶¶] for primary variables were performed using SAS statistical software (version 9.4; SAS Institute).

Overall, 20 (51%) countries reported implementing CBS, 15 (38%) were planning implementation, three (8%) were not planning implementation, and one (3%) was unsure of future implementation (Table 1). Implementation status substantially varied among continents. All surveyed countries in the regions[***] of Americas (11) and Europe (one) reported having implemented CBS. Among five surveyed countries in Asia, three (Papua New Guinea, Thailand, and Vietnam) had implemented CBS, and two (Cambodia and Laos) were planning implementation, whereas among 22 countries in sub-Saharan Africa, only five (Botswana, Ethiopia, Rwanda, Senegal, and Zimbabwe) reported having implemented CBS. Among the remaining 17 sub-Saharan African countries, 13 were planning implementation, three had no plans for implementation, and one was unsure about plans for implementing CBS.

Among the 20 implementing countries, all collect the date of diagnosis of HIV infection, and 17 (85%) collect sentinel event data; however, only 10 of these countries reported using a unique identifier for linking and deduplicating patient-level data (Table 2). An electronic health information system was used by 15 (75%) countries that have implemented CBS. Among the 18 implementing countries asked about electronic-based security measures, all reported having one or more such measures for transmitting data (if applicable), and 19 of 20 had such measures for storing data. Among 16 countries implementing paper-based CBS,[†††] 14 reported adopting one or more security measures.

Among the 15 countries planning to implement CBS, 13 planned to collect date of diagnosis data, and 11 planned to collect sentinel event data with date of events (Table 2). Four countries planning implementation of CBS have the capability to use unique identifiers to link and deduplicate patient-level data. Similar to countries that have already implemented CBS, all of the 14 countries planning to implement reported planning for security measures for transmitting data (if applicable), 14 of 15 reported planning for security measures for storing data, and seven of eight reported planning to implement paper-based surveillance reported planning for security measures (Table 2).

Many countries reported barriers to implementation of CBS. Stigmatization and criminalization of populations at high risk of HIV infection were reported by six of 20 countries that had implemented CBS, by six of 15 that were planning implementation, and by all four that were not planning to implement. Ten of 15 countries planning to implement reported the lack of national policy/guidance for CBS as an important barrier to implementation. Barriers reported by countries not planning to implement CBS included lack of funding and dedicated human resources. HIV was a nationally notifiable condition in 16 of 20 implementing countries, in five of 15 countries planning to implement CBS, and in none of the countries that did not have plans to implement CBS (Table 2).

Discussion

Although 35 (90%) of 39 PEPFAR-supported countries that responded to the survey have implemented HIV CBS or are planning implementation, barriers to implementation were identified in most countries, including absence of policies

[††] Unique identifiers include health identifier, passport number, driver license, biometrics, program-specific identifier (e.g., antiretroviral therapy number), civil identity card, and pseudo-identifier.

[§§] Includes female sex workers, men who have sex with men, persons who inject drugs, transgender persons, and persons incarcerated.

[¶¶] The country-level indicator is the current state of case-based surveillance implementation (implementing, planning implementation, not planning implementation, and unsure).

[***] WHO regions were used to group countries in the Americas, Europe, and Africa. Countries in Asia were grouped into a single region, rather than the two regions (Southeast Asia and Western Pacific) designated by WHO.

[†††] Among countries reporting paper-based abstraction of case-based surveillance data or using a courier for sending paper case report forms to the above-site level (n = 16).

TABLE 1. Status of implementation of case-based surveillance for human immunodeficiency virus infection in 39 countries supported by the U.S. President's Emergency Plan for AIDS Relief, May–July 2019

Region*/Country	Implementing	Planning implementation	Not planning implementation	Unsure†
Africa (n = 22)				
Angola	—	—	Yes	—
Botswana	Yes	—	—	—
Côte d'Ivoire	—	Yes	—	—
DRC	—	—	Yes	—
Eswatini	—	—	—	Yes
Ethiopia	Yes	—	—	—
Ghana	—	Yes	—	—
Kenya	—	Yes	—	—
Lesotho	—	Yes	—	—
Malawi	—	Yes	—	—
Mali	—	—	Yes	—
Mozambique	—	Yes	—	—
Namibia	—	Yes	—	—
Nigeria	—	Yes	—	—
Rwanda	Yes	—	—	—
Senegal	Yes		—	—
South Africa	—	Yes	—	—
South Sudan	—	Yes	—	—
Tanzania	—	Yes	—	—
Uganda	—	Yes	—	—
Zambia	—	Yes	—	—
Zimbabwe	Yes	—	—	—
Americas (n = 11)				
Brazil	Yes	—	—	—
Dominican Republic	Yes	—	—	—
El Salvador	Yes	—	—	—
Guatemala	Yes	—	—	—
Guyana	Yes	—	—	—
Haiti	Yes	—	—	—
Honduras	Yes	—	—	—
Jamaica	Yes	—	—	—
Nicaragua	Yes	—	—	—
Panama	Yes	—	—	—
Trinidad and Tobago	Yes	—	—	—
Asia (n = 5)				
Cambodia	—	Yes	—	—
Laos	—	Yes	—	—
Papua New Guinea	Yes	—	—	—
Thailand	Yes	—	—	—
Vietnam	Yes	—	—	—
Europe (n = 1)				
Ukraine	Yes	—	—	—
Total (N = 39)	**20**	**15**	**3**	**1**

Abbreviations: AIDS = acquired immunodeficiency syndrome; DRC = Democratic Republic of the Congo.
* World Health Organization (WHO) regions were used to group countries in the Americas, Europe, and Africa; countries in Asia were grouped into a single region, rather than the two regions (Southeast Asia and Western Pacific) designated by WHO.
† The "unsure" and "not planning implementation" categories are reported separately here but were combined for analyses because of small sample size.

related to HIV reporting and CBS, nonuniversal adoption of security measures for electronic-based and paper-based systems, lack of unique identifiers, and no collection of postdiagnosis sentinel event data. The fact that only half of countries implementing CBS use a unique identifier to match and deduplicate data highlights a need to improve understanding of the functional requirements of CBS. Ministries of health can request partners with surveillance, informatics, and policy expertise to assist in identifying barriers to implementing effective HIV CBS and in developing solutions.

Among the 39 participating countries, 22 (56%) were in sub-Saharan Africa; however, only 23% of these countries had implemented CBS. This finding might be partly explained by the region's high HIV prevalence, less developed health information system infrastructure, and fewer resources compared with countries with lower HIV prevalence or an epidemic among specific populations, such as those in the Americas, Asia, and Europe (*7*). Because HIV is a notifiable condition in most implementing countries, national policy changes could support CBS implementation. Implementing CBS

TABLE 2. Human Immunodeficiency virus (HIV) case-based surveillance functional requirements, security measures, national policies and guidelines, and barriers, by implementation status,* in 39† countries supported by the U.S. President's Emergency Plan for AIDS Relief, May–July 2019

Case-based surveillance characteristics	Case-based surveillance implementation status (no. of countries) %§ (no./total no.¶)			
	Implementing (20)	Planning implementation (15)	Not planning implementation** (4)	Total (39)
Functional requirements				
Use of unique identifiers††	50 (10/20)	27 (4/15)	0 (0/4)	**36 (14/39)**
Captures (or will capture) diagnosis and date of diagnosis	100 (20/20)	87 (13/15)	—§§	**94 (33/35)**
Captures (or will capture) ≥1 sentinel event¶¶ with date	85 (17/20)	73 (11/15)	—	**80 (28/35)**
Health information system integrated into case-based surveillance***	75 (15/20)	—	—	**75 (15/20)**
Security measures				
Paper-based†††	88 (14/16)	88 (7/8)	—	**88 (21/24)**
Electronic-based: storage of data§§§	95 (19/20)	93 (14/15)	—	**94 (33/35)**
Electronic-based: transmission of data¶¶¶	100 (18/18)	100 (14/14)	—	**100 (32/32)**
National policies and guidelines				
HIV infection is a notifiable condition	80 (16/20)	33 (5/15)	0 (0/4)	**54 (21/39)**
Mandated reporting of subsequent health events for diagnosed HIV-positive cases****	63 (10/16)	40 (2/5)	—	**57 (12/21)**
Mandated security measures for data storage	85 (17/20)	67 (10/15)	—	**77 (27/35)**
Mandated reporting of HIV infection to a public health surveillance system	85 (17/20)	40 (6/15)	0 (0/4)	**59 (23/39)**
Barriers to implementation and maintenance				
No national policy/guidance for case-based surveillance	15 (3/20)	67 (10/15)	75 (3/4)	**41 (16/39)**
No policies for data security, confidentiality, or privacy of HIV information	20 (4/20)	7 (1/15)	25 (1/4)	**15 (6/39)**
HIV criminalization laws	10 (2/20)	7 (1/15)	0 (0/4)	**8 (3/39)**
Stigmatization/Criminalization of populations at high risk††††	30 (6/20)	40 (6/15)	100 (4/4)	**41 (16/39)**
No funding	—	—	50 (2/4)	**50 (2/4)**
No dedicated human resources	—	—	50 (2/4)	**50 (2/4)**
Not a current priority	—	—	25 (1/4)	**25 (1/4)**
No perceived need	—	—	0 (0/4)	**0 (0/4)**

Abbreviation: AIDS = acquired immunodeficiency syndrome.

* Implementing countries include those that reported having an HIV case-based surveillance system in which individual-level information on diagnosed HIV cases is reported for surveillance purposes; planning countries include those that reported having plans to implement case-based surveillance; and the not planning category includes countries that reported not having plans to implement case-based surveillance.

† Angola, Botswana, Brazil, Cambodia, Côte d'Ivoire, Democratic Republic of the Congo, Dominican Republic, El Salvador, Eswatini, Ethiopia, Ghana, Guatemala, Guyana, Haiti, Honduras, Jamaica, Kenya, Laos, Lesotho, Mali, Malawi, Mozambique, Namibia, Nicaragua, Nigeria, Panama, Papua New Guinea, Rwanda, Senegal, South Africa, South Sudan, Tanzania, Thailand, Trinidad and Tobago, Uganda, Ukraine, Vietnam, Zambia, and Zimbabwe.

§ Column percentages might not sum to 100% because of rounding.

¶ Total number might vary based on number of countries to which each question was asked.

** One country reported not having case-based surveillance and was unsure about future implementation. Because of small sample size, this country was grouped with those that reported having no plans to implement case-based surveillance.

†† Unique identifiers include health identifier, passport number, driver license, biometrics, program specific identifier (e.g., antiretroviral therapy number), civil identity card, and pseudo-identifier that can be used to connect and deduplicate patient data across facilities.

§§ Dashes indicate that some questions were not asked for countries based on self-reported status of case-based surveillance implementation.

¶¶ Sentinel events data include various events throughout medical care for a client with diagnosed HIV infection, such as HIV recency status (recent or long-term infection at time of diagnosis), clinical laboratory values such as CD4 count and viral load, change in antiretroviral therapy regimens, and death.

*** Countries were asked if they reported using health information systems for case-based surveillance.

††† Among countries reporting paper-based abstraction of case-based surveillance data and/or using courier for sending paper case report forms to the above-site level (implementing countries, n = 16; planning countries, n = 8). Paper-based security measures include at least one of the following: forms kept in a secure and locked location or record retention policies.

§§§ Electronic-based security measures include one of more of the following steps: encryption of data; software barrier; limited personnel access; multifactor authentication; periodic password changes and/or complex passwords; and laws, policies, guidelines, or standard operating procedures mandating security.

¶¶¶ Among countries reporting electronic transmission of case-based surveillance data (implementing countries, n = 18; planning countries, n = 14). Electronic-based security measures include one of more of the following steps: encryption of data; software barrier; limited personnel access; multifactor authentication; periodic password changes and/or complex passwords; and laws, policies, guidelines, or standard operating procedures mandating security.

**** Among countries in which HIV infection is a nationally notifiable condition (implementing countries, n = 14; planning countries, n = 7).

†††† Groups that have high risk of HIV infection, including female sex workers, men who have sex with men, persons who inject drugs, transgender persons, and persons incarcerated.

for public health is an important policy consideration for all PEPFAR-supported countries (*2*); however, the fact that many countries have not yet implemented CBS underscores the need for increased efforts to address policy barriers and gaps in technical infrastructure so that comprehensive HIV CBS systems that can inform national responses to the HIV epidemic can be implemented.

These findings are subject to at least four limitations. First, several countries did not complete the survey despite multiple follow-up attempts; thus, these results might not be representative of all PEPFAR-supported countries. Second, this assessment might not have identified all potential facilitators and barriers for CBS implementation. Third, because the survey was self-administered, the questions might have been interpreted differently by different respondents. Finally, although persons familiar with the country's HIV surveillance systems were requested to complete the survey, not all responses were verified and were subject to reporting bias; in some cases, some responses were confirmed through follow-up communication with the respondent.

Despite these limitations, this is the first comprehensive global assessment of CBS implementation in PEPFAR-supported countries. CBS is an effective system for countries to monitor their HIV epidemics in real time and to better inform responses. The assessment identified important barriers that need to be addressed to implement CBS effectively. Moving forward, annual deployments of this assessment can help monitor countries' progress toward successful CBS implementation.

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Summary

What is already known on this topic?

Human immunodeficiency virus (HIV) case-based surveillance continuously and systematically monitors HIV-positive patients throughout their clinical care and facilitates rapid public health action.

What is added by this report?

Among 39 surveyed countries supported by the U.S. President's Emergency Plan for AIDS Relief, 20 had implemented case-based surveillance, 15 were planning implementation, and four were not planning implementation. Challenges for most countries, particularly those in sub-Saharan Africa, include need for unique identifiers to link data across systems, supportive national policy environments, and data security standards.

What are the implications for public health practice?

Enhanced efforts are needed to address policy barriers and gaps in technical infrastructure to implement comprehensive HIV case-based surveillance that can inform national response to the HIV epidemic.

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Characteristics of E-cigarette, or Vaping, Products Used by Patients with Associated Lung Injury and Products Seized by Law Enforcement — Minnesota, 2018 and 2019

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On November 26, 2019, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

During August 9–October 31, 2019, 96 patients were classified as having e-cigarette, or vaping, product use–associated lung injury (EVALI) by the Minnesota Department of Health (MDH); other patients are being investigated for case classification and exposures. Among 58 patients interviewed, 53 (91%) reported obtaining tetrahydrocannabinol (THC)–containing products from informal sources such as friends, family members, or in-person or online dealers. Using gas chromatography–mass spectrometry (GCMS), the MDH Public Health Laboratory (PHL) analyzed 46 THC-containing e-cigarette, or vaping, products obtained from 12 EVALI patients for various potential toxicants, including vitamin E acetate, which has recently been detected in some THC-containing products and in samples of lung fluid from EVALI patients (*1*–*4*). To explore whether vitamin E acetate is a recently added component in THC-containing products, MDH tested ten products seized by law enforcement in 2018, before the EVALI outbreak, and 20 products seized in 2019, during the outbreak. Twenty-four products obtained from 11 EVALI patients from 2019 contained vitamin E acetate. Among the seized products tested by MDH, none seized in 2018 contained vitamin E acetate, although all tested THC-containing products seized in 2019 tested positive for vitamin E acetate. These chemical analyses of products obtained from EVALI patients and of products intended for the illicit market both before and during the outbreak support a potential role for vitamin E acetate in the EVALI outbreak; however, the number of products tested was small, and further research is needed to establish a causal link between exposure to inhaled vitamin E acetate and EVALI. Collaboration between public health jurisdictions and law enforcement to characterize THC-containing products circulating before the recognition of the EVALI outbreak and during the outbreak might provide valuable information about a dynamic market. These Minnesota findings highlight concerns about e-cigarette, or vaping, products that contain THC acquired from informal sources. Because local supply chains and policy environments vary, CDC continues to recommend not using e-cigarette, or vaping, products that contain THC or any e-cigarette, or vaping, products obtained from informal sources. E-cigarette, or vaping, products should never be used by youths, young adults, or pregnant women.* Until the relationship between inhaled vitamin E acetate and lung health is better characterized, vitamin E acetate should not be added to e-cigarette, or vaping, products.

On August 12, the Minnesota Commissioner of Health requested that patients with EVALI be reported. Medical records of suspected cases were reviewed, and patients were classified using CDC case definitions.† EVALI patients or their proxies (e.g., parents) were interviewed using an adaptation of a structured questionnaire developed in Illinois and Wisconsin in consultation with CDC during investigation of cases in those states. Patients were asked to provide product samples to MDH for testing. In addition, to explore whether the content of the local supply of illicit e-cigarette, or vaping, products was different before the outbreak, local law enforcement provided products to MDH from a raid of unregulated manufacturers and distributors of e-cigarette, or vaping, products in 2018 and a comparison sample of products from a raid in 2019 that coincided with the current outbreak.

Product samples from EVALI patients and from the two law enforcement seizures were analyzed at MDH PHL using internally developed headspace GCMS and nontargeted GCMS methods and purchased reference materials. MDH PHL tested for active compounds (cannabidiol [CBD], nicotine, and THC), toxicants of concern (glycerin, medium-chain triglyceride [MCT], propylene glycol, and vitamin E acetate), and three vitamin E forms (alpha, beta, and gamma tocopherol).

Bronchoalveolar lavage (BAL) fluid samples from five EVALI patients were analyzed at CDC for active compounds and toxicants. MDH collaborated with the Minnesota Bureau of Criminal Apprehension Forensic Drug Chemistry Department, which had obtained six containers of bulk liquids, each labeled with a different flavor, and 100 cartridges (all labeled "Cali

* https://e-cigarettes.surgeongeneral.gov/documents/surgeon-generals-advisory-on-e-cigarette-use-among-youth-2018.pdf.

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

Plugs Grape Punch") from a spring 2018 raid. PHL tested five bulk liquid samples and five cartridges held by the Minnesota Bureau of Criminal Apprehension. In September 2019, local law enforcement seized 75,000 cartridges intended for the illicit THC market (5). These cartridges were packaged inside boxes bearing two market labels: "Dank Vapes" and "31 Flavors." Investigators used labeling to identify 31 different flavors of Dank Vapes and 19 different flavors of 31 Flavors. PHL evaluated 10 different flavor cartridges labeled "Dank Vapes" and 10 different flavor cartridges labeled "31 Flavors."

As of October 31, 2019, 96 patients were classified as having confirmed or probable EVALI in Minnesota, and additional cases are being investigated. The median age of patients was 21 years (range = 15–71 years), and 58 (60%) were male. Eighty-seven (91%) patients were hospitalized, including 26 (27%) in intensive care units. Three (3%) patients died. Among 58 (60%) interviewed EVALI patients, 53 (91%) reported using illicit THC-containing products obtained from informal sources in the 3 months before illness onset,[§] 41 (71%) used nicotine-containing products, and 14 (24%) used CBD oil products (Table). Two patients reported using illicit THC, medical cannabis, and nicotine-containing products. Thirty-nine (67%) patients reported using Dank Vapes.

Sixteen (28%) patients submitted 265 products, 67 of which were selected for testing because of available product volume and features that physically differentiated the cartridges; 46 contained THC, and 21 contained nicotine. Among the 46 assessed THC-containing products submitted by 12 patients, the most commonly detected compounds were vitamin E acetate (24, 52%), MCT (20, 43%), CBD (20, 43%), and alpha tocopherol (17, 37%). Eight (17%) THC-containing products did not contain either vitamin E acetate or MCT. THC-containing products used by 11 of 12 (92%) patients contained vitamin E acetate, and products from seven (58%) patients contained MCT. One patient who used medical cannabis submitted illicit THC-containing products; one tested product contained vitamin E acetate and another contained MCT. THC-containing products from one patient did not contain vitamin E acetate; however, this patient reported using multiple products daily, including Dank Vapes, which were not included among the products submitted for testing. Among 21 nicotine-containing products submitted by eight patients, 20 contained propylene glycol, and 15 contained glycerin but not the other analytes.

Among the 21 patient-submitted THC-containing products that were categorized by identifiable brands, two of two Dank Vapes samples contained vitamin E acetate (Figure). In five products labeled "Dr. Zodiak" and six labeled "TKO Extract," vitamin E acetate, MCT, and alpha tocopherol were variably detected.

Vitamin E acetate was detected in all five patient BAL fluid specimens. One of these patients submitted four THC-containing cartridges labeled "TKO Extract" (two), "Rove" (one), or "Dr. Zodiak" (one), all of which contained vitamin E acetate. Although the other patients were known to be exposed

TABLE. E-cigarette, or vaping, product use characteristics of interviewed e-cigarette, or vaping, product use–associated lung injury (EVALI) patients (N = 58) — Minnesota, 2019

Product use characteristics (no. with available information if <58)	No. (%)
Illicit THC-containing products	
Any use*	53 (91)
Exclusive use	13 (22)
Prefilled cartridges†	47 (81)
Nicotine-containing products	
Any use	41 (71)
Exclusive use	2 (3)
Nicotine use, without illicit THC	3 (5)
Any use, both illicit THC- and nicotine-containing products	37 (64)
Both illicit THC- and nicotine-containing products only	26 (45)
CBD-containing products	
Any use	14 (24)
CBD oil products, with illicit THC and nicotine	8 (14)
CBD oil with illicit THC	3 (5)
CBD and nicotine	1 (2)
Other product combinations§	
Illicit THC brand usage	
Any use Dank Vapes¶	39 (67)
Used Dank Vapes exclusively, with no other THC brands	11 (19)
Did not use Dank Vapes, but used other THC brands**	6 (10)
Solely used Dank Vapes, no other THC brand, nicotine, or CBD oil	2 (3)
Illicit THC- and nicotine-containing product use frequency††	
Daily use of THC-containing products (49)	37 (76)
Daily use of nicotine-containing products (40)	32 (80)
Illicit THC- and nicotine-containing product use duration††	
>1-year use of THC-containing products (37)	19 (51)
>1-year use of nicotine-containing products (31)	22 (71)

Abbreviations: CBD = cannabidiol; THC = tetrahydrocannabinol.

* Three patients reported use of CBD and THC only. Two additional patients did not report THC during interview, but testing of bronchoalveolar lavage fluid or product confirmed exposure to THC.

† Prefilled cartridge use was unknown for six respondents who used illicit THC.

§ Nicotine and unknown homemade oil (one, laboratory testing confirmed THC and vitamin E acetate present in bronchoalveolar lavage fluid); CBD and unknown (one, laboratory testing of product confirmed THC and vitamin E acetate in unlabeled cartridge); and illicit THC, nicotine, and prescribed THC products supplied by a medical marijuana dispensary (two).

¶ Dank Vapes are a class of largely counterfeit THC-containing products of unknown provenance that are marketed under a common name and distributed through informal sources.

** EVALI patients reported using these non-Dank Vapes brands: Banks Extracts (one), Cannaclear (one), Chronic (one), Cookie Cart (one), Dabwoods (one), King Pin (one), Off White (two), Runtz (one), Sauce Extracts (one), TKO Extracts (two), and West Coast Cure (one). Cartridge or brand use was unknown for eight respondents who used illicit THC.

†† Information on brand of THC-containing product and THC use duration and frequency was not available for all patients.

§ THC-containing products were obtained from informal sources such as friends, family members, or in-person or online dealers, and were not obtained from the Minnesota medical cannabis program (https://www.health.state.mn.us/people/cannabis/).

to THC based on interview or testing of the BAL fluid, none of the other patients whose BAL fluid specimens were tested submitted THC-containing products for testing.

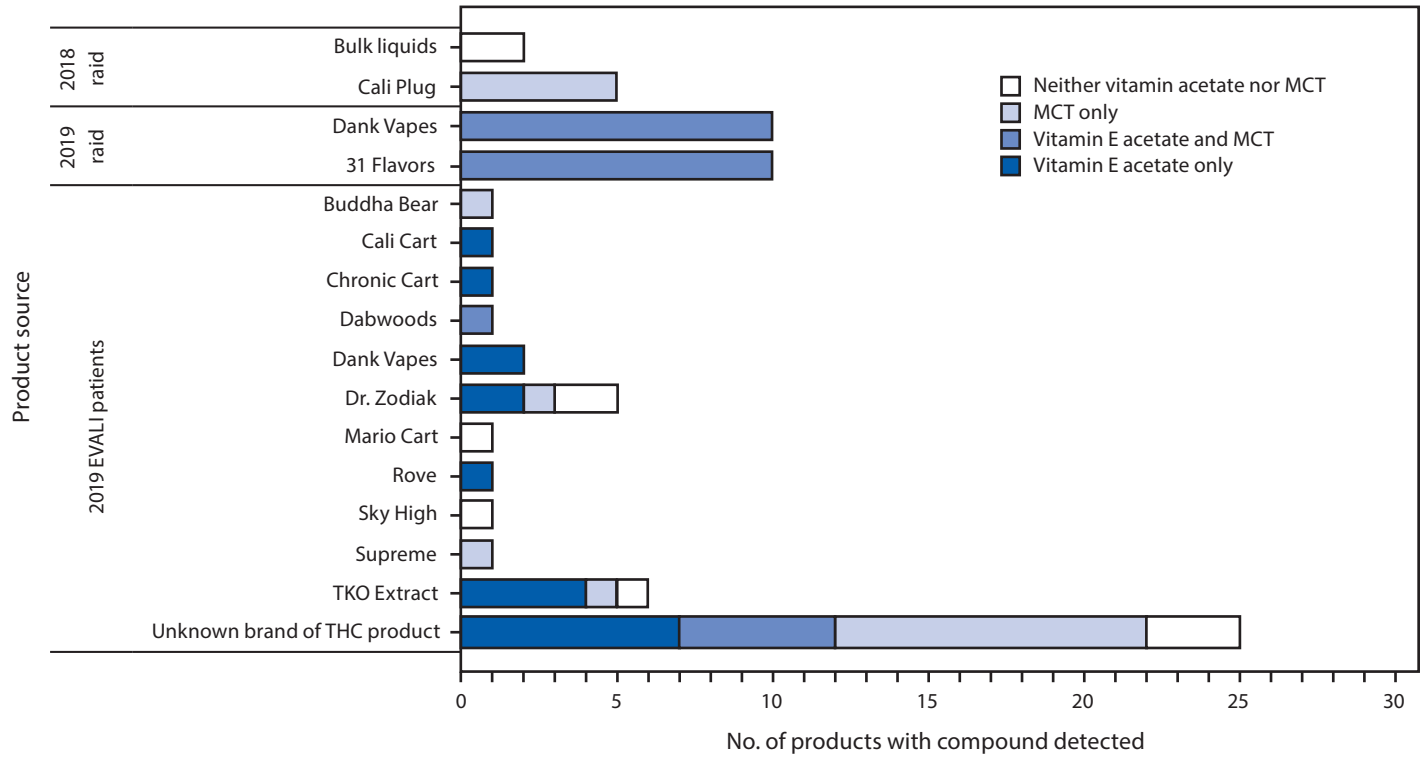
Among products seized during the 2018 raid, all five bulk liquid samples tested negative for vitamin E acetate and MCT; two tested positive for THC (Figure). The bulk liquids appeared to be flavoring agents. All five Cali Plug cartridges tested contained THC and MCT, but not vitamin E acetate. Among the 20 tested cartridges seized during September 2019, all contained THC, vitamin E acetate, and MCT. In addition, five cartridges of 31 Flavors also contained gamma tocopherol.

Discussion

This report evaluated e-cigarette, or vaping, products used by EVALI patients and products intended for the illicit market and seized by law enforcement both before and during the current EVALI outbreak. The findings support a potential role for vitamin E acetate in lung injury in EVALI patients. Vitamin E acetate has been detected in a high proportion of THC-containing products associated with EVALI cases, including those tested at MDH PHL, New York (*4*), Utah (*3*), and the Food and Drug Administration (from 25 states) (*2*). In addition, evaluation at CDC of 29 BAL fluid specimens from a convenience sample of EVALI patients from 10 states, including five Minnesota patients, found vitamin E acetate in all specimens (*1*). Although the long-term stability of vitamin E acetate in THC-containing products is unknown, vitamin E acetate is reported to remain stable for at least 36 months in cosmetic products (*6*). Whereas vitamin E acetate was not detected in the limited number of tested products seized in 2018, it was detected in products seized in 2019, suggesting that vitamin E acetate might have been introduced recently as a diluent or filler. However, verification of this observation requires testing of more products from Minnesota before 2019 as well as products from other states.

All Dank Vapes tested, including those from patients and those confiscated by law enforcement in 2019, contained vitamin E acetate. The majority of interviewed EVALI patients in Minnesota reported using Dank Vapes products: to date, 87%–95% of EVALI patients in Illinois, Minnesota, Utah, and Wisconsin have reported using illicit THC-containing products, with 40%–75% of patients interviewed reporting using cartridges labeled "Dank Vapes" (*3*,*7*). In Illinois, EVALI patients aged 18–44 years had higher odds of reporting use of illicit THC-containing products and of using products labeled "Dank Vapes," compared with persons aged 18–44 years who in an online survey reported use of THC-containing products but who did not have EVALI (*8*).

FIGURE. Detection of vitamin E acetate and medium chain triglyceride (MCT) by mass spectrometry methods in tetrahydrocannabinol (THC)–containing products obtained from e-cigarette, or vaping, product use–associated lung injury patients (N = 46) and law enforcement raids (N = 27) — Minnesota, 2018 and 2019



MCT was found in many of the THC-containing products tested in Minnesota. Although the numbers are small, MCT was not found in any of the 29 tested BAL fluid samples from EVALI patients (*1*). MCT was found in products seized by law enforcement during both 2018 and 2019, suggesting that persons using illicit THC-containing products in Minnesota were exposed to MCT before 2019. However, more information on MCT is needed. Alpha tocopherol and gamma tocopherol were detected in some products. These forms of vitamin E can be naturally derived from plant products; whether these compounds have a role in EVALI is unknown (*9*). Additional work, including quantitative analysis of the various compounds in products, assessment of interactions and changes occurring with heating, and assessment of the biologic activity of potential toxicants in animal models should be considered.

Because many EVALI patients used THC- and nicotine-containing products, nicotine-containing products were evaluated as well. None of the nicotine-containing products tested contained alpha tocopherol, gamma tocopherol, MCT, THC, or vitamin E acetate.

Two EVALI-patients discussed here used medical cannabis vaping products as well as illicit THC-containing e-cigarette, or vaping, products. One patient submitted illicit THC-containing e-cigarette, or vaping, products; one product tested contained vitamin E acetate and another contained MCT. Another EVALI-patient refused interview, but medical records indicated that the patient was enrolled in the medical cannabis program and also used illicit THC-containing e-cigarette, or vaping, products. After the analytic period covered by this report, MDH learned of two additional patients who used medical cannabis products, one of whom reported use of marijuana. The type of medical cannabis used by these patients, as analyzed by MDH PHL, does not contain vitamin E acetate or MCT. Another medical cannabis manufacturer in Minnesota had used MCT, but no longer uses this compound. Further investigation of these patients is ongoing.

The findings in this report are subject to at least six limitations. First, EVALI patients might have been misclassified. Second, many EVALI patients did not agree to be interviewed or to provide products for testing, which might limit the generalizability of these findings to other EVALI patients. Third, products submitted by EVALI patients did not represent all THC- and nicotine-containing products they had recently used. Fourth, many products did not contain sufficient material to test. Fifth, mass spectrometric laboratory testing of products focused on 10 compounds for which reference materials were obtained; however, other toxicants might have been present but not identified. Finally, only a limited number of products and brands from law enforcement were tested, and these might not be representative of available products in Minnesota.

Summary

What is already known about this topic?

Tetrahydrocannabinol (THC)-containing e-cigarette, or vaping, products also containing vitamin E acetate appear to be associated with e-cigarette, or vaping, product use–associated lung injury (EVALI).

What is added by this report?

Illicit THC-containing products submitted by 11 of 12 EVALI patients in Minnesota contained vitamin E acetate. Twenty THC-containing products seized during September 2019 contained vitamin E acetate; ten products seized during 2018, before the EVALI outbreak, did not contain vitamin E acetate.

What are the implications for public health practice?

These data further support a potential role for vitamin E acetate in EVALI. While potential toxicants continue to be evaluated, vitamin E acetate should not be added to e-cigarette, or vaping, products.

Although vitamin E acetate was detected in THC-containing products provided by 11 of 12 EVALI patients and a convenience sample of confiscated products from 2019 in Minnesota, additional analyses are needed to establish whether a causal link exists between inhaled vitamin E acetate exposure and EVALI. According to these and other published data, using THC-containing products with vitamin E acetate appears to be associated with EVALI; however, it is possible that more than one compound or ingredient could be a cause of lung injury, and evidence is not yet sufficient to rule out contribution of other toxicants. The ongoing investigation in Minnesota has shown that collaborating with law enforcement to obtain and test products confiscated before and during the current outbreak can provide valuable information on the potential changes in these products in a dynamic market. Such collaboration is encouraged elsewhere to provide insight into the national picture and an improved understanding of THC-containing products. These findings from Minnesota highlight concerns about e-cigarette, or vaping, products that contain THC acquired from informal sources such as friends, family members, or in-person or online dealers. Because local supply chains and policy environments vary, CDC continues to recommend not to use e-cigarette, or vaping, products that contain THC and not to use any e-cigarette, or vaping, products obtained from informal sources. Further, e-cigarette, or vaping, products should never be used by youths, young adults, or pregnant women. Until the relationship between vitamin E acetate and lung health is better characterized, vitamin E acetate should not be added to e-cigarette, or vaping, products.

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Erratum

Vol. 68, No. 43

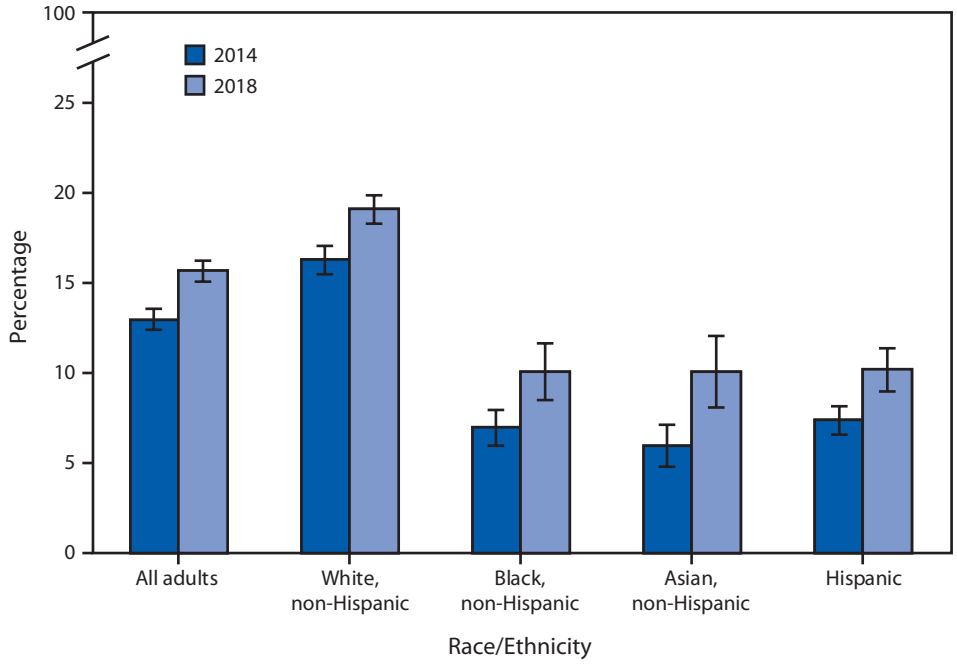
In the report "Progress Toward Global Eradication of Dracunculiasis — January 2018–June 2019," on page 979, a sentence was omitted from the first paragraph. The paragraph should have read as follows:

"Dracunculiasis (also known as Guinea worm disease) is caused by the parasite *Dracunculus medinensis* and is acquired by drinking water containing copepods (water fleas) infected with *D. medinensis* larvae. The worm typically emerges through the skin on a lower limb approximately 1 year after infection, resulting in pain and disability (*1*). There is no vaccine or medicine to treat the disease; eradication efforts rely on case containment* to prevent water contamination and other interventions to prevent infection, including health education, water filtration, chemical treatment of unsafe water with temephos (an organophosphate larvicide to kill copepods), and provision of safe drinking water (*1*,*2*). **The worldwide eradication campaign began in 1980 at CDC**. In 1986, with an estimated 3.5 million cases† occurring each year in 20 African and Asian countries§ (*3*), the World Health Assembly called for dracunculiasis elimination (*4*). The global Guinea Worm Eradication Program (GWEP), led by The Carter Center and supported by the World Health Organization (WHO), CDC, the United Nations Children's Fund, and other partners, began assisting ministries of health in countries with dracunculiasis. This report, based on updated health ministry data, describes progress to eradicate dracunculiasis during January 2018–June 2019 and updates previous reports (*2*,*4*,*5*). With only five countries currently affected by dracunculiasis (Angola, Chad, Ethiopia, Mali, and South Sudan), achievement of eradication is within reach, but it is challenged by civil unrest, insecurity, and lingering epidemiologic and zoologic questions."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Percentage* of Adults Who Had Ever Used an E-cigarette,† by Race and Ethnicity — National Health Interview Survey, United States, 2014 and 2018§



* With 95% confidence intervals indicated by error bars.
† Based on the response of "yes" to the survey question "Have you ever used an e-cigarette even one time?" Data on e-cigarette use were first collected in the 2014 National Health Interview Survey.
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey, Sample Adult component. The estimates are age-adjusted to the projected 2000 U.S. population as the standard population using five age groups: 18–24, 25–34, 35–44, 45–64, and ≥65 years.

From 2014 to 2018, the percentage of all U.S. adults aged ≥18 years who had ever used an e-cigarette increased from 13.0% to 15.7% overall and, by race/ethnicity, increased among non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and Hispanic adults. Non-Hispanic white adults were the most likely, in both years, to have ever used an e-cigarette. In 2018, 19.1% of non-Hispanic white adults had ever used an e-cigarette, compared with 10.1% of non-Hispanic blacks and non-Hispanic Asians and 10.2% of Hispanics.

Source: National Center for Health Statistics, National Health Interview Survey, 2014 and 2018 data. https://www.cdc.gov/nchs/nhis.htm.

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