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Characteristics of E-Cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI) Patients

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Abstract

During August-December 2019, 23 persons who received a diagnosis of e-cigarette, or vaping, product use-associated lung injury (EVALI) were reported to the Arkansas Department of Health (ADH); none died. Among Arkansas EVALI patients, most were aged <25 years and white; two-thirds were male. Approximately half of Arkansas EVALI patients were admitted to intensive care units. Among 18 patients who were interviewed, 61% reported using both nicotine and tetrahydrocannabinol in an e-cigarette, or vaping, device during the 90 days preceding illness onset. Clinicians should remain vigilant for EVALI and continue to report cases to ADH.

Introduction

During July 2019 in Wisconsin and Illinois, the first cluster of persons with severe lung injury that was eventually termed e-cigarette, or vaping, product use-associated lung injury (EVALI) was identified. Common symptoms reported by patients were shortness of breath, nausea, and subjective fever.[1] Characteristic clinical findings included hypoxemia, neutrophilia, lack of evidence of bilateral pulmonary infiltrates on chest radiographs or chest computed tomography (CT) images, and an absence of infectious disease etiology.[1] Additional states subsequently reported patients with similar injuries, and on August 16, 2019, the Arkansas Department of Health (ADH) identified its first EVALI patient.

Since the outbreak started, state health departments, CDC, and the U.S. Food and Drug Administration have worked collaboratively to more fully understand causes, prevention, clinical features, and management of EVALI. This report describes the outbreak and response in Arkansas to raise clinician awareness, optimize diagnosis and patient care, and promote public health reporting.

Methods

On August 30, 2019, ADH re-released CDC's Health Advisory "Severe Pulmonary Disease Associated with Using E-Cigarette Products" to health care providers across the state using the voluntary ADH Health Alert Network (HAN) system.[2,3] In this HAN notification, clinicians were asked to report to ADH any patient with severe pulmonary disease of unclear etiology and a history of e-cigarette, or vaping, product (EVP) use during the past 90 days.

All cases summarized in this report have been classified according to CDC's Lung Injury Surveillance Primary Case Definition released on September 18, 2019.[4] By definition, "confirmed" EVALI cases were patients who reported use of an EVP ≤90 days before symptom onset, had pulmonary infiltrates on chest radiographs or ground glass opacities on chest CT scans, had negative respiratory viral panel, influenza (if local epidemiology supported influenza testing), and all other clinically indicated respiratory infectious disease tests, and no alternative plausible diagnoses for pulmonary illness. "Probable" EVALI cases were those who met all aspects of the "confirmed" definition, except the patient did not have a full infectious disease workup, or a respiratory pathogen was identified but the clinical team believed the infectious agent was not the sole cause of illness.

For all reported cases, patient medical records were requested. Records were received by fax or mail and data regarding demographics, symptoms, clinical course, chest imaging, and infectious disease testing were abstracted and entered into a database (Research Electronic Data Capture [RedCap]; version 8.8.0). When patients were available, they were interviewed by telephone about their history of EVP use. Data entered into RedCap were downloaded and descriptive statistics were computed using Microsoft Excel for Office 365 (version 2002).

Results

In total, 23 persons with EVALI were reported to ADH (eight confirmed and 15 probable cases). Arkansas EVALI patients reported illness onset during August-December 2019; about half (12, 52.2%) had onset of illness in September (Figure 1).

Table 1 summarizes demographic information; median age at injury onset was 21 years (range: 17–54 years), 78.2% of cases were among individuals aged 18–34 years old, and 15 (65.2%) were male. Injuries were reported throughout the state, although approximately half of patients resided in ADH's Northwest Public Health Region (56.5%). Rural Baxter County in the Northwest Region reported seven cases accounting for 30.4% of all cases in the state.

All 23 patients required hospitalization, with a median hospital stay of six days (range: two–14 days); no patient died. Twelve (52.2%) patients visited a health care provider for EVALI-related symptoms before the visit for which they were ultimately admitted for hospitalization. Of these 12 patients, four first sought treatment at an urgent care center (33.3%), four (33.3%) at a hospital emergency department (ED), and four (33.3%) at their primary care provider. Of 11 patients who were admitted to the hospital on the same day they first sought treatment for EVALI-related symptoms, one (9.1%) presented to an urgent care provider before ED referral, and 10 (90.9%) sought care directly from a hospital ED.

Clinical characteristics, diagnostic testing, and therapeutic procedures for these 23 patients are summarized in Table 2. Influenza testing was performed for 18 (78.3%) patients; all these tests were negative. Ten patients (43.5%) received a respiratory viral panel, and nine patients (39.1%) had negative results for all pathogens tested. Adenovirus was detected in one patient, but the patient's clinical team believed that this infection was not the sole cause of illness. Twenty-two (95.7%) persons with EVALI received chest radiographs during their illness. Of these, 20 (90.9%) had bilateral pulmonary infiltrates. Of 23 EVALI patients, 19 (82.6%) had a chest CT scan at some point during their hospitalization, all of whom had bilateral ground-glass opacities. Eighteen (78.3%) patients received both chest radiographs and one or more CT scans.

Eighteen of 23 (78.3%) patients were available for interviews regarding EVP use or had complete information in their medical records on substances used in e-cigarette, or vaping, devices. Of these 18 patients, 14 (77.8%) had used nicotine, 15 (83.3%) had used tetrahydrocannabinol (THC), and two (11.1%) had used cannabinoid (CBD) in an e-cigarette, or vaping, device in the 90 days preceding illness onset. Two (11.1%) of these 18 patients reported exclusively using nicotine-containing products, three (16.7%) exclusively THC-containing products, and one (5.6%) CBD-containing products only. Eleven patients (61.1%) used both THC and nicotine-containing products, and one (5.6%) patient used nicotine, THC, and CBD-containing products.

Discussion

According to CDC, 2,807 hospitalized EVALI cases have been reported nationwide through February 2020, and 68 deaths have been confirmed.[5] The outbreak course in Arkansas followed the national outbreak, where EVALI cases peaked in September and then steadily decreased thereafter.[6] However, despite significant progress in controlling the outbreak, some cases continue to occur.[7] Therefore, clinicians should remain vigilant for this diagnosis in patients with an EVP use history and who also have compatible respiratory, gastrointestinal, or constitutional symptoms. Clinical guidance and tools for health care providers can be found on CDC's Lung Injury Outbreak webpage, including an algorithm for EVALI patient management and a discharge readiness checklist.[8]

Nationwide, most EVALI patients reported use of THC-containing EVP's obtained through informal sources such as family, friends, and online or in-person dealers.[8] In toxicologic analyses, vitamin E acetate was found in 94% of 51 EVALI-patient bronchoalveolar lavage (BAL) samples and in THC-containing e-cigarette, or vaping, products from 81% of patients.[9,10] Vitamin E acetate was not found in BAL specimens from people without EVALI.[9] Further implicating vitamin E acetate as a toxicant causing EVALI, media sources have reported vitamin E acetate being sold on the internet beginning in late 2018 or early 2019 as a diluent-thickener for illicit THC-containing e-cigarette, or vaping, product liquids.[11] Additionally, analyses of THC-containing products seized by law enforcement in Minnesota revealed presence of vitamin E acetate in products confiscated during 2019, but not in products confiscated in 2018.[12] Although vitamin E acetate is strongly associated with EVALI, current evidence is not sufficient to rule out the contribution of other toxicants or

chemicals of concern, including chemicals in either THC-containing or nicotine-containing products, in some of the reported EVALI cases.

Consistent with data from Illinois and Wisconsin, approximately 17% of Arkansas EVALI patients denied THC product use in an e-cigarette, or vaping, device during the 90 days preceding illness onset.[1] Therefore, EVALI should still be considered as a possible diagnosis among patients with compatible clinical symptoms who deny using THC-containing EVPs. Clinicians should continue to advise against the use of nicotine- or THC-containing EVPs by youths, young adults, or pregnant women and advocate avoidance of THC-containing EVPs for all persons, particularly those acquired from informal sources.

ADH will continue to investigate cases of EVALI and asks that providers report suspected cases to the Outbreak Response Section at 501-537-8969. To receive timely, updated information on outbreak response activities, clinicians are encouraged to enroll in the voluntary Health Alert Network on the ADH webpage (https://hanregistration.adh.arkansas.gov/).

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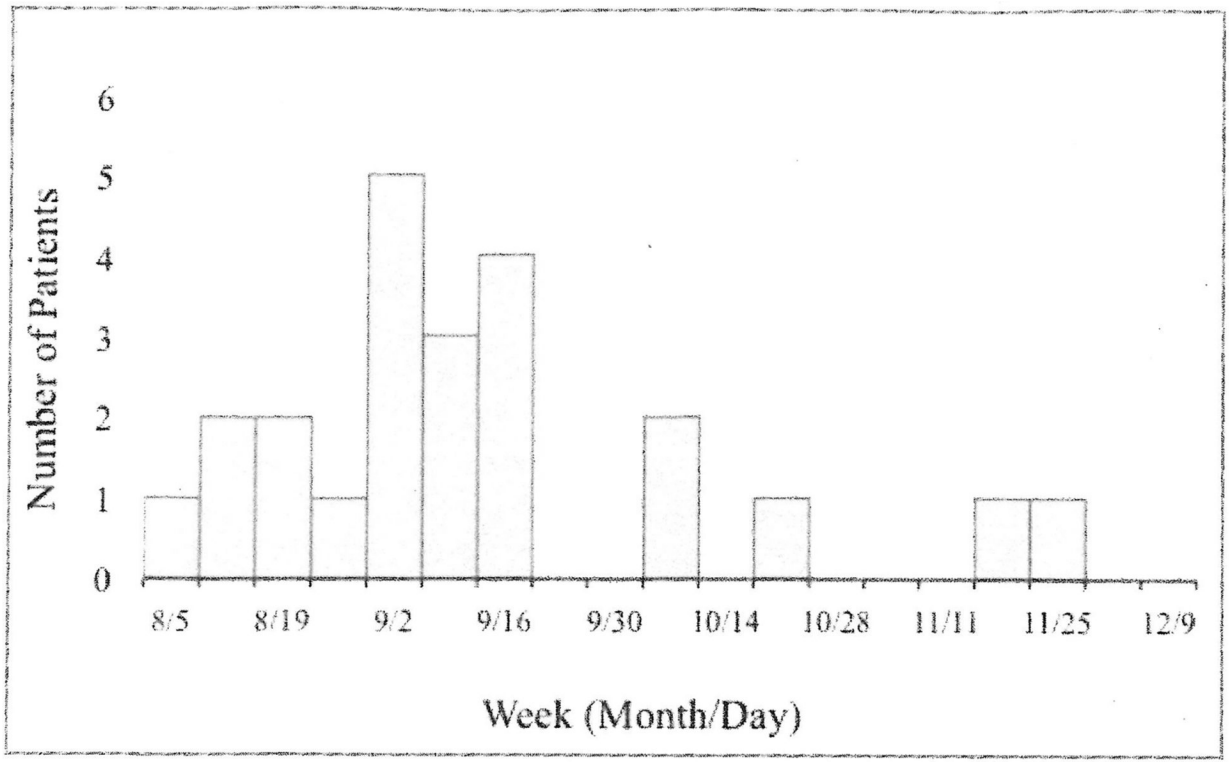

FIGURE 1.

WEEK OF SYMPTOM ONSET FOR EVALI PATIENTS (N = 23) REPORTED TO THE ARKANSAS DEPARTMENT OF HEALTH – ARKANSAS, AUGUST 4, 2019-DECEMBER 8, 2019

Table 1.

Demographic Characteristics of Arkansas EVALI Patients (N = 23)

	No. (%)
Age (yrs)	
<18	2 (8.7)
18–24	13 (56.5)
25–34	5 (21.7)
35–44	2 (8.7)
45–54	1 (4.3)
Sex	
Male	15 (65.2)
Female	8 (34.8)
Race/Ethnicity	
Non-Hispanic White	18 (78.3)
Hispanic, Any Race	4 (17.4)
Non-Hispanic Black	1 (4.3)
ADH Public Health Region of Residence[a]	
Northwest	13 (56.5)
Northeast	2 (8.7)
Central	8 (34.8)
Southwest	0 (0)
Southeast	0 (0)

[a]Counties belonging to ADH Public Health Regions can be found at www.healthy.arkansas.gov/health-units

Table 2.

Common Clinical Characteristics and Therapeutic Procedures of Arkansas EVALI Patients (N = 23)

	No. (%)
Initial Signs and Symptoms[a]	
Shortness of breath	22 (95.7)
Cough	22 (95.7)
Fever or chills[b]	20 (87.0)
Hypoxemia[c]	19 (82.6)
Nausea or vomiting	18 (78.3)
Diarrhea	9 (39.1)
ICU Admission and Therapeutic Procedures	
ICU admission	11 (47.8)
Mechanical ventilation	8 (34.8)
BiPAP or CPAP	7 (30.4)

Abbreviations: ICU = intensive care unit, BiPAP = bilevel positive airway pressure, CPAP = continuous positive airway pressure

[a]Patients could report more than one symptom

[b]Subjective or objective (temperature ≥100.4°F)

[c]Oxygen saturation ≤95% while breathing room air